

# CONSTRUCTION REQUEST FOR PROPOSAL

**RFP# 22-65**

**Wheeler Service Center  
Building Management System Modernization**

**City of Ann Arbor  
Public Services Area/Public Works Unit**



**Due Date: October 4, 2022 by 2:00 p.m. (local time)**

Issued By:

City of Ann Arbor  
Procurement Unit  
301 E. Huron Street  
Ann Arbor, MI 48104

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## **SECTION I - GENERAL INFORMATION**

### **A. OBJECTIVE**

The City of Ann Arbor is seeking qualified firms to provide pricing for the removal and replacement of the existing Siemens Building Automation System at the Wheeler Transportation Center. The existing system will be replaced with the City of Ann Arbor's Building Management System (BMS.) standard of Automated Logic WebCTRL software and hardware. BMS hardware will be replaced at the following buildings:

- Operations Building
- Vehicle Storage
- Car Wash

### **B. QUESTIONS AND CLARIFICATIONS / DESIGNATED CITY CONTACTS**

All questions regarding this Request for Proposal (RFP) shall be submitted via e-mail. Questions will be accepted and answered in accordance with the terms and conditions of this RFP.

**All questions shall be submitted on or before September 13, 2022 at 1:00 p.m. (local time)**, and should be addressed as follows:

Scope of Work/Proposal Content questions shall be e-mailed to **Kirk Pennington, Public Works Supervisor – kapennington@a2gov.org**

RFP Process and Compliance questions shall be e-mailed to Colin Spencer, Buyer - CSpencer@a2gov.org

Should any prospective bidder be in doubt as to the true meaning of any portion of this RFP, or should the prospective bidder find any ambiguity, inconsistency, or omission therein, the prospective bidder shall make a written request for an official interpretation or correction by the due date for questions above.

All interpretations, corrections, or additions to this RFP will be made only as an official addendum that will be posted to a2gov.org and MITN.info and it shall be the prospective bidder's responsibility to ensure they have received all addenda before submitting a proposal. Any addendum issued by the City shall become part of the RFP, and must be incorporated in the proposal where applicable.

### **C. PRE-PROPOSAL MEETING**

A **mandatory** pre-proposal conference for this project will be held on **September 06, 2022** at **10:00 AM** at **4251 Stone School Road, Ann Arbor, MI 48108**. **Failure to attend the meeting and sign the RFP sign-in sheet at the pre-proposal meeting will automatically disqualify a bidder from submitting a valid proposal.** Any proposal submitted by a party not attending and signing the roster at the pre-proposal meeting will not be opened or considered. Administrative and technical questions regarding this project will be answered at this time. The pre-proposal meeting is for information only. Any answers furnished will not be official until verified in writing by the Financial Service Area, Procurement Unit. Answers that change or substantially clarify the proposal will be affirmed in an addendum.

### **D. PROPOSAL FORMAT**

To be considered, each firm must submit a response to this RFP using the format provided in Section III. No other distribution of proposals is to be made by the prospective bidder. An official authorized to bind the bidder to its provisions must sign the proposal. Each proposal must remain valid for at least one hundred and twenty (120) days from the due date of this RFP.

Proposals should be prepared simply and economically providing a straightforward, concise description of the bidder's ability to meet the requirements of the RFP. No erasures are permitted. Mistakes may be crossed out and corrected and must be initialed in ink by the person signing the proposal.

### **E. SELECTION CRITERIA**

Responses to this RFP will be evaluated using a point system as shown in Section III. A selection committee comprised primarily of staff from the City will complete the evaluation.

If interviews are desired by the City, the selected firms will be given the opportunity to discuss their proposal, qualifications, past experience, and their fee proposal in more detail. The City further reserves the right to interview the key personnel assigned by the selected bidder to this project.

All proposals submitted may be subject to clarifications and further negotiation. All agreements resulting from negotiations that differ from what is represented within the RFP or in the proposal response shall be documented and included as part of the final contract.

## F. SEALED PROPOSAL SUBMISSION

**All proposals are due and must be delivered to the City on or before October 4, 2022 by 2:00 p.m. (local time).** Proposals submitted late or via oral, telephonic, telegraphic, electronic mail or facsimile **will not** be considered or accepted.

**Each respondent should submit in a sealed envelope**

- **one (1) original proposal**
- **two (2) additional proposal copy**
- **one (1) digital copy of the proposal preferably on a USB/flash drive as one file in PDF format**

Proposals submitted should be clearly marked: **“RFP No. 22-65 – Wheeler Service Center Building Management System Modernization”** and list the bidder’s name and address.

Proposals must be addressed and delivered to:  
City of Ann Arbor  
c/o Customer Service  
301 East Huron Street  
Ann Arbor, MI 48107

All proposals received on or before the due date will be publicly opened and recorded on the due date. No immediate decisions will be rendered.

Hand delivered proposals may be dropped off in the Purchasing drop box located in the Ann Street (north) vestibule/entrance of City Hall which is open to the public Monday through Friday from 8am to 5pm (except holidays). The City will not be liable to any prospective bidder for any unforeseen circumstances, delivery, or postal delays. Postmarking on the due date will not substitute for receipt of the proposal.

Bidders are responsible for submission of their proposal. Additional time will not be granted to a single prospective bidder. However, additional time may be granted to all prospective bidders at the discretion of the City.

**A proposal may be disqualified if the following required forms are not included with the proposal:**

- **Attachment D - Prevailing Wage Declaration of Compliance**
- **Attachment E - Living Wage Declaration of Compliance**
- **Attachment G - Vendor Conflict of Interest Disclosure Form**
- **Attachment H - Non-Discrimination Declaration of Compliance**

***Proposals that fail to provide these forms listed above upon proposal opening may be deemed non-responsive and may not be considered for award.***

## **G. DISCLOSURES**

Under the Freedom of Information Act (Public Act 442), the City is obligated to permit review of its files, if requested by others. All information in a proposal is subject to disclosure under this provision. This act also provides for a complete disclosure of contracts and attachments thereto.

## **H. TYPE OF CONTRACT**

A sample of the Construction Agreement is included as Attachment A. Those who wish to submit a proposal to the City are required to review this sample agreement carefully. **The City will not entertain changes to its Construction Agreement.**

For all construction work, the respondent must further adhere to the City of Ann Arbor General Conditions. The General Conditions are included herein. Retainage will be held as necessary based on individual tasks and not on the total contract value. The Contractor shall provide the required bonds included in the Contract Documents for the duration of the Contract.

The City reserves the right to award the total proposal, to reject any or all proposals in whole or in part, and to waive any informality or technical defects if, in the City's sole judgment, the best interests of the City will be so served.

This RFP and the selected bidder's response thereto, shall constitute the basis of the scope of services in the contract by reference.

## **I. NONDISCRIMINATION**

All bidders proposing to do business with the City shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the Section 9:158 of the Ann Arbor City Code. Breach of the obligation not to discriminate as outlined in Attachment G shall be a material breach of the contract. Contractors are required to post a copy of Ann Arbor's Non-Discrimination Ordinance attached at all work locations where its employees provide services under a contract with the City.

## **J. WAGE REQUIREMENTS**

The Attachments provided herein outline the requirements for payment of prevailing wages or of a "living wage" to employees providing service to the City under this contract. The successful bidder must comply with all applicable requirements and provide documentary proof of compliance when requested.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. Use of Michigan Department of Transportation Prevailing Wage Forms (sample attached hereto) or a City-approved equivalent will be required along with wage rate interviews.

For laborers whose wage level are subject to federal, state and/or local prevailing wage law the appropriate Davis-Bacon wage rate classification is identified based upon the work including within this contract. **The wage determination(s) current on the date 10 days before proposals are due shall apply to this contract.** The U.S. Department of Labor (DOL) has provided explanations to assist with classification in the following resource link: [www.wdol.gov](http://www.wdol.gov).

For the purposes of this RFP the Construction Type of Building will apply.

#### **K. CONFLICT OF INTEREST DISCLOSURE**

The City of Ann Arbor Purchasing Policy requires that the consultant complete a Conflict of Interest Disclosure form. A contract may not be awarded to the selected bidder unless and until the Procurement Unit and the City Administrator have reviewed the Disclosure form and determined that no conflict exists under applicable federal, state, or local law or administrative regulation. Not every relationship or situation disclosed on the Disclosure Form may be a disqualifying conflict. Depending on applicable law and regulations, some contracts may awarded on the recommendation of the City Administrator after full disclosure, where such action is allowed by law, if demonstrated competitive pricing exists and/or it is determined the award is in the best interest of the City. A copy of the Conflict of Interest Disclosure Form is attached.

#### **L. COST LIABILITY**

The City of Ann Arbor assumes no responsibility or liability for costs incurred by the bidder prior to the execution of an Agreement. The liability of the City is limited to the terms and conditions outlined in the Agreement. By submitting a proposal, bidder agrees to bear all costs incurred or related to the preparation, submission, and selection process for the proposal.

#### **M. DEBARMENT**

Submission of a proposal in response to this RFP is certification that the Respondent is not currently debarred, suspended, proposed for debarment, and declared ineligible or voluntarily excluded from participation in this transaction by any State or Federal departments or agency. Submission is also agreement that the City will be notified of any changes in this status.

## **N. PROPOSAL PROTEST**

All proposal protests must be in writing and filed with the Purchasing Manager within five (5) business days of the award action. The bidder must clearly state the reasons for the protest. If any bidder contacts a City Service Area/Unit and indicates a desire to protest an award, the Service Area/Unit shall refer the bidder to the Purchasing Manager. The Purchasing Manager will provide the bidder with the appropriate instructions for filing the protest. The protest shall be reviewed by the City Administrator or designee, whose decision shall be final.

Any inquiries or requests regarding this procurement should be only submitted in writing to the Designated City Contacts provided herein. Attempts by the bidder to initiate contact with anyone other than the Designated City Contacts provided herein that the bidder believes can influence the procurement decision, e.g., Elected Officials, City Administrator, Selection Committee Members, Appointed Committee Members, etc., may lead to immediate elimination from further consideration.

## **O. SCHEDULE**

The following is the schedule for this RFP process.

<b>Activity/Event</b>	<b>Anticipated Date</b>
Pre Proposal Conference	September 6, 2022, 10:00 A.M.
Written Question Deadline	September 13, 2022, 1:00 p.m. (Local)
Addenda Published (if needed)	Week of September 18, 2022
Proposal Due Date	October 4, 2022, 2:00 p.m. (Local)
Selection/Negotiations	Week of October 16, 2022
Expected City Council Authorizations	December 19, 2022

The above schedule is for information purposes only and is subject to change at the City's discretion.

## **P. IRS FORM W-9**

The selected bidder will be required to provide the City of Ann Arbor an IRS form W-9.

## **Q. RESERVATION OF RIGHTS**

1. The City reserves the right in its sole and absolute discretion to accept or reject any or all proposals, or alternative proposals, in whole or in part, with or without cause.
2. The City reserves the right to waive, or not waive, informalities or irregularities in terms or conditions of any proposal if determined by the City to be in its best interest.
3. The City reserves the right to request additional information from any or all bidders.



4. The City reserves the right to reject any proposal that it determines to be unresponsive and deficient in any of the information requested within RFP.
5. The City reserves the right to determine whether the scope of the project will be entirely as described in the RFP, a portion of the scope, or a revised scope be implemented.
6. The City reserves the right to select one or more contractors or service providers to perform services.
7. The City reserves the right to retain all proposals submitted and to use any ideas in a proposal regardless of whether that proposal is selected. Submission of a proposal indicates acceptance by the firm of the conditions contained in this RFP, unless clearly and specifically noted in the proposal submitted.
8. The City reserves the right to disqualify proposals that fail to respond to any requirements outlined in the RFP, or failure to enclose copies of the required documents outlined within the RFP.

## **R. IDLEFREE ORDINANCE**

The City of Ann Arbor adopted an idling reduction Ordinance that went into effect July 1, 2017. The full text of the ordinance (including exemptions) can be found at: [www.a2gov.org/idlefree](http://www.a2gov.org/idlefree).

Under the ordinance, No Operator of a Commercial Vehicle shall cause or permit the Commercial Vehicle to Idle:

- (a) For any period of time while the Commercial Vehicle is unoccupied; or
- (b) For more than 5 minutes in any 60-minute period while the Commercial Vehicle is occupied.

In addition, generators and other internal combustion engines are covered

- (1) Excluding Motor Vehicle engines, no internal combustion engine shall be operated except when it is providing power or electrical energy to equipment or a tool that is actively in use.

## **S. ENVIRONMENTAL COMMITMENT**

The City of Ann Arbor recognizes its responsibility to minimize negative impacts on human health and the environment while supporting a vibrant community and economy. The City further recognizes that the products and services the City buys have inherent environmental and economic impacts and that the City should make procurement decisions that embody, promote, and encourage the City's commitment to the environment.

The City encourages potential vendors to bring forward emerging and progressive products and services that are best suited to the City's environmental principles.

## **T. BID SECURITY**

Each bid must be accompanied by a certified check, or Bid Bond by a surety licensed and authorized to do business within the State of Michigan, in the amount of 5% of the total of the bid price.

#### **U. MAJOR SUBCONTRACTORS**

The Bidder shall identify each major subcontractor it expects to engage for this Contract if the work to be subcontracted is 15% or more of the bid sum or over \$50,000, whichever is less. The Bidder also shall identify the work to be subcontracted to each major subcontractor. The Bidder shall not change or replace a subcontractor without approval by the City.

#### **V. LIQUIDATED DAMAGES**

A liquidated damages clause, as given on page C-2, Article III of the Contract, provides that the Contractor shall pay the City as liquidated damages, and not as a penalty, a sum certain per day for each and every day that the Contractor may be in default of completion of the specified work, within the time(s) stated in the Contract, or written extensions.

Liquidated damages clauses, as given in the General Conditions, provide further that the City shall be entitled to impose and recover liquidated damages for breach of the obligations under Chapter 112 of the City Code.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

## **SECTION II - SCOPE OF WORK**

Please see the plan set for more detail.

### **A. Objective**

#### **A. Background:**

The City of Ann Arbor Wheeler Service Center is used as a base of operations for municipal maintenance operations, as commissioned in 2007 the building complex houses the Operations and Maintenance staff, warehousing and equipment for the Public Works, Signs and Signals and Parks Maintenance units. The complex's building automation system as constructed is beyond end of life and no longer adequately serves the uses of the building and occupants.

Wheeler Operations Building	38,620 Square Feet
Wheeler Vehicle Storage Building	81,651 Square Feet
Wheeler Car Wash	2,850 Square Feet

#### **B. Objective:**

The City of Ann Arbor's objective for this project is to replace the existing BMS hardware and software to the City's specified Automated Logic WebCTRL platform. Note that the WebCTRL software and server computer currently resides in the City's Justice / Larcom building. Each building listed below will require a G5CE BACnet Router. Note that all Siemens control modules will be removed. The contractor shall also remove and replace control components not compatible with the Automated Logic system. Control Valves and Damper Actuators may be reused. If any Control valve or damper/actuator are proven to be defective, the contractor will notify the owner of the deficiency and submit a cost for its replacement.

Please review the Systems that are currently under control at the following buildings.

#### **1. Operations Building**

- (5) Energy Recovery Units
- (5) Roof Top Units
- (24) VAV Terminal Units including (1) currently unmanaged
- (3) Lighting Control integration
- Generator Interface

#### **2. Vehicle Storage Building**

- (5) Make Up Air Units
- (5) Exhaust Fans
- (2) Lighting Zones
- Generator Interface

**3. Vehicle Wash Building**

- (1) Roof Top Unit
- (2) Radiant Heat Zones currently unmanaged

**C. Requirements**

1. Successful bidder will be required to provide shop drawings and submittals for owners review prior to installation.
2. Upon completion of the project the successful bidder will be required to provide (16) hours of on-site training for up to five (5) city staff.
3. As part of the bid package the bidding contractors must identify a cost for a (3) year service agreement for the new BMS.

## **SECTION III - MINIMUM INFORMATION REQUIRED**

### **PROPOSAL FORMAT**

The following describes the elements that should be included in each of the proposal sections and the weighted point system that will be used for evaluation of the proposals.

Bidders should organize Proposals into the following Sections:

- A. Qualifications, Experience and Accountability
- B. Workplace Safety
- C. Workforce Development
- D. Social Equity and Sustainability
- E. Schedule of Pricing/Cost
- F. Authorized Negotiator
- G. Attachments

*Bidders are strongly encouraged to provide details for all of the information requested below within initial proposals. Backup documentation may be requested at the sole discretion of the City to validate all of the responses provided herein by bidders. False statements by bidders to any of the criteria provided herein will result in the proposal being considered non-responsive and will not be considered for award.*

Pursuant to Sec 1:314(9) of the City Code which sets forth requirements for evaluating construction bids, Bidders should submit the following:

#### **A. Qualifications, Experience and Accountability - 20 Points**

1. Qualifications and experience of the bidder and of key persons, management, and supervisory personnel to be assigned by the bidder.
2. References from individuals or entities the bidder has worked for within the last five (5) years including information regarding records of performance and job site cooperation.
3. Evidence of any quality assurance program used by the bidder and the results of any such program on the bidder's previous projects.
4. A statement from the bidder as to any major subcontractors it expects to engage including the name, work, and amount.

#### **B. Workplace Safety – 20 Points**

1. Documentation of an on-going, Michigan OSHA-approved safety-training program for employees to be used on the proposed job site.
2. Evidence of the bidder's worker's compensation Experience Modification Rating ("EMR"). Preference within this criterion will be given to an EMR of 1.0 or less based on a three-year average.
3. Evidence that all craft labor that will be employed by the bidder for the project has, or will have prior to project commencement, completed at least the OSHA 10-hour training course for safety established by the U.S. Department of Labor, Occupational Safety & Health Administration.
4. The safety record of bidder and major subcontractors, including OSHA, MIOSHA, or other safety violations.

**C. Workforce Development – 20 Points**

1. The ratio of masters or journeypersons to apprentices proposed to be used on the construction project job site, if apprentices are to be used on the project.
2. Documentation as to bidder's pay rates, health insurance, pension or other retirement benefits, paid leave, or other fringe benefits to its employees.
3. Documentation that the bidder participates in a Registered Apprenticeship Program that is registered with the United States Department of Labor Office of Apprenticeship or by a State Apprenticeship Agency recognized by the USDOL Office of Apprenticeship.

**D. Social Equity and Sustainability – 20 Points**

1. A statement from the bidder as to what percentage of its workforce resides in the City of Ann Arbor and in Washtenaw County, Michigan. The City will consider in evaluating which bids best serve its interests, the extent to which responsible and qualified bidders are able to achieve this goal.
2. Evidence of Equal Employment Opportunity Programs for minorities, women, veterans, returning citizens, and small businesses.
3. Evidence that the bidder is an equal opportunity employer and does not discriminate on the basis of race, sex, pregnancy, age, religion, national origin,

marital status, sexual orientation, gender identity or expression, height, weight, or disability.

4. The bidder's proposed use of sustainable products, technologies, or practices for the project, which reduce the impact on human health and the environment, including raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and waste management.
5. The bidder's environmental record, including findings of violations and penalties imposed by government agencies.

**E. Schedule of Pricing/Cost – 20 Points**

City of Ann Arbor – RFP #22-65

**Wheeler Service Center Building Management System Modernization**

Design, Installation, Calibration and City staff training \$ \_\_\_\_\_

Three (3) year maintenance agreement \$ \_\_\_\_\_

Provide pricing at the specified unit of measure for labor, materials and equipment to repair replace existing faulty wiring / damper / valve actuators if / as discovered during modernization installation.

- Miscellaneous Equipment
  - Aerial Lift \_\_\_\_\_ Daily
- Labor
  - Electrician \_\_\_\_\_ Hourly
  - Instrumentation Technician \_\_\_\_\_ Hourly
  - Pipe Fitter \_\_\_\_\_ Hourly
  - Sheet Metal Worker \_\_\_\_\_ Hourly
- Material \_\_\_\_\_ Percent off MSRP

The undersigned hereby declares that they have carefully examined the conditions of this request for proposal and will provide the services as specified for the prices set for in this proposal.

Representative's Name (printed): \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Firm Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Email: \_\_\_\_\_



**F. Authorized Negotiator / Negotiable Elements (Alternates)**

Include the name, phone number, and e-mail address of persons(s) in your organization authorized to negotiate the agreement with the City.

The proposal price shall include materials and equipment selected from the designated items and manufacturers listed in the bidding documents. This is done to establish uniformity in bidding and to establish standards of quality for the items named.

If the bidder wishes to quote alternate items for consideration by the City, it may do so under this Section. A complete description of the item and the proposed price differential must be provided. Unless approved at the time of award, substitutions where items are specifically named will be considered only as a negotiated change in Contract Sum.

If the Bidder takes exception to the time stipulated in Article III of the Contract, Time of Completion, page C-2, it is requested to stipulate its proposed time for performance of the work.

Consideration for any proposed alternative items or time may be negotiated at the discretion of the City.

**G. Attachments**

General Declaration, Legal Status of Bidder, Conflict of Interest Form, Living Wage Compliance Form, Prevailing Wage Compliance Form and the Non-Discrimination Form should be completed and returned with the proposal. These elements should be included as attachments to the proposal submission.

**PROPOSAL EVALUATION**

1. The selection committee will evaluate each proposal by the above-described criteria and point system. The City reserves the right to reject any proposal that it determines to be unresponsive and deficient in any of the information requested for evaluation. A proposal with all the requested information does not guarantee the proposing firm to be a candidate for an interview if interviews are selected to be held by the City. The committee may contact references to verify material submitted by the bidder.
2. The committee then will schedule interviews with the selected firms if necessary. The selected firms will be given the opportunity to discuss in more detail their qualifications, past experience, proposed work plan (if applicable) and pricing.
3. The interview should include the project team members expected to work on the project, but no more than six members total. The interview shall consist of a

presentation of up to thirty minutes (or the length provided by the committee) by the bidder, including the person who will be the project manager on this contract, followed by approximately thirty minutes of questions and answers. Audiovisual aids may be used during the oral interviews. The committee may record the oral interviews.

4. The firms interviewed will then be re-evaluated by the above criteria and adjustments to scoring will be made as appropriate. After evaluation of the proposals, further negotiation with the selected firm may be pursued leading to the award of a contract by City Council, if suitable proposals are received.

The City reserves the right to waive the interview process and evaluate the bidder based on their proposal and pricing schedules alone.

The City will determine whether the final scope of the project to be negotiated will be entirely as described in this RFP, a portion of the scope, or a revised scope.

Work to be done under this contract is generally described through the detailed specifications and must be completed fully in accordance with the contract documents.

Any proposal that does not conform fully to these instructions may be rejected.

## **PREPARATION OF PROPOSALS**

Proposals should have no plastic bindings but will not be rejected as non-responsive for being bound. Staples or binder clips are acceptable. Proposals should be printed double sided on recycled paper.

Each person signing the proposal certifies that they are a person in the bidder's firm/organization responsible for the decisions regarding the fees being offered in the Proposal and has not and will not participate in any action contrary to the terms of this provision.

## **ADDENDA**

If it becomes necessary to revise any part of the RFP, notice of the addendum will be posted to Michigan Inter-governmental Trade Network (MITN) [www.mitn.info](http://www.mitn.info) and/or the City of Ann Arbor web site [www.A2gov.org](http://www.A2gov.org) for all parties to download.

Each bidder should acknowledge in its proposal all addenda it has received on the General Declarations form provided in the Attachments section herein. The failure of a bidder to receive or acknowledge receipt of any addenda shall not relieve the bidder of the responsibility for complying with the terms thereof. The City will not be bound by oral responses to inquiries or written responses other than official written addenda.

## **SECTION IV - ATTACHMENTS**

Attachment A – Sample Standard Contract

Attachment B – General Declarations

Attachment C - Legal Status of Bidder

Attachment D – Prevailing Wage Declaration of Compliance Form

Attachment E – Living Wage Declaration of Compliance Form

Attachment F – Living Wage Ordinance Poster

Attachment G – Vendor Conflict of Interest Disclosure Form

Attachment H – Non-Discrimination Ordinance Declaration of Compliance Form

Attachment I – Non-Discrimination Ordinance Poster

Sample Certified Payroll Report Template

Attachment J -City Of Ann Arbor Wheeler AsBuilt Siemens Line Drawings reduced

Attachment K - City Of Ann Arbor Wheeler AsBuilt Siemens Product sheets reduced

Attachment L - City Of Ann Arbor Wheeler Lithonia Synergy Light Controller Pictures reduced

Attachment M - City of Ann Arbor Wheeler Lithonia Synergy Lighting Controller Bill of Materials reduced

Attachment N - City Of Ann Arbor Wheeler Mechanical As Builts and Sheet Index reduced

Attachment O - City of Ann Arbor Wheeler Seimens System Panel Pictures reduced

**ATTACHMENT A  
SAMPLE STANDARD CONTRACT**

*If a contract is awarded, the selected contractor will be required to adhere to a set of general contract provisions which will become a part of any formal agreement. These provisions are general principles which apply to all contractors of service to the City of Ann Arbor such as the following:*

**Administrative Use Only**  
Contract Date: \_\_\_\_\_

**CONTRACT**

THIS CONTRACT is between the CITY OF ANN ARBOR, a Michigan Municipal Corporation, 301 East Huron Street, Ann Arbor, Michigan 48104 ("City") and \_\_\_\_\_ ("Contractor")

\_\_\_\_\_  
(An individual/partnership/corporation, include state of incorporation) (Address)

Based upon the mutual promises below, the Contractor and the City agree as follows:

**ARTICLE I - Scope of Work**

The Contractor agrees to furnish all of the materials, equipment and labor necessary; and to abide by all the duties and responsibilities applicable to it for the project titled **RFP #22-65 - Wheeler Service Center Building Management System Modernization** in accordance with the requirements and provisions of the following documents, including all written modifications incorporated into any of the documents, all of which are incorporated as part of this Contract:

- |  |                         |
|--|-------------------------|
| Non-discrimination and Living Wage Declaration of Compliance Forms (if applicable) | General Conditions      |
| Vendor Conflict of Interest Form   | Standard Specifications |
| Prevailing Wage Declaration of Compliance Form (if applicable)                     | Detailed Specifications |
| Bid Forms  | Plans                   |
| Contract and Exhibits  | Addenda                 |
| Bonds  |                         |

**ARTICLE II - Definitions**

**Administering Service Area/Unit** means **Public Services / Public Works**

**Project** means **RFP #22-65 - Wheeler Service Center Building Management System Modernization**

**Supervising Professional** means the person acting under the authorization of the manager of the Administering Service Area/Unit. At the time this Contract is executed,

the Supervising Professional is: **Kirk Pennington** whose job title is **Public Works Supervisor**. If there is any question concerning who the Supervising Professional is, Contractor shall confirm with the manager of the Administering Service Area/Unit.

**Contractor's Representative** means \_\_\_\_\_ **[Insert name]** whose job title is **[Insert job title]**.

### **ARTICLE III - Time of Completion**

- (A) The work to be completed under this Contract shall begin immediately on the date specified in the Notice to Proceed issued by the City.
- (B) The entire work for this Contract shall be completed within ninety (90) consecutive calendar days.
- (C) Failure to complete all the work within the time specified above, including any extension granted in writing by the Supervising Professional, shall obligate the Contractor to pay the City, as liquidated damages and not as a penalty, an amount equal to \$100.00 for each calendar day of delay in the completion of all the work. If any liquidated damages are unpaid by the Contractor, the City shall be entitled to deduct these unpaid liquidated damages from the monies due the Contractor.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

### **ARTICLE IV - The Contract Sum**

- (A) The City shall pay to the Contractor for the performance of the Contract, the unit prices as given in the Bid Form for the estimated bid total of:

\_\_\_\_\_ Dollars (\$\_\_\_\_\_)

- (B) The amount paid shall be equitably adjusted to cover changes in the work ordered by the Supervising Professional but not required by the Contract Documents. Increases or decreases shall be determined only by written agreement between the City and Contractor.

### **ARTICLE V - Assignment**

This Contract may not be assigned or subcontracted any portion of any right or obligation under this contract without the written consent of the City. Notwithstanding any consent by the City to any assignment, Contractor shall at all times remain bound to all warranties, certifications, indemnifications, promises and performances, however described, as are required of it under this contract unless specifically released from the requirement, in writing, by the City.

**ARTICLE VI - Choice of Law**

This Contract shall be construed, governed, and enforced in accordance with the laws of the State of Michigan. By executing this Contract, the Contractor and the City agree to venue in a court of appropriate jurisdiction sitting within Washtenaw County for purposes of any action arising under this Contract. The parties stipulate that the venue referenced in this Contract is for convenience and waive any claim of non-convenience.

Whenever possible, each provision of the Contract will be interpreted in a manner as to be effective and valid under applicable law. The prohibition or invalidity, under applicable law, of any provision will not invalidate the remainder of the Contract.

**ARTICLE VII - Relationship of the Parties**

The parties of the Contract agree that it is not a Contract of employment but is a Contract to accomplish a specific result. Contractor is an independent Contractor performing services for the City. Nothing contained in this Contract shall be deemed to constitute any other relationship between the City and the Contractor.

Contractor certifies that it has no personal or financial interest in the project other than the compensation it is to receive under the Contract. Contractor certifies that it is not, and shall not become, overdue or in default to the City for any Contract, debt, or any other obligation to the City including real or personal property taxes. City shall have the right to set off any such debt against compensation awarded for services under this Contract.

**ARTICLE VIII - Notice**

All notices given under this Contract shall be in writing, and shall be by personal delivery or by certified mail with return receipt requested to the parties at their respective addresses as specified in the Contract Documents or other address the Contractor may specify in writing. Notice will be deemed given on the date when one of the following first occur: (1) the date of actual receipt; or (2) three days after mailing certified U.S. mail.

**ARTICLE IX - Indemnification**

To the fullest extent permitted by law, Contractor shall indemnify, defend and hold the City, its officers, employees and agents harmless from all suits, claims, judgments and expenses including attorney's fees resulting or alleged to result, in whole or in part, from any act or omission, which is in any way connected or associated with this Contract, by the Contractor or anyone acting on the Contractor's behalf under this Contract. Contractor shall not be responsible to indemnify the City for losses or damages caused by or resulting from the City's sole negligence. The provisions of this Article shall survive the expiration or earlier termination of this contract for any reason.

**ARTICLE X - Entire Agreement**

This Contract represents the entire understanding between the City and the Contractor and it supersedes all prior representations, negotiations, agreements, or understandings whether written or oral. Neither party has relied on any prior representations in entering into this Contract. No terms or conditions of either party's invoice, purchase order or other administrative document shall modify the terms and conditions of this Contract, regardless of the other party's failure to object to such form. This Contract shall be binding on and shall inure to the benefit of the parties

to this Contract and their permitted successors and permitted assigns and nothing in this Contract, express or implied, is intended to or shall confer on any other person or entity any legal or equitable right, benefit, or remedy of any nature whatsoever under or by reason of this Contract. This Contract may be altered, amended or modified only by written amendment signed by the City and the Contractor.

**ARTICLE XI – Electronic Transactions**

The City and Contractor agree that signatures on this Contract may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this Contract. This Contract may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

**FOR CONTRACTOR**

By \_\_\_\_\_

Its: \_\_\_\_\_

**FOR THE CITY OF ANN ARBOR**

By \_\_\_\_\_  
Christopher Taylor, Mayor

By \_\_\_\_\_  
Jacqueline Beaudry, City Clerk

**Approved as to substance**

By \_\_\_\_\_  
Milton Dohoney Jr., City Administrator

By \_\_\_\_\_  
Brian Steglitz P.E.  
Interim Public Services Area  
Administrator

**Approved as to form and content**

\_\_\_\_\_  
Atleen Kaur, City Attorney

**PERFORMANCE BOND**

- (1) \_\_\_\_\_ (referred to as "Principal"), and \_\_\_\_\_, a corporation duly authorized to do business in the State of Michigan (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for \$ \_\_\_\_\_, the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.
- (2) The Principal has entered a written Contract with the City entitled \_\_\_\_\_, for RFP No. \_\_\_\_\_ and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963, as amended, being MCL 129.201 *et seq.*
- (3) Whenever the Principal is declared by the City to be in default under the Contract, the Surety may promptly remedy the default or shall promptly:
- (a) complete the Contract in accordance with its terms and conditions; or
  - (b) obtain a bid or bids for submission to the City for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, arrange for a Contract between such bidder and the City, and make available, as work progresses, sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which Surety may be liable hereunder, the amount set forth in paragraph 1.
- (4) Surety shall have no obligation to the City if the Principal fully and promptly performs under the Contract.
- (5) Surety agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder, or the specifications accompanying it shall in any way affect its obligations on this bond, and waives notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work, or to the specifications.
- (6) Principal, Surety, and the City agree that signatures on this bond may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this bond. This bond may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

**SIGNED AND SEALED** this \_\_\_\_\_ day of \_\_\_\_\_, 202\_.

\_\_\_\_\_  
(Name of Surety Company)  
By \_\_\_\_\_  
(Signature)

Its \_\_\_\_\_  
(Title of Office)

Approved as to form:

\_\_\_\_\_  
Atleen Kaur, City Attorney

\_\_\_\_\_  
(Name of Principal)  
By \_\_\_\_\_  
(Signature)

Its \_\_\_\_\_  
(Title of Office)

Name and address of agent:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



**LABOR AND MATERIAL BOND**

- (1) \_\_\_\_\_  
of \_\_\_\_\_ (referred to as "Principal"), and \_\_\_\_\_, a corporation duly authorized to do business in the State of Michigan, (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for the use and benefit of claimants as defined in Act 213 of Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq., in the amount of \$ \_\_\_\_\_, for the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.
- (2) The Principal has entered a written Contract with the City entitled \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_, for RFP No. \_\_\_\_\_; and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963 as amended;
- (3) If the Principal fails to promptly and fully repay claimants for labor and material reasonably required under the Contract, the Surety shall pay those claimants.
- (4) Surety's obligations shall not exceed the amount stated in paragraph 1, and Surety shall have no obligation if the Principal promptly and fully pays the claimants.
- (5) Principal, Surety, and the City agree that signatures on this bond may be delivered electronically in lieu of an original signature and agree to treat electronic signatures as original signatures that bind them to this bond. This bond may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

**SIGNED AND SEALED** this \_\_\_\_\_ day of \_\_\_\_\_, 202\_

\_\_\_\_\_  
(Name of Surety Company)  
By \_\_\_\_\_  
(Signature)

Its \_\_\_\_\_  
(Title of Office)

Approved as to form:

\_\_\_\_\_  
Atleen Kaur, City Attorney

\_\_\_\_\_  
(Name of Principal)  
By \_\_\_\_\_  
(Signature)

Its \_\_\_\_\_  
(Title of Office)

Name and address of agent:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## **GENERAL CONDITIONS**

### **Section 1 - Execution, Correlation and Intent of Documents**

The contract documents shall be signed in 2 copies by the City and the Contractor.

The contract documents are complementary and what is called for by any one shall be binding. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which so applied have a well-known technical or trade meaning have the meaning of those recognized standards.

In case of a conflict among the contract documents listed below in any requirement(s), the requirement(s) of the document listed first shall prevail over any conflicting requirement(s) of a document listed later.

(1) Addenda in reverse chronological order; (2) Detailed Specifications; (3) Standard Specifications; (4) Plans; (5) General Conditions; (6) Contract; (7) Bid Forms; (8) Bond Forms; (9) Bid.

### **Section 2 - Order of Completion**

The Contractor shall submit with each invoice, and at other times reasonably requested by the Supervising Professional, schedules showing the order in which the Contractor proposes to carry on the work. They shall include the dates at which the Contractor will start the several parts of the work, the estimated dates of completion of the several parts, and important milestones within the several parts.

### **Section 3 - Familiarity with Work**

The Bidder or its representative shall make personal investigations of the site of the work and of existing structures and shall determine to its own satisfaction the conditions to be encountered, the nature of the ground, the difficulties involved, and all other factors affecting the work proposed under this Contract. The Bidder to whom this Contract is awarded will not be entitled to any additional compensation unless conditions are clearly different from those which could reasonably have been anticipated by a person making diligent and thorough investigation of the site.

The Bidder shall immediately notify the City upon discovery, and in every case prior to submitting its Bid, of every error or omission in the bidding documents that would be identified by a reasonably competent, diligent Bidder. In no case will a Bidder be allowed the benefit of extra compensation or time to complete the work under this Contract for extra expenses or time spent as a result of the error or omission.

### **Section 4 - Wage Requirements**

Under this Contract, the Contractor shall conform to Chapter 14 of Title I of the Code of the City of Ann Arbor as amended; which in part states "...that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of

subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. At the request of the City, any contractor or subcontractor shall provide satisfactory proof of compliance with the contract provisions required by the Section.

Pursuant to Resolution R-16-469 all public improvement contractors are subject to prevailing wage and will be required to provide to the City payroll records sufficient to demonstrate compliance with the prevailing wage requirements. A sample Prevailing Wage Form is provided in the Appendix herein for reference as to what will be expected from contractors. Use of the Prevailing Wage Form provided in the Appendix section or a City-approved equivalent will be required along with wage rate interviews.

Where the Contract and the Ann Arbor City Ordinance are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used.

If the Contractor is a "covered employer" as defined in Chapter 23 of the Ann Arbor City Code, the Contractor agrees to comply with the living wage provisions of Chapter 23 of the Ann Arbor City Code. The Contractor agrees to pay those employees providing Services to the City under this Contract a "living wage," as defined in Section 1:815 of the Ann Arbor City Code, as adjusted in accordance with Section 1:815(3); to post a notice approved by the City of the applicability of Chapter 23 in every location in which regular or contract employees providing services under this Contract are working; to maintain records of compliance; if requested by the City, to provide documentation to verify compliance; to take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee or person contracted for employment in order to pay the living wage required by Section 1:815; and otherwise to comply with the requirements of Chapter 23.

Contractor agrees that all subcontracts entered into by the Contractor shall contain similar wage provision covering subcontractor's employees who perform work on this contract.

## **Section 5 - Non-Discrimination**

The Contractor agrees to comply, and to require its subcontractor(s) to comply, with the nondiscrimination provisions of MCL 37.2209. The Contractor further agrees to comply with the provisions of Section 9:158 of Chapter 112 of Title IX of the Ann Arbor City Code, and to assure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity.

## **Section 6 - Materials, Appliances, Employees**

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary or used for the execution and completion of the work. Unless otherwise specified, all materials incorporated in the permanent work shall be new, and both workmanship and materials shall be of the highest quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall at all times enforce strict discipline and good order among its employees, and shall seek to avoid employing on the work any unfit person or anyone not skilled in the work assigned.

Adequate sanitary facilities shall be provided by the Contractor.

## **Section 7 - Qualifications for Employment**

The Contractor shall employ competent laborers and mechanics for the work under this Contract. For work performed under this Contract, employment preference shall be given to qualified local residents.

## **Section 8 - Royalties and Patents**

The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringements of any patent rights and shall hold the City harmless from loss on account of infringement except that the City shall be responsible for all infringement loss when a particular process or the product of a particular manufacturer or manufacturers is specified, unless the City has notified the Contractor prior to the signing of the Contract that the particular process or product is patented or is believed to be patented.

## **Section 9 - Permits and Regulations**

The Contractor must secure and pay for all permits, permit or plan review fees and licenses necessary for the prosecution of the work. These include but are not limited to City building permits, right-of-way permits, lane closure permits, right-of-way occupancy permits, and the like. The City shall secure and pay for easements shown on the plans unless otherwise specified.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the contract documents are at variance with those requirements, it shall promptly notify the Supervising Professional in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work.

## **Section 10 - Protection of the Public and of Work and Property**

The Contractor is responsible for the means, methods, sequences, techniques and procedures of construction and safety programs associated with the work contemplated by this contract. The Contractor, its agents or sub-contractors, shall comply with the "General Rules and Regulations for the Construction Industry" as published by the Construction Safety Commission of the State of Michigan and to all other local, State and National laws, ordinances, rules and regulations pertaining to safety of persons and property.

The Contractor shall take all necessary and reasonable precautions to protect the safety of the public. It shall continuously maintain adequate protection of all work from damage, and shall take all necessary and reasonable precautions to adequately protect all public and private property from injury or loss arising in connection with this Contract. It shall make good any damage, injury or loss to its work and to public and private property resulting from lack of reasonable protective precautions, except as may be due to errors in the contract documents, or caused by agents or

employees of the City. The Contractor shall obtain and maintain sufficient insurance to cover damage to any City property at the site by any cause.

In an emergency affecting the safety of life, or the work, or of adjoining property, the Contractor is, without special instructions or authorization from the Supervising Professional, permitted to act at its discretion to prevent the threatened loss or injury. It shall also so act, without appeal, if authorized or instructed by the Supervising Professional.

Any compensation claimed by the Contractor for emergency work shall be determined by agreement or in accordance with the terms of Claims for Extra Cost - Section 15.

## **Section 11 - Inspection of Work**

The City shall provide sufficient competent personnel for the inspection of the work.

The Supervising Professional shall at all times have access to the work whenever it is in preparation or progress, and the Contractor shall provide proper facilities for access and for inspection.

If the specifications, the Supervising Professional's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Supervising Professional timely notice of its readiness for inspection, and if the inspection is by an authority other than the Supervising Professional, of the date fixed for the inspection. Inspections by the Supervising Professional shall be made promptly, and where practicable at the source of supply. If any work should be covered up without approval or consent of the Supervising Professional, it must, if required by the Supervising Professional, be uncovered for examination and properly restored at the Contractor's expense.

Re-examination of any work may be ordered by the Supervising Professional, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to be in accordance with the contract documents, the City shall pay the cost of re-examination and replacement. If the work is not in accordance with the contract documents, the Contractor shall pay the cost.

## **Section 12 - Superintendence**

The Contractor shall keep on the work site, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Supervising Professional. The superintendent will be responsible to perform all on-site project management for the Contractor. The superintendent shall be experienced in the work required for this Contract. The superintendent shall represent the Contractor and all direction given to the superintendent shall be binding as if given to the Contractor. Important directions shall immediately be confirmed in writing to the Contractor. Other directions will be confirmed on written request. The Contractor shall give efficient superintendence to the work, using its best skill and attention.

## **Section 13 - Changes in the Work**

The City may make changes to the quantities of work within the general scope of the Contract at any time by a written order and without notice to the sureties. If the changes add to or deduct from the extent of the work, the Contract Sum shall be adjusted accordingly. All the changes shall be

executed under the conditions of the original Contract except that any claim for extension of time caused by the change shall be adjusted at the time of ordering the change.

In giving instructions, the Supervising Professional shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Supervising Professional, and no claim for an addition to the Contract Sum shall be valid unless the additional work was ordered in writing.

The Contractor shall proceed with the work as changed and the value of the work shall be determined as provided in Claims for Extra Cost - Section 15.

## **Section 14 - Extension of Time**

Extension of time stipulated in the Contract for completion of the work will be made if and as the Supervising Professional may deem proper under any of the following circumstances:

- (1) When work under an extra work order is added to the work under this Contract;
- (2) When the work is suspended as provided in Section 20;
- (3) When the work of the Contractor is delayed on account of conditions which could not have been foreseen, or which were beyond the control of the Contractor, and which were not the result of its fault or negligence;
- (4) Delays in the progress of the work caused by any act or neglect of the City or of its employees or by other Contractors employed by the City;
- (5) Delay due to an act of Government;
- (6) Delay by the Supervising Professional in the furnishing of plans and necessary information;
- (7) Other cause which in the opinion of the Supervising Professional entitles the Contractor to an extension of time.

The Contractor shall notify the Supervising Professional within 7 days of an occurrence or conditions which, in the Contractor's opinion, entitle it to an extension of time. The notice shall be in writing and submitted in ample time to permit full investigation and evaluation of the Contractor's claim. The Supervising Professional shall acknowledge receipt of the Contractor's notice within 7 days of its receipt. Failure to timely provide the written notice shall constitute a waiver by the Contractor of any claim.

In situations where an extension of time in contract completion is appropriate under this or any other section of the contract, the Contractor understands and agrees that the only available adjustment for events that cause any delays in contract completion shall be extension of the required time for contract completion and that there shall be no adjustments in the money due the Contractor on account of the delay.

## Section 15 - Claims for Extra Cost

If the Contractor claims that any instructions by drawings or other media issued after the date of the Contract involved extra cost under this Contract, it shall give the Supervising Professional written notice within 7 days after the receipt of the instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property. The procedure shall then be as provided for Changes in the Work-Section I3. No claim shall be valid unless so made.

If the Supervising Professional orders, in writing, the performance of any work not covered by the contract documents, and for which no item of work is provided in the Contract, and for which no unit price or lump sum basis can be agreed upon, then the extra work shall be done on a Cost-Plus-Percentage basis of payment as follows:

- (1) The Contractor shall be reimbursed for all reasonable costs incurred in doing the work, and shall receive an additional payment of 15% of all the reasonable costs to cover both its indirect overhead costs and profit;
- (2) The term "Cost" shall cover all payroll charges for employees and supervision required under the specific order, together with all worker's compensation, Social Security, pension and retirement allowances and social insurance, or other regular payroll charges on same; the cost of all material and supplies required of either temporary or permanent character; rental of all power-driven equipment at agreed upon rates, together with cost of fuel and supply charges for the equipment; and any costs incurred by the Contractor as a direct result of executing the order, if approved by the Supervising Professional;
- (3) If the extra is performed under subcontract, the subcontractor shall be allowed to compute its charges as described above. The Contractor shall be permitted to add an additional charge of 5% percent to that of the subcontractor for the Contractor's supervision and contractual responsibility;
- (4) The quantities and items of work done each day shall be submitted to the Supervising Professional in a satisfactory form on the succeeding day, and shall be approved by the Supervising Professional and the Contractor or adjusted at once;
- (5) Payments of all charges for work under this Section in any one month shall be made along with normal progress payments. Retainage shall be in accordance with Progress Payments-Section 16.

No additional compensation will be provided for additional equipment, materials, personnel, overtime or special charges required to perform the work within the time requirements of the Contract.

When extra work is required and no suitable price for machinery and equipment can be determined in accordance with this Section, the hourly rate paid shall be 1/40 of the basic weekly rate listed in the Rental Rate Blue Book published by Dataquest Incorporated and applicable to the time period the equipment was first used for the extra work. The hourly rate will be deemed to include all costs of operation such as bucket or blade, fuel, maintenance, "regional factors", insurance, taxes, and the like, but not the costs of the operator.

## **Section 16 - Progress Payments**

The Contractor shall submit each month, or at longer intervals, if it so desires, an invoice covering work performed for which it believes payment, under the Contract terms, is due. The submission shall be to the City's Finance Department - Accounting Division. The Supervising Professional will, within 10 days following submission of the invoice, prepare a certificate for payment for the work in an amount to be determined by the Supervising Professional as fairly representing the acceptable work performed during the period covered by the Contractor's invoice. To insure the proper performance of this Contract, the City will retain a percentage of the estimate in accordance with Act 524, Public Acts of 1980. The City will then, following the receipt of the Supervising Professional's Certificate, make payment to the Contractor as soon as feasible, which is anticipated will be within 15 days.

An allowance may be made in progress payments if substantial quantities of permanent material have been delivered to the site but not incorporated in the completed work if the Contractor, in the opinion of the Supervising Professional, is diligently pursuing the work under this Contract. Such materials shall be properly stored and adequately protected. Allowance in the estimate shall be at the invoice price value of the items. Notwithstanding any payment of any allowance, all risk of loss due to vandalism or any damages to the stored materials remains with the Contractor.

In the case of Contracts which include only the Furnishing and Delivering of Equipment, the payments shall be; 60% of the Contract Sum upon the delivery of all equipment to be furnished, or in the case of delivery of a usable portion of the equipment in advance of the total equipment delivery, 60% of the estimated value of the portion of the equipment may be paid upon its delivery in advance of the time of the remainder of the equipment to be furnished; 30% of the Contract Sum upon completion of erection of all equipment furnished, but not later than 60 days after the date of delivery of all of the equipment to be furnished; and payment of the final 10% on final completion of erection, testing and acceptance of all the equipment to be furnished; but not later than 180 days after the date of delivery of all of the equipment to be furnished, unless testing has been completed and shows the equipment to be unacceptable.

With each invoice for periodic payment, the Contractor shall enclose a Contractor's Declaration - Section 43, and an updated project schedule per Order of Completion - Section 2.

## **Section 17 - Deductions for Uncorrected Work**

If the Supervising Professional decides it is inexpedient to correct work that has been damaged or that was not done in accordance with the Contract, an equitable deduction from the Contract price shall be made.

## **Section 18 - Correction of Work Before Final Payment**

The Contractor shall promptly remove from the premises all materials condemned by the Supervising Professional as failing to meet Contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute the work in accordance with the Contract and without expense to the City and shall bear the expense of making good all work of other contractors destroyed or damaged by the removal or replacement.

If the Contractor does not remove the condemned work and materials within 10 days after written notice, the City may remove them and, if the removed material has value, may store the material



at the expense of the Contractor. If the Contractor does not pay the expense of the removal within 10 days thereafter, the City may, upon 10 days written notice, sell the removed materials at auction or private sale and shall pay to the Contractor the net proceeds, after deducting all costs and expenses that should have been borne by the Contractor. If the removed material has no value, the Contractor must pay the City the expenses for disposal within 10 days of invoice for the disposal costs.

The inspection or lack of inspection of any material or work pertaining to this Contract shall not relieve the Contractor of its obligation to fulfill this Contract and defective work shall be made good. Unsuitable materials may be rejected by the Supervising Professional notwithstanding that the work and materials have been previously overlooked by the Supervising Professional and accepted or estimated for payment or paid for. If the work or any part shall be found defective at any time before the final acceptance of the whole work, the Contractor shall forthwith make good the defect in a manner satisfactory to the Supervising Professional. The judgment and the decision of the Supervising Professional as to whether the materials supplied and the work done under this Contract comply with the requirements of the Contract shall be conclusive and final.

## **Section 19 - Acceptance and Final Payment**

Upon receipt of written notice that the work is ready for final inspection and acceptance, the Supervising Professional will promptly make the inspection. When the Supervising Professional finds the work acceptable under the Contract and the Contract fully performed, the Supervising Professional will promptly sign and issue a final certificate stating that the work required by this Contract has been completed and is accepted by the City under the terms and conditions of the Contract. The entire balance found to be due the Contractor, including the retained percentage, shall be paid to the Contractor by the City within 30 days after the date of the final certificate.

Before issuance of final certificates, the Contractor shall file with the City:

- (1) The consent of the surety to payment of the final estimate;
- (2) The Contractor's Affidavit in the form required by Section 44.

In case the Affidavit or consent is not furnished, the City may retain out of any amount due the Contractor, sums sufficient to cover all lienable claims.

The making and acceptance of the final payment shall constitute a waiver of all claims by the City except those arising from:

- (1) unsettled liens;
- (2) faulty work appearing within 12 months after final payment;
- (3) hidden defects in meeting the requirements of the plans and specifications;
- (4) manufacturer's guarantees.

It shall also constitute a waiver of all claims by the Contractor, except those previously made and still unsettled.

## **Section 20 - Suspension of Work**

The City may at any time suspend the work, or any part by giving 5 days notice to the Contractor in writing. The work shall be resumed by the Contractor within 10 days after the date fixed in the

written notice from the City to the Contractor to do so. The City shall reimburse the Contractor for expense incurred by the Contractor in connection with the work under this Contract as a result of the suspension.

If the work, or any part, shall be stopped by the notice in writing, and if the City does not give notice in writing to the Contractor to resume work at a date within 90 days of the date fixed in the written notice to suspend, then the Contractor may abandon that portion of the work suspended and will be entitled to the estimates and payments for all work done on the portions abandoned, if any, plus 10% of the value of the work abandoned, to compensate for loss of overhead, plant expense, and anticipated profit.

## **Section 21 - Delays and the City's Right to Terminate Contract**

If the Contractor refuses or fails to prosecute the work, or any separate part of it, with the diligence required to insure completion, ready for operation, within the allowable number of consecutive calendar days specified plus extensions, or fails to complete the work within the required time, the City may, by written notice to the Contractor, terminate its right to proceed with the work or any part of the work as to which there has been delay. After providing the notice the City may take over the work and prosecute it to completion, by contract or otherwise, and the Contractor and its sureties shall be liable to the City for any excess cost to the City. If the Contractor's right to proceed is terminated, the City may take possession of and utilize in completing the work, any materials, appliances and plant as may be on the site of the work and useful for completing the work. The right of the Contractor to proceed shall not be terminated or the Contractor charged with liquidated damages where an extension of time is granted under Extension of Time - Section 14.

If the Contractor is adjudged a bankrupt, or if it makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of its insolvency, or if it persistently or repeatedly refuses or fails except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials, or if it fails to make prompt payments to subcontractors or for material or labor, or persistently disregards laws, ordinances or the instructions of the Supervising Professional, or otherwise is guilty of a substantial violation of any provision of the Contract, then the City, upon the certificate of the Supervising Professional that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy and after giving the Contractor 3 days written notice, terminate this Contract. The City may then take possession of the premises and of all materials, tools and appliances thereon and without prejudice to any other remedy it may have, make good the deficiencies or finish the work by whatever method it may deem expedient, and deduct the cost from the payment due the Contractor. The Contractor shall not be entitled to receive any further payment until the work is finished. If the expense of finishing the work, including compensation for additional managerial and administrative services exceeds the unpaid balance of the Contract Sum, the Contractor and its surety are liable to the City for any excess cost incurred. The expense incurred by the City, and the damage incurred through the Contractor's default, shall be certified by the Supervising Professional.

## **Section 22 - Contractor's Right to Terminate Contract**

If the work should be stopped under an order of any court, or other public authority, for a period of 3 months, through no act or fault of the Contractor or of anyone employed by it, then the Contractor may, upon 7 days written notice to the City, terminate this Contract and recover from the City payment for all acceptable work executed plus reasonable profit.

## **Section 23 - City's Right To Do Work**

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the City, 3 days after giving written notice to the Contractor and its surety may, without prejudice to any other remedy the City may have, make good the deficiencies and may deduct the cost from the payment due to the Contractor.

## **Section 24 - Removal of Equipment and Supplies**

In case of termination of this Contract before completion, from any or no cause, the Contractor, if notified to do so by the City, shall promptly remove any part or all of its equipment and supplies from the property of the City, failing which the City shall have the right to remove the equipment and supplies at the expense of the Contractor.

The removed equipment and supplies may be stored by the City and, if all costs of removal and storage are not paid by the Contractor within 10 days of invoicing, the City upon 10 days written notice may sell the equipment and supplies at auction or private sale, and shall pay the Contractor the net proceeds after deducting all costs and expenses that should have been borne by the Contractor and after deducting all amounts claimed due by any lien holder of the equipment or supplies.

## **Section 25 - Responsibility for Work and Warranties**

The Contractor assumes full responsibility for any and all materials and equipment used in the construction of the work and may not make claims against the City for damages to materials and equipment from any cause except negligence or willful act of the City. Until its final acceptance, the Contractor shall be responsible for damage to or destruction of the project (except for any part covered by Partial Completion and Acceptance - Section 26). The Contractor shall make good all work damaged or destroyed before acceptance. All risk of loss remains with the Contractor until final acceptance of the work (Section 19) or partial acceptance (Section 26). The Contractor is advised to investigate obtaining its own builders risk insurance.

The Contractor shall guarantee the quality of the work for a period of one year. The Contractor shall also unconditionally guarantee the quality of all equipment and materials that are furnished and installed under the contract for a period of one year. At the end of one year after the Contractor's receipt of final payment, the complete work, including equipment and materials furnished and installed under the contract, shall be inspected by the Contractor and the Supervising Professional. Any defects shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. Any defects that are identified prior to the end of one year shall also be inspected by the Contractor and the Supervising Professional and shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. The Contractor shall assign all manufacturer or material supplier warranties to the City prior to final payment. The assignment shall not relieve the Contractor of its obligations under this paragraph to correct defects.

## **Section 26 - Partial Completion and Acceptance**

If at any time prior to the issuance of the final certificate referred to in Acceptance and Final Payment - Section 19, any portion of the permanent construction has been satisfactorily completed, and if the Supervising Professional determines that portion of the permanent construction is not required for the operations of the Contractor but is needed by the City, the Supervising Professional shall issue to the Contractor a certificate of partial completion, and immediately the City may take over and use the portion of the permanent construction described in the certificate, and exclude the Contractor from that portion.

The issuance of a certificate of partial completion shall not constitute an extension of the Contractor's time to complete the portion of the permanent construction to which it relates if the Contractor has failed to complete it in accordance with the terms of this Contract. The issuance of the certificate shall not release the Contractor or its sureties from any obligations under this Contract including bonds.

If prior use increases the cost of, or delays the work, the Contractor shall be entitled to extra compensation, or extension of time, or both, as the Supervising Professional may determine.

## **Section 27 - Payments Withheld Prior to Final Acceptance of Work**

The City may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any certificate to the extent reasonably appropriate to protect the City from loss on account of:

- (1) Defective work not remedied;
- (2) Claims filed or reasonable evidence indicating probable filing of claims by other parties against the Contractor;
- (3) Failure of the Contractor to make payments properly to subcontractors or for material or labor;
- (4) Damage to another Contractor.

When the above grounds are removed or the Contractor provides a Surety Bond satisfactory to the City which will protect the City in the amount withheld, payment shall be made for amounts withheld under this section.

## **Section 28 - Contractor's Insurance**

- (1) The Contractor shall procure and maintain during the life of this Contract, including the guarantee period and during any warranty work, such insurance policies, including those set forth below, as will protect itself and the City from all claims for bodily injuries, death or property damage that may arise under this Contract; whether the act(s) or omission(s) giving rise to the claim were made by the Contractor, any subcontractor, or anyone employed by them directly or indirectly. Prior to commencement of any work under this contract, Contractor shall provide to the City documentation satisfactory to the City, through City-approved means (currently myCOI), demonstrating it has obtained the required policies and endorsements. The certificates of insurance endorsements and/or copies of

policy language shall document that the Contractor satisfies the following minimum requirements. Contractor shall add registration@mycoitracking.com to its safe sender's list so that it will receive necessary communication from myCOI. When requested, Contractor shall provide the same documentation for its subcontractor(s) (if any).

Required insurance policies include:

- (a) Worker's Compensation Insurance in accordance with all applicable state and federal statutes. Further, Employers Liability Coverage shall be obtained in the following minimum amounts:

- Bodily Injury by Accident - \$500,000 each accident
  - Bodily Injury by Disease - \$500,000 each employee
  - Bodily Injury by Disease - \$500,000 each policy limit

- (b) Commercial General Liability Insurance equivalent to, as a minimum, Insurance Services Office form CG 00 01 04 13 or current equivalent. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements specifically for the following coverages: Products and Completed Operations, Explosion, Collapse and Underground coverage or Pollution. Further there shall be no added exclusions or limiting endorsements that diminish the City's protections as an additional insured under the policy. The following minimum limits of liability are required:

- \$1,000,000 Each occurrence as respect Bodily Injury Liability or Property Damage Liability, or both combined.
  - \$2,000,000 Per Project General Aggregate
  - \$1,000,000 Personal and Advertising Injury
  - \$2,000,000 Products and Completed Operations Aggregate, which, notwithstanding anything to the contrary herein, shall be maintained for three years from the date the Project is completed.

- (c) Motor Vehicle Liability Insurance, including Michigan No-Fault Coverages, equivalent to, as a minimum, Insurance Services Office form CA 00 01 10 13 or current equivalent. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements that diminish the City's protections as an additional insured under the policy. Further, the limits of liability shall be \$1,000,000 for each occurrence as respects Bodily Injury Liability or Property Damage Liability, or both combined.

- (d) Umbrella/Excess Liability Insurance shall be provided to apply excess of the Commercial General Liability, Employers Liability and the Motor Vehicle coverage enumerated above, for each occurrence and for aggregate in the amount of \$1,000,000.

- (2) Insurance required under subsection (1)(b) and (1)(c) above shall be considered primary as respects any other valid or collectible insurance that the City may possess, including any self-insured retentions the City may have; and any other insurance the City does possess shall be considered excess insurance only and shall not be required to contribute

with this insurance. Further, the Contractor agrees to waive any right of recovery by its insurer against the City for any insurance listed herein.

- (3) Insurance companies and policy forms are subject to approval of the City Attorney, which approval shall not be unreasonably withheld. Documentation must provide and demonstrate an unconditional and un-qualified 30-day written notice of cancellation in favor of the City of Ann Arbor. Further, the documentation must explicitly state the following: (a) the policy number(s); name of insurance company(s); name and address of the agent(s) or authorized representative(s); name(s), email address(es), and address of insured; project name; policy expiration date; and specific coverage amounts; (b) any deductibles or self-insured retentions which may be approved by the City, in its sole discretion; (c) that the policy conforms to the requirements specified Contractor shall furnish the City with satisfactory certificates of insurance and endorsements prior to commencement of any work. Upon request, the Contractor shall provide within 30 days a copy of the policy(ies) and all required endorsements to the City. If any of the above coverages expire by their terms during the term of this Contract, the Contractor shall deliver proof of renewal and/or new policies and endorsements to the Administering Service Area/Unit at least ten days prior to the expiration date.
- (4) Any Insurance provider of Contractor shall be authorized to do business in the State of Michigan and shall carry and maintain a minimum rating assigned by A.M. Best & Company's Key Rating Guide of "A-" Overall and a minimum Financial Size Category of "V". Insurance policies and certificates issued by non-authorized insurance companies are not acceptable unless approved in writing by the City.
- (5) City reserves the right to require additional coverage and/or coverage amounts as may be included from time to time in the Detailed Specifications for the Project.
- (6) The provisions of General Condition 28 shall survive the expiration or earlier termination of this contract for any reason.

## **Section 29 - Surety Bonds**

Bonds will be required from the successful bidder as follows:

- (1) A Performance Bond to the City of Ann Arbor for the amount of the bid(s) accepted;
- (2) A Labor and Material Bond to the City of Ann Arbor for the amount of the bid(s) accepted.

Bonds shall be executed on forms supplied by the City in a manner and by a Surety Company authorized to transact business in Michigan and satisfactory to the City Attorney.

## **Section 30 - Damage Claims**

The Contractor shall be held responsible for all damages to property of the City or others, caused by or resulting from the negligence of the Contractor, its employees, or agents during the progress of or connected with the prosecution of the work, whether within the limits of the work or elsewhere. The Contractor must restore all property injured including sidewalks, curbing, sodding, pipes, conduit, sewers or other public or private property to not less than its original condition with new work.

## **Section 31 - Refusal to Obey Instructions**

If the Contractor refuses to obey the instructions of the Supervising Professional, the Supervising Professional shall withdraw inspection from the work, and no payments will be made for work performed thereafter nor may work be performed thereafter until the Supervising Professional shall have again authorized the work to proceed.

## **Section 32 - Assignment**

Neither party to the Contract shall assign the Contract without the written consent of the other. The Contractor may assign any monies due to it to a third party acceptable to the City.

## **Section 33 - Rights of Various Interests**

Whenever work being done by the City's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Supervising Professional, to secure the completion of the various portions of the work in general harmony.

The Contractor is responsible to coordinate all aspects of the work, including coordination of, and with, utility companies and other contractors whose work impacts this project.

## **Section 34 - Subcontracts**

The Contractor shall not award any work to any subcontractor without prior written approval of the City. The approval will not be given until the Contractor submits to the City a written statement concerning the proposed award to the subcontractor. The statement shall contain all information the City may require.

The Contractor shall be as fully responsible to the City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and all other contract documents applicable to the work of the subcontractors and to give the Contractor the same power to terminate any subcontract that the City may exercise over the Contractor under any provision of the contract documents.

Nothing contained in the contract documents shall create any contractual relation between any subcontractor and the City.

## **Section 35 - Supervising Professional's Status**

The Supervising Professional has the right to inspect any or all work. The Supervising Professional has authority to stop the work whenever stoppage may be appropriate to insure the proper execution of the Contract. The Supervising Professional has the authority to reject all work and materials which do not conform to the Contract and to decide questions which arise in the execution of the work.

The Supervising Professional shall make all measurements and determinations of quantities. Those measurements and determinations are final and conclusive between the parties.

## **Section 36 - Supervising Professional's Decisions**

The Supervising Professional shall, within a reasonable time after their presentation to the Supervising Professional, make decisions in writing on all claims of the City or the Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the contract documents.

## **Section 37 - Storing Materials and Supplies**

Materials and supplies may be stored at the site of the work at locations agreeable to the City unless specific exception is listed elsewhere in these documents. Ample way for foot traffic and drainage must be provided, and gutters must, at all times, be kept free from obstruction. Traffic on streets shall be interfered with as little as possible. The Contractor may not enter or occupy with agents, employees, tools, or material any private property without first obtaining written permission from its owner. A copy of the permission shall be furnished to the Supervising Professional.

## **Section 38 - Lands for Work**

The Contractor shall provide, at its own expense and without liability to the City, any additional land and access that may be required for temporary construction facilities or for storage of materials.

## **Section 39 - Cleaning Up**

The Contractor shall, as directed by the Supervising Professional, remove at its own expense from the City's property and from all public and private property all temporary structures, rubbish and waste materials resulting from its operations unless otherwise specifically approved, in writing, by the Supervising Professional.

## **Section 40 - Salvage**

The Supervising Professional may designate for salvage any materials from existing structures or underground services. Materials so designated remain City property and shall be transported or stored at a location as the Supervising Professional may direct.



## **Section 41 - Night, Saturday or Sunday Work**

No night or Sunday work (without prior written City approval) will be permitted except in the case of an emergency and then only to the extent absolutely necessary. The City may allow night work which, in the opinion of the Supervising Professional, can be satisfactorily performed at night. Night work is any work between 8:00 p.m. and 7:00 a.m. No Saturday work will be permitted unless the Contractor gives the Supervising Professional at least 48 hours but not more than 5 days notice of the Contractor's intention to work the upcoming Saturday.

## **Section 42 - Sales Taxes**

Under State law the City is exempt from the assessment of State Sales Tax on its direct purchases. Contractors who acquire materials, equipment, supplies, etc. for incorporation in City projects are not likewise exempt. State Law shall prevail. The Bidder shall familiarize itself with the State Law and prepare its Bid accordingly. No extra payment will be allowed under this Contract for failure of the Contractor to make proper allowance in this bid for taxes it must pay.

## Section 43

### CONTRACTOR'S DECLARATION

I hereby declare that I have not, during the period \_\_\_\_\_, 20\_\_\_\_, to \_\_\_\_\_, 20\_\_\_\_, performed any work, furnished any materials, sustained any loss, damage or delay, or otherwise done anything in addition to the regular items (or executed change orders) set forth in the Contract titled \_\_\_\_\_, for which I shall ask, demand, sue for, or claim compensation or extension of time from the City, except as I hereby make claim for additional compensation or extension of time as set forth on the attached itemized statement. I further declare that I have paid all payroll obligations related to this Contract that have become due during the above period and that all invoices related to this Contract received more than 30 days prior to this declaration have been paid in full except as listed below.

There is/is not (Contractor please circle one and strike one as appropriate) an itemized statement attached regarding a request for additional compensation or extension of time.

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Date

By \_\_\_\_\_  
(Signature)

Its \_\_\_\_\_  
(Title of Office)

Past due invoices, if any, are listed below.

**Section 44**

**CONTRACTOR'S AFFIDAVIT**

The undersigned Contractor, \_\_\_\_\_, represents that on \_\_\_\_\_, 20\_\_, it was awarded a contract by the City of Ann Arbor, Michigan to \_\_\_\_\_ under the terms and conditions of a Contract titled \_\_\_\_\_. The Contractor represents that all work has now been accomplished and the Contract is complete.

The Contractor warrants and certifies that all of its indebtedness arising by reason of the Contract has been fully paid or satisfactorily secured; and that all claims from subcontractors and others for labor and material used in accomplishing the project, as well as all other claims arising from the performance of the Contract, have been fully paid or satisfactorily settled. The Contractor agrees that, if any claim should hereafter arise, it shall assume responsibility for it immediately upon request to do so by the City of Ann Arbor.

The Contractor, for valuable consideration received, does further waive, release and relinquish any and all claims or right of lien which the Contractor now has or may acquire upon the subject premises for labor and material used in the project owned by the City of Ann Arbor.

This affidavit is freely and voluntarily given with full knowledge of the facts.

\_\_\_\_\_  
Contractor Date

By \_\_\_\_\_  
(Signature)

Its \_\_\_\_\_  
(Title of Office)

Subscribed and sworn to before me, on this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_  
\_\_\_\_\_, \_\_\_\_\_ County, Michigan

Notary Public  
\_\_\_\_\_  
County, MI  
My commission expires on:

## **STANDARD SPECIFICATIONS**

## DETAILED SPECIFICATIONS

## APPENDIX

**ATTACHMENT B**  
**GENERAL DECLARATIONS**

City of Ann Arbor  
Guy C. Larcom Municipal Building  
Ann Arbor, Michigan 48107

Ladies and Gentlemen:

The undersigned, as Bidder, declares that this Bid is made in good faith, without fraud or collusion with any person or persons bidding on the same Contract; that this Bidder has carefully read and examined the bid documents, including City Nondiscrimination requirements and Declaration of Compliance Form, Living Wage requirements and Declaration of Compliance Form, Prevailing Wage requirements and Declaration of Compliance Form, Vendor Conflict of Interest Form, Notice of Pre-Bid Conference, General Information, Bid, Bid Forms, Contract, Bond Forms, General Conditions, Standard Specifications, Detailed Specifications, all Addenda, and the Plans (if applicable) and understands them. The Bidder declares that it conducted a full investigation at the site and of the work proposed and is fully informed as to the nature of the work and the conditions relating to the work's performance. The Bidder also declares that it has extensive experience in successfully completing projects similar to this one.

The Bidder acknowledges that it has not received or relied upon any representations or warrants of any nature whatsoever from the City of Ann Arbor, its agents or employees, and that this Bid is based solely upon the Bidder's own independent business judgment.

The undersigned proposes to perform all work shown on the plans or described in the bid documents, including any addenda issued, and to furnish all necessary machinery, tools, apparatus, and other means of construction to do all the work, furnish all the materials, and complete the work in strict accordance with all terms of the Contract of which this Bid is one part.

In accordance with these bid documents, and Addenda numbered \_\_\_\_\_, the undersigned, as Bidder, proposes to perform at the sites in and/or around Ann Arbor, Michigan, all the work included herein for the amounts set forth in the Bid Forms.

The Bidder declares that it has become fully familiar with the liquidated damage clauses for completion times and for compliance with City Code Chapter 112, understands and agrees that the liquidated damages are for the non-quantifiable aspects of non-compliance and do not cover actual damages that may be shown and agrees that if awarded the Contract, all liquidated damage clauses form part of the Contract.

The Bidder declares that it has become fully familiar with the provisions of Chapter 14, Section 1:320 (Prevailing wages) and Chapter 23 (Living Wage) of the Code of the City of Ann Arbor and that it understands and agrees to comply, to the extent applicable to employees providing services to the City under this Contract, with the wage and reporting requirements stated in the City Code provisions cited. Bidder certifies that the statements contained in the City Prevailing Wage and Living Wage Declaration of Compliance Forms are true and correct. Bidder further agrees that the cited provisions of Chapter 14 and Chapter 23 form a part of this Contract.

The Bidder declares that it has become familiar with the City Conflict of Interest Disclosure Form and certifies that the statement contained therein is true and correct.

The Bidder encloses a certified check or Bid Bond in the amount of 5% of the total of the Bid Price. The Bidder agrees both to contract for the work and to furnish the necessary Bonds and insurance documentation within 10 days after being notified of the acceptance of the Bid.

If this Bid is accepted by the City and the Bidder fails to contract and furnish the required Bonds and insurance documentation within 10 days after being notified of the acceptance of this Bid, then the Bidder shall be considered to have abandoned the Contract and the certified check or Bid Bond accompanying this Bid shall become due and payable to the City.

If the Bidder enters into the Contract in accordance with this Bid, or if this Bid is rejected, then the accompanying check or Bid Bond shall be returned to the Bidder.

In submitting this Bid, it is understood that the right is reserved by the City to accept any Bid, to reject any or all Bids, to waive irregularities and/or informalities in any Bid, and to make the award in any manner the City believes to be in its best interest.

SIGNED THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 202\_.

\_\_\_\_\_  
Bidder's Name

\_\_\_\_\_  
Authorized Signature of Bidder

\_\_\_\_\_  
Official Address

\_\_\_\_\_  
(Print Name of Signer Above)

\_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
Email Address for Award Notice



**ATTACHMENT C**  
**LEGAL STATUS OF BIDDER**

(The bidder shall fill out the appropriate form and strike out the other three.)

Bidder declares that it is:

\* A corporation organized and doing business under the laws of the State of \_\_\_\_\_, for whom \_\_\_\_\_, bearing the office title of \_\_\_\_\_, whose signature is affixed to this Bid, is authorized to execute contracts.

**NOTE: If not incorporated in Michigan, please attach the corporation's Certificate of Authority**

• A limited liability company doing business under the laws of the State of \_\_\_\_\_, whom \_\_\_\_\_ bearing the title of \_\_\_\_\_ whose signature is affixed to this proposal, is authorized to execute contract on behalf of the LLC.

\* A partnership, organized under the laws of the state of \_\_\_\_\_ and filed in the county of \_\_\_\_\_, whose members are (list all members and the street and mailing address of each) (attach separate sheet if necessary):

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\* An individual, whose signature with address, is affixed to this Bid: \_\_\_\_\_ (initial here)

**Authorized Official**

\_\_\_\_\_ **Date** \_\_\_\_\_, 202\_

(Print) Name \_\_\_\_\_ Title \_\_\_\_\_

Company:

---

Address:

---

Contact Phone ( ) \_\_\_\_\_ Fax ( ) \_\_\_\_\_

Email \_\_\_\_\_

**ATTACHMENT D**  
**PREVAILING WAGE DECLARATION OF COMPLIANCE**

The "wage and employment requirements" of Section 1:320 of Chapter 14 of Title I of the Ann Arbor City Code mandates that the city not enter any contract, understanding or other arrangement for a public improvement for or on behalf of the city unless the contract provides that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. Where the contract and the Ann Arbor City Code are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used. Further, to the extent that any employees of the contractor providing services under this contract are not part of the class of craftsmen, mechanics and laborers who receive a prevailing wage in conformance with section 1:320 of Chapter 14 of Title I of the Code of the City of Ann Arbor, employees shall be paid a prescribed minimum level of compensation (i.e. Living Wage) for the time those employees perform work on the contract in conformance with section 1:815 of Chapter 23 of Title I of the Code of the City of Ann Arbor.

At the request of the city, any contractor or subcontractor shall provide satisfactory proof of compliance with this provision.

The Contractor agrees:

- (a) To pay each of its employees whose wage level is required to comply with federal, state or local prevailing wage law, for work covered or funded by this contract with the City,
- (b) To require each subcontractor performing work covered or funded by this contract with the City to pay each of its employees the applicable prescribed wage level under the conditions stated in subsection (a) or (b) above.
- (c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.
- (d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the wage and employment provisions of the Chapter 14 of the Ann Arbor City Code. The undersigned certifies that he/she has read and is familiar with the terms of Section 1:320 of Chapter 14 of the Ann Arbor City Code and by executing this Declaration of Compliance obligates his/her employer and any subcontractor employed by it to perform work on the contract to the wage and employment requirements stated herein. The undersigned further acknowledges and agrees that if it is found to be in violation of the wage and employment requirements of Section 1:320 of the Chapter 14 of the Ann Arbor City Code it shall has been deemed a material breach of the terms of the contract and grounds for termination of same by the City.

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Signature of Authorized Representative                      Date

\_\_\_\_\_  
Print Name and Title

\_\_\_\_\_  
Address, City, State, Zip

\_\_\_\_\_  
Phone/Email address

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500

## ATTACHMENT E

### LIVING WAGE ORDINANCE DECLARATION OF COMPLIANCE

The Ann Arbor Living Wage Ordinance (Section 1:811-1:821 of Chapter 23 of Title I of the Code) requires that an employer who is (a) a contractor providing services to or for the City for a value greater than \$10,000 for any twelve-month contract term, or (b) a recipient of federal, state, or local grant funding administered by the City for a value greater than \$10,000, or (c) a recipient of financial assistance awarded by the City for a value greater than \$10,000, shall pay its employees a prescribed minimum level of compensation (i.e., Living Wage) for the time those employees perform work on the contract or in connection with the grant or financial assistance. The Living Wage must be paid to these employees for the length of the contract/program.

*Companies employing fewer than 5 persons and non-profits employing fewer than 10 persons are exempt from compliance with the Living Wage Ordinance. If this exemption applies to your company/non-profit agency please check here  No. of employees \_\_\_\_\_*

The Contractor or Grantee agrees:

- (a) To pay each of its employees whose wage level is not required to comply with federal, state or local prevailing wage law, for work covered or funded by a contract with or grant from the City, no less than the Living Wage. The current Living Wage is defined as \$14.82/hour for those employers that provide employee health care (as defined in the Ordinance at Section 1:815 Sec. 1 (a)), or no less than \$16.52/hour for those employers that do not provide health care. The Contractor or Grantor understands that the Living Wage is adjusted and established annually on April 30 in accordance with the Ordinance and covered employers shall be required to pay the adjusted amount thereafter to be in compliance with Section 1:815(3).

**Check the applicable box below which applies to your workforce**

- Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage without health benefits
- Employees who are assigned to any covered City contract/grant will be paid at or above the applicable living wage with health benefits

- (b) To post a notice approved by the City regarding the applicability of the Living Wage Ordinance in every work place or other location in which employees or other persons contracting for employment are working.
- (c) To provide to the City payroll records or other documentation within ten (10) business days from the receipt of a request by the City.
- (d) To permit access to work sites to City representatives for the purposes of monitoring compliance, and investigating complaints or non-compliance.
- (e) To take no action that would reduce the compensation, wages, fringe benefits, or leave available to any employee covered by the Living Wage Ordinance or any person contracted for employment and covered by the Living Wage Ordinance in order to pay the living wage required by the Living Wage Ordinance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services or agrees to accept financial assistance in accordance with the terms of the Living Wage Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Living Wage Ordinance, obligates the Employer/Grantee to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract or grant of financial assistance.

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Street Address

\_\_\_\_\_  
Signature of Authorized Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
City, State, Zip

\_\_\_\_\_  
Print Name and Title

\_\_\_\_\_  
Phone/Email address

## Attachment F

# CITY OF ANN ARBOR LIVING WAGE ORDINANCE

**RATE EFFECTIVE APRIL 30, 2022 - ENDING APRIL 29, 2023**

**\$14.82 per hour**

If the employer provides health care benefits\*

**\$16.52 per hour**

If the employer does **NOT** provide health care benefits\*

Employers providing services to or for the City of Ann Arbor or recipients of grants or financial assistance from the City of Ann Arbor for a value of more than \$10,000 in a twelve-month period of time must pay those employees performing work on a City of Ann Arbor contract or grant, the above living wage.

## **ENFORCEMENT**

The City of Ann Arbor may recover back wages either administratively or through court action for the employees that have been underpaid in violation of the law. Persons denied payment of the living wage have the right to bring a civil action for damages in addition to any action taken by the City.

Violation of this Ordinance is punishable by fines of not more than \$500/violation plus costs, with each day being considered a separate violation. Additionally, the City of Ann Arbor has the right to modify, terminate, cancel or suspend a contract in the event of a violation of the Ordinance.

\* Health Care benefits include those paid for by the employer or making an employer contribution toward the purchase of health care. The employee contribution must not exceed \$.50 an hour for an average work week; and the employer cost or contribution must equal no less than \$1/hr for the average work week.

**The Law Requires Employers to Display This Poster Where Employees Can Readily See It.**

**For Additional Information or to File a Complaint contact  
Colin Spencer at 734/794-6500 or [cspencer@a2gov.org](mailto:cspencer@a2gov.org)**



**ATTACHEMENT G**

<b>Vendor Conflict of Interest Disclosure Form</b>
--

All vendors interested in conducting business with the City of Ann Arbor must complete and return the Vendor Conflict of Interest Disclosure Form in order to be eligible to be awarded a contract. Please note that all vendors are subject to comply with the City of Ann Arbor’s conflict of interest policies as stated within the certification section below.

If a vendor has a relationship with a City of Ann Arbor official or employee, an immediate family member of a City of Ann Arbor official or employee, the vendor shall disclose the information required below.

1. No City official or employee or City employee’s immediate family member has an ownership interest in vendor’s company or is deriving personal financial gain from this contract.
2. No retired or separated City official or employee who has been retired or separated from the City for less than one (1) year has an ownership interest in vendor’s Company.
3. No City employee is contemporaneously employed or prospectively to be employed with the vendor.
4. Vendor hereby declares it has not and will not provide gifts or hospitality of any dollar value or any other gratuities to any City employee or elected official to obtain or maintain a contract.
5. Please note any exceptions below:

<b>Conflict of Interest Disclosure*</b>	
Name of City of Ann Arbor employees, elected officials or immediate family members with whom there may be a potential conflict of interest.	<input type="checkbox"/> Relationship to employee <hr style="border: 0; border-top: 1px solid black;"/> <input type="checkbox"/> Interest in vendor’s company <input type="checkbox"/> Other (please describe in box below)

\*Disclosing a potential conflict of interest does not disqualify vendors. In the event vendors do not disclose potential conflicts of interest and they are detected by the City, vendor will be exempt from doing business with the City.

<b>I certify that this Conflict of Interest Disclosure has been examined by me and that its contents are true and correct to my knowledge and belief and I have the authority to so certify on behalf of the Vendor by my signature below:</b>		
<b>Vendor Name</b>	<b>Vendor Phone Number</b>	
<b>Signature of Vendor Authorized Representative</b>	<b>Date</b>	<b>Printed Name of Vendor Authorized Representative</b>

Questions about this form? Contact Procurement Office City of Ann Arbor Phone: 734/794-6500, [procurement@a2gov.org](mailto:procurement@a2gov.org)

# ATTACHMENT H

## DECLARATION OF COMPLIANCE

### Non-Discrimination Ordinance

The "non discrimination by city contractors" provision of the City of Ann Arbor Non-Discrimination Ordinance (Ann Arbor City Code Chapter 112, Section 9:158) requires all contractors proposing to do business with the City to treat employees in a manner which provides equal employment opportunity and does not discriminate against any of their employees, any City employee working with them, or any applicant for employment on the basis of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight. It also requires that the contractors include a similar provision in all subcontracts that they execute for City work or programs.

In addition the City Non-Discrimination Ordinance requires that all contractors proposing to do business with the City of Ann Arbor must satisfy the contract compliance administrative policy adopted by the City Administrator. A copy of that policy may be obtained from the Purchasing Manager

The Contractor agrees:

- (a) To comply with the terms of the City of Ann Arbor's Non-Discrimination Ordinance and contract compliance administrative policy, including but not limited to an acceptable affirmative action program if applicable.
- (b) To post the City of Ann Arbor's Non-Discrimination Ordinance Notice in every work place or other location in which employees or other persons are contracted to provide services under a contract with the City.
- (c) To provide documentation within the specified time frame in connection with any workforce verification, compliance review or complaint investigation.
- (d) To permit access to employees and work sites to City representatives for the purposes of monitoring compliance, or investigating complaints of non-compliance.

The undersigned states that he/she has the requisite authority to act on behalf of his/her employer in these matters and has offered to provide the services in accordance with the terms of the Ann Arbor Non-Discrimination Ordinance. The undersigned certifies that he/she has read and is familiar with the terms of the Non-Discrimination Ordinance, obligates the Contractor to those terms and acknowledges that if his/her employer is found to be in violation of Ordinance it may be subject to civil penalties and termination of the awarded contract.

---

Company Name

---

Signature of Authorized Representative

Date

---

Print Name and Title

---

Address, City, State, Zip

---

Phone/Email Address

**Questions about the Notice or the City Administrative Policy, Please contact:**  
Procurement Office of the City of Ann Arbor  
(734) 794-6500

# ATTACHMENT I

## CITY OF ANN ARBOR NON-DISCRIMINATION ORDINANCE

Relevant provisions of Chapter 112, Nondiscrimination, of the Ann Arbor City Code are included below.  
You can review the entire ordinance at [www.a2gov.org/humanrights](http://www.a2gov.org/humanrights).

**Intent:** It is the intent of the city that no individual be denied equal protection of the laws; nor shall any individual be denied the enjoyment of his or her civil or political rights or be discriminated against because of actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight.

**Discriminatory Employment Practices:** No person shall discriminate in the hire, employment, compensation, work classifications, conditions or terms, promotion or demotion, or termination of employment of any individual. No person shall discriminate in limiting membership, conditions of membership or termination of membership in any labor union or apprenticeship program.

**Discriminatory Effects:** No person shall adopt, enforce or employ any policy or requirement which has the effect of creating unequal opportunities according to actual or perceived age, arrest record, color, disability, educational association, familial status, family responsibilities, gender expression, gender identity, genetic information, height, HIV status, marital status, national origin, political beliefs, race, religion, sex, sexual orientation, source of income, veteran status, victim of domestic violence or stalking, or weight for an individual to obtain housing, employment or public accommodation, except for a bona fide business necessity. Such a necessity does not arise due to a mere inconvenience or because of suspected objection to such a person by neighbors, customers or other persons.

**Nondiscrimination by City Contractors:** All contractors proposing to do business with the City of Ann Arbor shall satisfy the contract compliance administrative policy adopted by the City Administrator in accordance with the guidelines of this section. All city contractors shall ensure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity and tends to eliminate inequality based upon any classification protected by this chapter. All contractors shall agree not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of any applicable protected classification. All contractors shall be required to post a copy of Ann Arbor's Non-Discrimination Ordinance at all work locations where its employees provide services under a contract with the city.

**Complaint Procedure:** If any individual believes there has been a violation of this chapter, he/she may file a complaint with the City's Human Rights Commission. The complaint must be filed within 180 calendar days from the date of the individual's knowledge of the allegedly discriminatory action or 180 calendar days from the date when the individual should have known of the allegedly discriminatory action. A complaint that is not filed within this timeframe cannot be considered by the Human Rights Commission. To file a complaint, first complete the complaint form, which is available at [www.a2gov.org/humanrights](http://www.a2gov.org/humanrights). Then submit it to the Human Rights Commission by e-mail ([hrc@a2gov.org](mailto:hrc@a2gov.org)), by mail (Ann Arbor Human Rights Commission, PO Box 8647, Ann Arbor, MI 48107), or in person (City Clerk's Office). For further information, please call the commission at 734-794-6141 or e-mail the commission at [hrc@a2gov.org](mailto:hrc@a2gov.org).

**Private Actions For Damages or Injunctive Relief:** To the extent allowed by law, an individual who is the victim of discriminatory action in violation of this chapter may bring a civil action for appropriate injunctive relief or damages or both against the person(s) who acted in violation of this chapter.

THIS IS AN OFFICIAL GOVERNMENT NOTICE AND  
MUST BE DISPLAYED WHERE EMPLOYEES CAN READILY SEE IT.

## MICHIGAN DEPARTMENT OF TRANSPORTATION CERTIFIED PAYROLL

COMPLETION OF CERTIFIED PAYROLL FORM FULFILLS THE MINIMUM MDOT PREVAILING WAGE REQUIREMENTS

(1) NAME OF CONTRACTOR / SUBCONTRACTOR (CIRCLE ONE) (2) ADDRESS

(3) PAYROLL NO. (4) FOR WEEK ENDING (5) PROJECT AND LOCATION (6) CONTRACT ID

(a)	(b)	(c)	(d) DAY AND DATE							(e)	(f)	(g)	(h)	(i)	(j) DEDUCTIONS						(k)
															TOTAL HOURS ON PROJECT	PROJECT RATE OF PAY	PROJECT RATE OF FRINGE PAY	GROSS PROJECT EARNED	GROSS WEEKLY EARNED	TOTAL WEEKLY HOURS WORKED ALL JOBS	
EMPLOYEE INFORMATION	WORK CLASSIFICATION	Hour Type	HOURS WORKED ON PROJECT							TOTAL HOURS ON PROJECT	PROJECT RATE OF PAY	PROJECT RATE OF FRINGE PAY	GROSS PROJECT EARNED	GROSS WEEKLY EARNED	TOTAL WEEKLY HOURS WORKED ALL JOBS	FICA	FEDERAL	STATE	OTHER	TOTAL DEDUCT	TOTAL WEEKLY WAGES PAID FOR ALL JOBS
NAME:									0				\$0.00							\$0.00	\$0.00
ETH#GEN: ID #:	GROUP/CLASS #:	S							0											\$0.00	\$0.00
NAME:									0				\$0.00							\$0.00	\$0.00
ETH#GEN: ID #:	GROUP/CLASS #:	S							0											\$0.00	\$0.00
NAME:									0				\$0.00							\$0.00	\$0.00
ETH#GEN: ID #:	GROUP/CLASS #:	S							0											\$0.00	\$0.00
NAME:									0				\$0.00							\$0.00	\$0.00
ETH#GEN: ID #:	GROUP/CLASS #:	S							0											\$0.00	\$0.00
NAME:									0				\$0.00							\$0.00	\$0.00
ETH#GEN: ID #:	GROUP/CLASS #:	S							0											\$0.00	\$0.00
NAME:									0				\$0.00							\$0.00	\$0.00
ETH#GEN: ID #:	GROUP/CLASS #:	S							0											\$0.00	\$0.00
NAME:									0				\$0.00							\$0.00	\$0.00



Date \_\_\_\_\_

I, \_\_\_\_\_ (Name of Signatory Party) \_\_\_\_\_ (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

\_\_\_\_\_ on the \_\_\_\_\_ (Contractor or Subcontractor)  
 \_\_\_\_\_; that during the payroll period commencing on the \_\_\_\_\_ (Building or Work)  
 \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, and ending the \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_,  
 all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

\_\_\_\_\_ from the full \_\_\_\_\_ (Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 C.F.R. Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Stat. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. § 3145), and described below:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, or if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

- in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

- Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.

DWG	DESCRIPTION	DWG	DESCRIPTION	DWG	DESCRIPTION
GEN	<b>GENERAL</b> GENERAL CONDITIONS	1-1	OPERATIONS BUILDING RISER	2-1	MAINTENANCE BUILDING RISER
ABAC	ANIXTER BUILDING AUTO. CABLES	1-2	BOILER CONTROL DIAGRAM	2-2	RTU 2-1 CONTROL DIAGRAM
BFTRM	BLN/FLN TERMINATION SPECIFICATION	1-3	RTU 1-1 CONTROL DIAGRAM	2-3	RTU 2-1 CONTROL
MTRM	MBC TERMINATION SPECIFICATION	1-4	RTU 1-1 CONTROLLER	2-4	RTU 2-2 CONTROL DIAGRAM
MWIR	MBC WIRING SPECIFICATION	1-5	RTU 1-2 CONTROL DIAGRAM	2-5	RTU 2-2 CONTROLLER
ETRM	MEC TERMINATION SPECIFICATION	1-6	RTU 1-2 CONTROLLER	2-6	RTU 2-3 CONTROL DIAGRAM
EWIR	MEC WIRING SPECIFICATION	1-7	RTU 1-3 CONTROL DIAGRAM	2-7	RTU 2-3 CONTROLLER
MECPC	MEC WIRING SPECIFICATION	1-8	RTU 1-3 CONTROLLER	2-8	RTU 2-1 CONTROL DIAGRAM
PTRM1	MEC POWER/COMMUNICATION	1-9	RTU 1-4 CONTROL DIAGRAM	2-9	ERU 2-1 CONTROLLER
PTRM2	PXCC TERMINATION SPECIFICATION	1-10	RTU 1-4 CONTROLLER	2-10	ERU 2-2 CONTROL DIAGRAM
PWIR	PXCC TERMINATION SPEC. SHEET 2	1-11	RTU 1-5 CONTROL DIAGRAM	2-11	ERU 2-2 CONTROLLER
	PXCC WIRING SPECIFICATION	1-12	RTU 1-5 CONTROLLER	2-12	ERU 2-3 CONTROL DIAGRAM
		1-13	RTU 1-6A CONTROL DIAGRAM	2-13	ERU 2-3 CONTROLLER
		1-14	RTU 1-6A CONTROLLER	2-14	ERU 2-4 CONTROL DIAGRAM
	<b>VALVE SUBMITTAL</b>	1-15	RTU 1-6B CONTROL DIAGRAM	2-15	ERU 2-4 CONTROLLER
	VALVE SUBMITTAL	1-16	RTU 1-6B CONTROLLER	2-16	ERU 2-5 CONTROL DIAGRAM
	<b>DAMPER SUBMITTAL</b>	1-17	ERU 1-1 CONTROL DIAGRAM	2-17	ERU 2-5 CONTROLLER
	DAMPER SUBMITTAL	1-18	ERU 1-1 CONTROLLER	2-18	ERU 2-6 CONTROL DIAGRAM
	<b>TEC SCHEDULE</b>	1-19	ERU 1-2 CONTROL DIAGRAM	2-19	ERU 2-6 CONTROLLER
	TERMINAL EQUIPMENT SCHEDULE	1-20	ERU 1-2 CONTROLLER	2-20	GENERATOR SYSTEM INTERFACE
		1-21	ERU 1-3 CONTROL DIAGRAM	2-21	LIGHTING SYSTEM INTERFACE
		1-22	ERU 1-3 CONTROLLER	2-22	EXHAUST FAN CONTROL
		1-23	ERU 1-4 CONTROL DIAGRAM	2-23	UNIT HEATER CONTROL
		1-24	ERU 1-4 CONTROLLER	2-24	MB.14.COMM.222 LAYOUT
		1-25	ERU 1-5 CONTROL DIAGRAM	2-25	TCP-14 PANEL LAYOUT
		1-26	ERU 1-5 CONTROLLER		
		1-27	GENERATOR SYSTEM INTERFACE		
		1-28	LIGHTING SYSTEM INTERFACE		
		1-29	VAV w/HW REHEAT	3-1	<b>VEHICLE BUILDING CONTROL DRAWINGS</b>
		1-30	VAV/HW REHEAT & FTR	3-2	VEHICLE BUILDING RISER
		1-31	EXHAUST FAN CONTROL	3-3	MAKE-UP AIR CONTROL
		1-32	UNIT HEATER CONTROL	3-4	MAKE-UP AIR CONTROL
		1-33	OB.01.BLRROOM.100 LAYOUT	3-5	GENERATOR SYSTEM INTERFACE
		1-34	XFMR-1 PANEL LAYOUT	3-6	LIGHTING SYSTEM INTERFACE
				3-7	EXHAUST FAN CONTROL
				3-8	UNIT HEATER CONTROL
				3-8B	VB.24.ELECRROOM.308 LAYOUT
				3-9	VB.24.ELECRROOM.308-X1 LAYOUT
					TCP-24 PANEL LAYOUT
					<b>TRUCK/AUTO BUILDING CONTROL DRAWINGS</b>
				4-1	TRUCK/AUTO WASH RISER
				4-2	MAKE-UP AIR CONTROL
				4-3	UNIT HEATER CONTROL
				4-4	TW.25.MECHROOM.401 LAYOUT
				4-5	TCP-25 PANEL LAYOUT

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone 734-468-3800  
Fax 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	LWJ	10/27/06	12/03/07

440P-702374  
0

**TOCA**

**GENERAL CONDITIONS**

**WIRING:**

- ALL WIRING WILL BE IN ACCORDANCE WITH NEC, STATE AND LOCAL CODE
- ALL LOW VOLTAGE WIRING (30 VAC OR 30 VDC) WILL BE RUN SEPARATE FROM LINE VOLTAGE WIRING
- ALL OTHER WIRING WILL BE INSTALLED IN APPROVED CONDUIT OR CABLE TRAY
- ALL WIRING WILL BE SIEMENS APPROVED, TAGGED AND COLOR CODED
  - ALL BLN CABLE CONNECTIONS WILL BE LABELED WITH THE PANEL "FROM" OR THE PANEL "TO"
  - ALL TEC POWER CONNECTIONS WILL BE LABELED WITH THE TEC/ TRANSFORMER "FROM" OR THE TEC "TO"
  - ALL FLN CABLE CONNECTIONS WILL BE LABELED WITH THE TEC/ FLNC "FROM" OR THE TEC "TO"
- ALL CONTROL JUNCTION BOX COVERS WILL BE PAINTED GREEN.

**MECHANICAL WORK:**

- MECHANICAL CONTRACTOR WILL INSTALL ALL CONTROL VALVES AND PIPE WELLS AS REQUIRED BY SIEMENS SUBMITTALS & CONTRACT DOCUMENTS AS PREPARED BY HOBBS + BLACK ARCHITECTS.
- SHEET METAL CONTRACTOR WILL INSTALL ALL DAMPERS AS REQUIRED BY SIEMENS SUBMITTALS & CONTRACT DOCUMENTS AS PREPARED BY HOBBS + BLACK ARCHITECTS.
- ALL LOCATIONS OF CONTROL DEVICES WILL BE COORDINATED WITH SIEMENS FOR INCORPORATION INTO AS-BUILT SHOP DRAWINGS.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ct. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

Siemens Building Technologies  
BAU

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

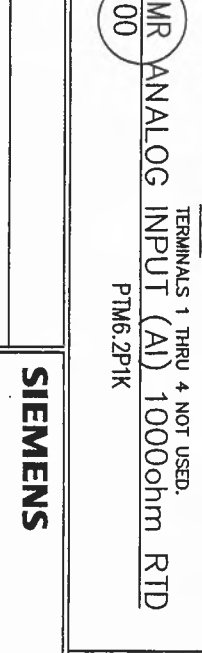
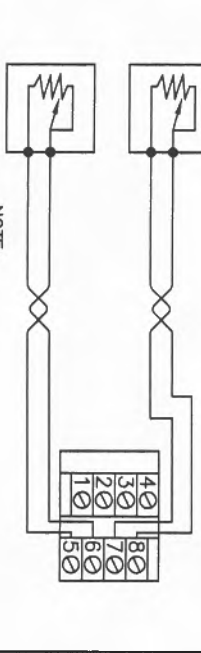
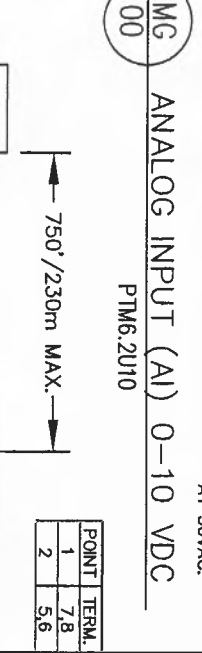
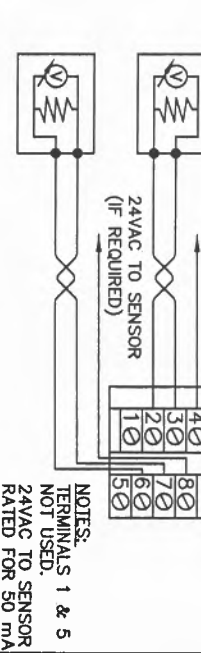
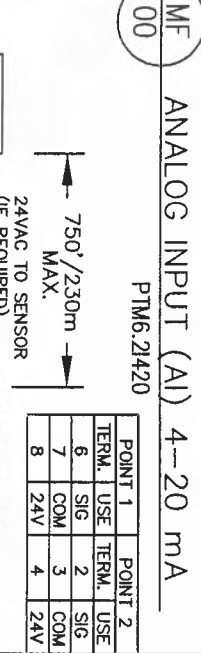
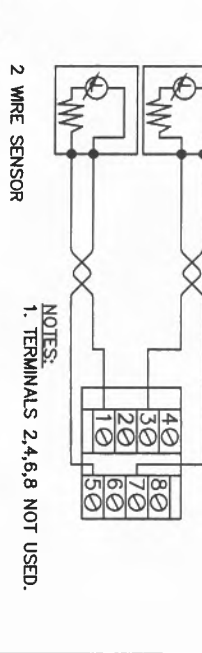
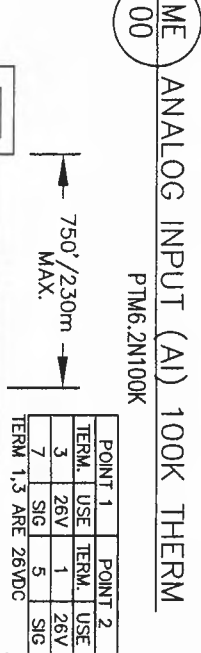
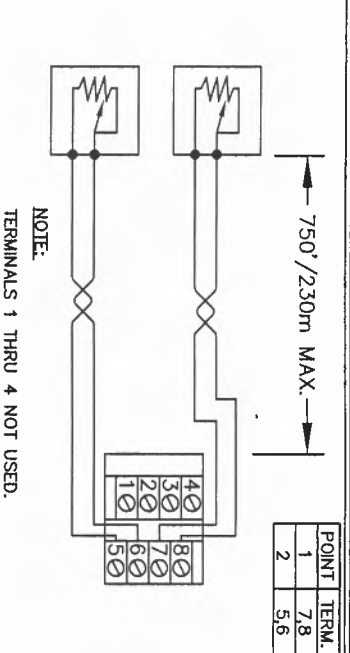
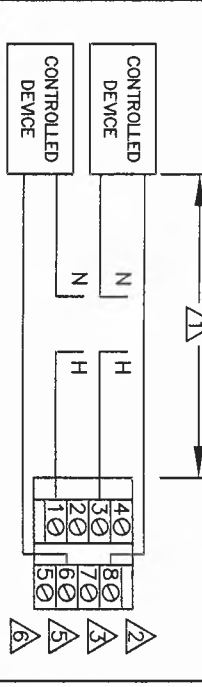
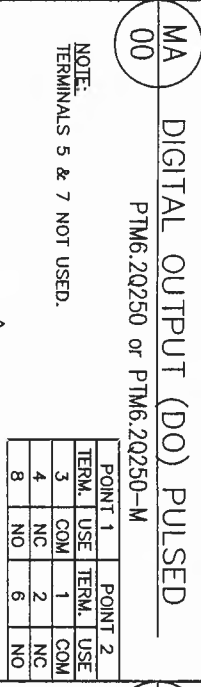
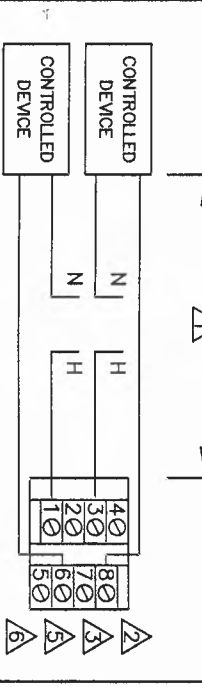
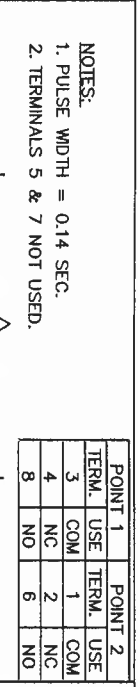
ENGINEER	DRAWER	CHECKED BY	INITIAL	RELEASE	LAST EDIT DATE
SFM	SFM	<i>[Signature]</i>		10/27/08	11/28/07

**GENERAL CONDITIONS**

440P-702374  
0

**GEN**





**NOTES:**

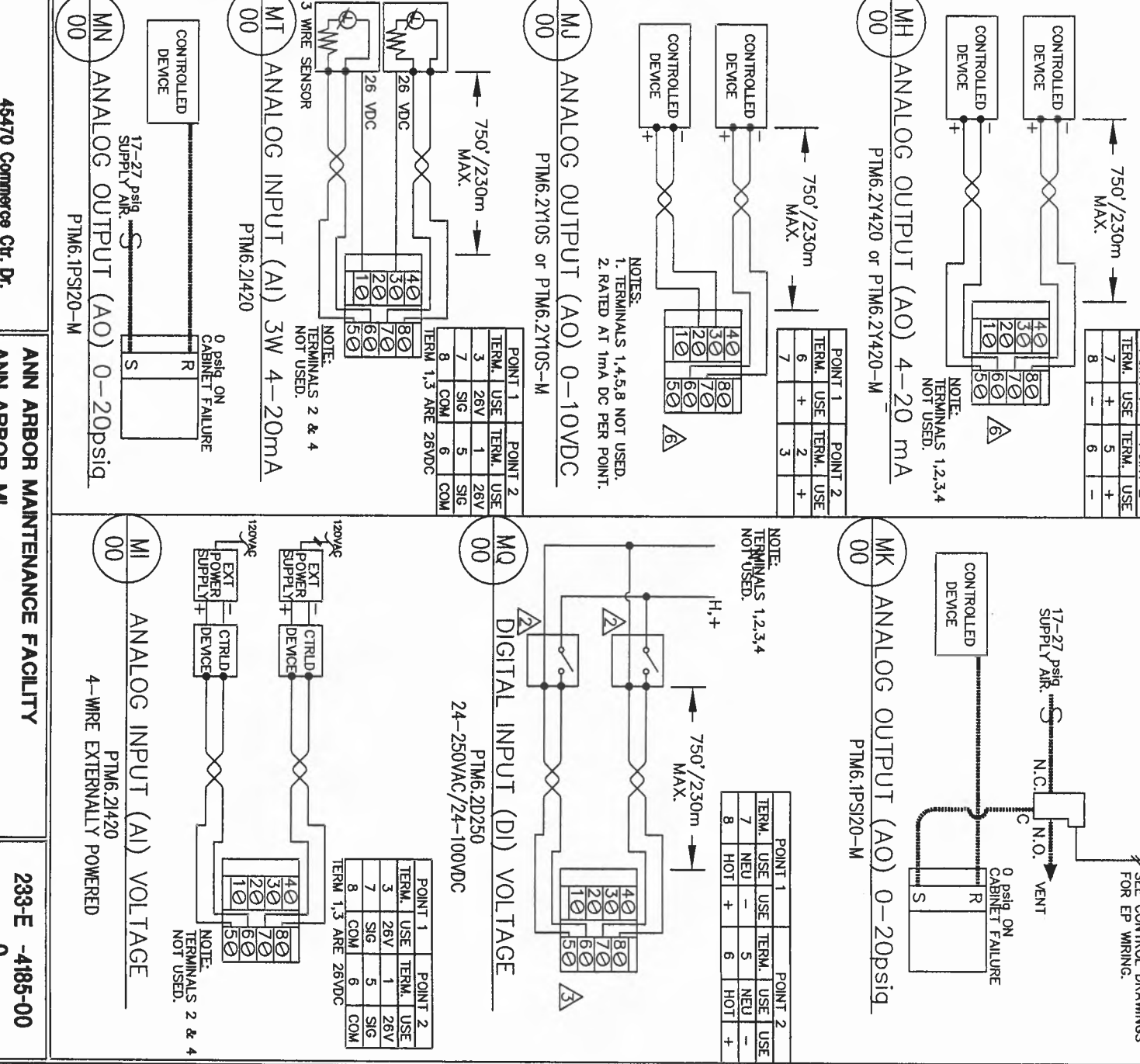
- 1. MAXIMUM WIRE RUN LENGTHS ARE BASED ON THE CURRENT DRAW AND WIRE GAUGE. SEE DRAWING M1.
- 2. SEE CONTROL DRAWINGS FOR NORMAL DE-ENERGIZED CONTACT STATE.
- 3. DO NOT MIX HIGH AND LOW VOLTAGE WIRING ON THE SAME POINT MODULE.
- 4. FOR PULSE DIGITAL INPUTS: MAXIMUM PULSE FREQUENCY = 25 Hz. MINIMUM PULSE WIDTH = 20 ms
- 5. MBC DO CONTACT RATINGS
- 6. AC OPERATION: 4A @ 240VAC (RESISTIVE) 3A @ 240VAC (INDUCTIVE) SIZE 4 MOTOR STARTER DC OPERATION: 40W @ < 50VDC 20W @ > 50 VDC

**GENERAL NOTES:**

- POINT 1 CORRESPONDS TO LOWEST EVEN ADDRESS ON MODULE.
- POINT 2 CORRESPONDS TO LOWEST ODD ADDRESS ON MODULE.
- POINT 3 CORRESPONDS TO HIGHEST EVEN ADDRESS ON MODULE.
- POINT 4 CORRESPONDS TO HIGHEST ODD ADDRESS ON MODULE.
- ADDRESS KEY SHOWS LOWEST ADDRESS ON MODULE.

SEE CONTROL DRAWINGS FOR EP WIRING.

0 psig ON CABINET FAILURE



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ct. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3900  
FAX: 888-815-0749

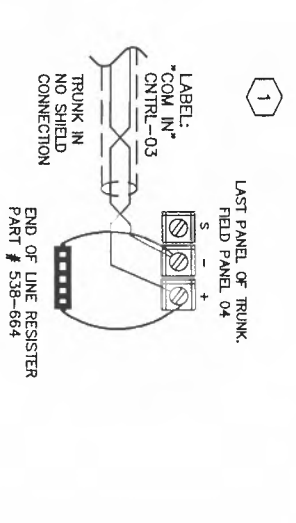
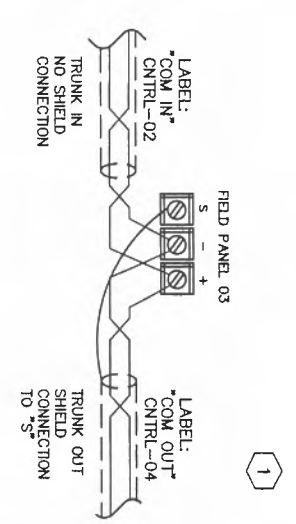
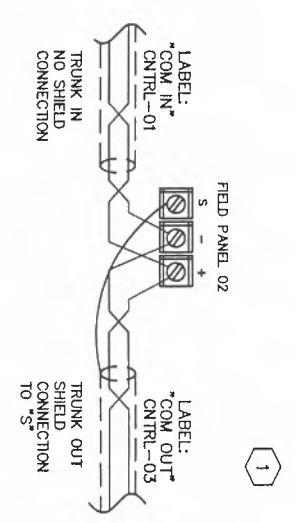
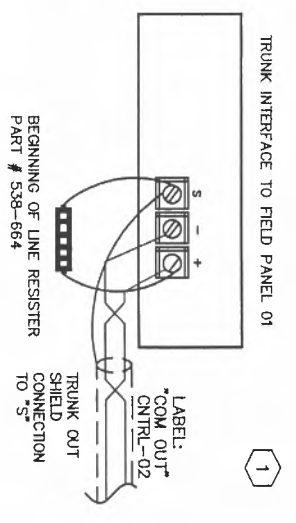
**ANN ARBOR MAINTENANCE FACILITY**  
ANN ARBOR, MI

ENGINEER DRATER CHECKED BY INITIAL RELEASE LAST EDIT DATE  
SFM SFM 10/27/08 11/28/07

233-E -4185-00  
0  
**MTRM**

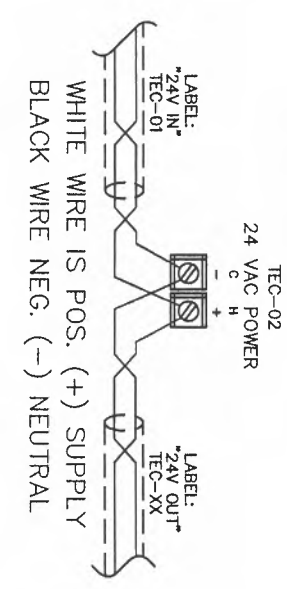
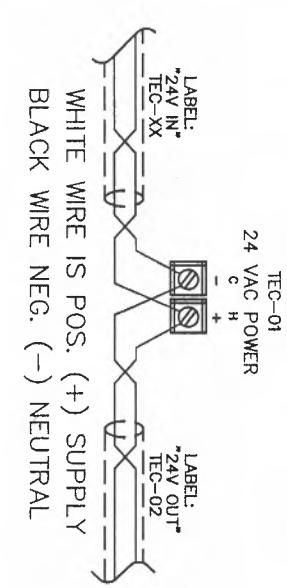
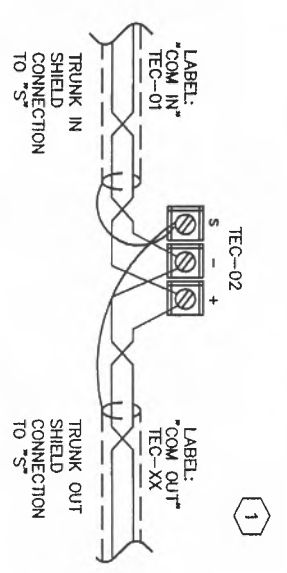
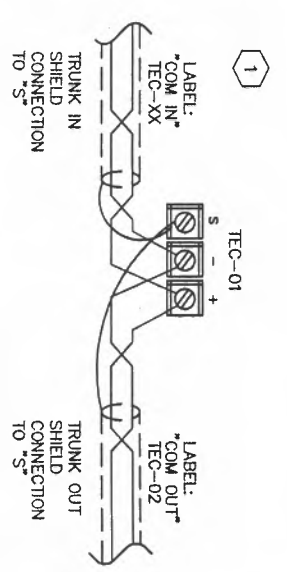
- ① USE ONLY # 5201 PLENUM RATED WIRE FOR THE FLN TRUNK 24 AWG TSP LOW CAPACITANCE (12.5 pf/ft)
- ② 32 TECs ON ONE FLN TRUNK ADDRESSED 0-31
- ③ FLN WIRING SHALL BE DAISY CHAINED ONLY.

## BLN WIRING



### 3 CONTROLLER BLN TERMINATION

NOTE: NO SPLICES IN BLN TRUNK  
NOTE: LABEL BLN TRUNK PER GENERAL COND.



POWER WIRING SHALL BE DAISY CHAINED.

### 2 TEC FLN TERMINATION

NOTE: NO SPLICES OF FLN TRUNK  
NOTE: LABEL TEC FLN TRUNK PER GENERAL COND.

### 1 TEC POWER TRUNK TERMINATION

NOTE: DO NOT GROUND TEC PWR TRUNK WIRING  
NOTE: LABEL TEC PWR TRUNK PER GENERAL COND.

## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
Phone: 734-456-3800  
Fax: 886-815-0149  
BAU

## ANN ARBOR MAINTENANCE FACILITY

ENGINEER	DRFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/28/07

440P-702374  
0  
**BFTRM**

# BUILDING AUTOMATION CABLES

## Specification Catalog

Instruction: Click on SBT Part Number to view detailed cable specifications.

### Non-Plenum Cables

SBT Part Number	Description	Application Pts	Jacket Color	Ref.
H-TP18-CMR	HVAC CBL 18AWG,STR,1TP,CMR	DI, DO, AI, AO	Blue	8.3
H-TP20-CM	HVAC CBL 20AWG,STR,1TP,CM	DI, DO, AI, AO	Blue	8.1
H-3P24-CMR	HVAC CBL 24AWG,SOL,3P,CMR	TEC STAT	Blue	8.8
H-3C18-CMR	HVAC CBL 18AWG,STR,3COND,CMR	TEC V/D	Blue	8.4
H-3C20-CM	HVAC CBL 20AWG,STR,3COND,CM	TEC V/D	Blue	8.2
H-2C14-CL3R	HVAC CBL 14AWG,STR,2COND,CL3R	LV Power	Dark Blue	8.5
H-B-TSP24LC-CM	HVAC BL24AWG,STR,TSP,LOCAP,CM	BLN	Orange	8.6
H-F-TSP24LC-CM	HVAC FL24AWG,STR,TSP,LOCAP,CM	FLN	Org/Blu Stripe	8.7
LON-1P22-CM	LON CBL 22AWG,STR,1PAIR,CM	LON	Org/Wht Stripe	8.17
LON-1PS22-CM	LON CBL 22AWG,STR,1PAIR,OAS,CM	LON	Org/Wht Stripe	8.19
LON-2P22-CM	LON CBL 22AWG,STR,2PAIR,CM	LON	Org/Wht Stripe	8.18
LON-2PS22-CM	LON CBL 22AWG,STR,2PAIR,OAS,CM	LON	Org/Wht Stripe	8.20
E-4TP24CAT5-CM	ETHERNET 24AWG,SOL,4TP,CAT5,CM	Ethernet	White	11.1

### Plenum Cables

SBT Part Number	Description	Application Pts	Jacket Color	Ref.
H-TP18-CMP	HVAC CBL 18AWG,STR,1TP,CMP	DI, DO, AI, AO	Blue	8.11
H-TP20-CMP	HVAC CBL 20AWG,STR,1TP,CMP	DI, DO, AI, AO	Blue	8.9
H-3P24-CMP	HVAC CBL 24AWG,SOL,3P,CMP	TEC STAT	Blue	8.18
H-3C18-CMP	HVAC CBL 18AWG,STR,3COND,CMP	TEC V/D	Blue	8.12
H-3C20-CMP	HVAC CBL 20AWG,STR,3COND,CMP	TEC V/D	Blue	8.10
H-2C14-CL3P	HVAC CBL 14AWG,STR,2COND,CL3P	LV Power	Dark Blue	8.13
H-B-TSP24LC-CMP	HVAC BLN24AWG,STR,TSP,LOCAP,CMP	BLN	Orange	8.14
H-F-TSP24LC-CMP	HVAC FLN24AWG,STR,TSP,LOCAP,CMP	FLN	Org/Blu Stripe	8.15
LON-1P22-CMP	LON CBL 22AWG,STR,1PAIR,CMR	LON	Org/Wht Stripe	8.21
LON-1PS22-CMP	LON CBL 22AWG,STR,1PAIR,OAS,CMR	LON	Org/Wht Stripe	8.23
LON-2P22-CMP	LON CBL 22AWG,STR,2PAIR,CMR	LON	Org/Wht Stripe	8.22
LON-2PS22-CMP	LON CBL 22AWG,STR,2PAIR,OAS,CMR	LON	Org/Wht Stripe	8.24
E-4TP24CAT5-CMP	ETHERNET 24AWG,SOL,4TP,CAT5,CMR	Ethernet	White	11.2

### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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### SIEMENS

Siemens Building Technologies  
 BAU

46470 Commerce Ctr. Dr.  
 Plymouth Twp., MA 01870  
 USA  
 PHONE: 794-456-3800  
 FAX: 888-85-0749

### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	2/74	10/27/06	11/28/07

### ANIXTER BUILDING AUTO. CABLES

440P-702374

0

**ABAC**

**MBC WIRING TYPE AND GAUGE REQUIREMENTS**

TABLE 1

CIRCUIT TYPE	CLASS	WIRE TYPE	MAX. DISTANCE <sup>1</sup>	CONDUIT SHARING <sup>3</sup>
AC LINE POWER	POWER	#12-14 THHN	AS REQUIRED	CHECK LOCAL CODES
DIGITAL OUTPUT	1 & 2	CHECK LOCAL CODES	SEE TABLE 3	CHECK LOCAL CODES
DIGITAL INPUT	2	#18-22 TP CM OR CMP	750ft (230 m)	CHECK LOCAL CODES
HIGH VOLTAGE DIGITAL INPUT	1	CHECK LOCAL CODES	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT <sup>2</sup>	2	#20 TP CM OR CMP	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT THERMISTOR	2	#20 TP CM OR CMP	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT 0-10 V	2	#20 TP CM OR CMP	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT 4-20 mA	2	#20 TP CM OR CMP	750ft (230 m)	CHECK LOCAL CODES
ANALOG OUTPUT 0-10 V	2	#20 TP CM OR CMP	750ft (230 m)	CHECK LOCAL CODES
ANALOG OUTPUT 4-20 mA	2	#20 TP CM OR CMP	750ft (230 m)	CHECK LOCAL CODES
PMD TRUNK 4800 BAUD	2	18 AWG TSP 20 AWG TSP 24 AWG TSP	104ft (3.05km) 44ft (1.22km) 44ft (1.22km)	CLASS 2 ONLY
PMD TRUNK 9600 BAUD	2	18 AWG TSP 20 AWG TSP 24 AWG TSP	44ft (1.22km) 44ft (1.22km) 44ft (1.22km)	CLASS 2 ONLY
BLN TRUNK 115,200 BAUD	2	24 AWG TSP	SEE TABLE 4	CLASS 2 ONLY

TABLE 1 & 2 NOTES:

- MAXIMUM WIRE RUN DISTANCES FOR BLN TRUNKS ARE PER LOGICAL TRUNK, WITHOUT USE OF HIGH SPEED TRUNK ISOLATOR EXTENDERS (HSTIE). (SEE TABLE 4) IF HSTIE ARE USED.
- WIRE LENGTHS AFFECT POINT INTERCEPTS.
- CONDUIT SHARING RULES:  
CLASS 2 POINT WIRING MAY SHARE CONDUIT WITH CLASS 1 WIRING ONLY WHERE LOCAL CODES PERMIT. BOTH CLASS 1 AND CLASS 2 WIRING MAY BE RUN TOGETHER IN THE MBC ENCLOSURE PROVIDING THE CLASS 2 WIRE IS UL RATED 300V / 75C (167F) OR BETTER, OR THE CLASS 2 WIRE IS NEC TYPE CM(FT4) OR CMP(FT6) RATED 75C (167F) OR BETTER. NEC TYPE CL2 AND CL2P IS NOT ACCEPTABLE UNLESS ALSO UL RATED AND MARKED 300V / 75C (167F) OR WIRE BARRIER IS INSTALLED.
- TWISTED PAIR, NON-JACKETED (RATED 75C AND 300 V) CABLE MAY BE USED IN PLACE OF CM OR CMP CABLE WHEN CONTAINED IN CONDUIT AS PER LOCAL CODES.

**MAXIMUM DO WIRE RUN LENGTHS**

TABLE 3

NOMINAL INRUSH	STARTER SIZE	WIRE SIZE		
		#18	#16	#14
200 VA	0	500ft (152m)	900ft (274m)	1400ft (427m)
550 VA	2	200ft (61m)	300ft (91m)	500ft (152m)
1150 VA	3	100ft (30m)	150ft (46m)	250ft (76m)
1500 VA	4	70ft (21m)	100ft (30m)	200ft (61m)

TABLE 3 NOTES:

- DISTANCES SHOWN ASSURE LESS THAN 10% VOLTAGE DROP ACROSS THE WIRE FOR A TYPICAL STARTER.

2.

AC OPERATION:  
4A @ 240VAC (RESISTIVE)  
3A @ 240VAC (INDUCTIVE)  
SIZE 4 MOTOR STARTER

DC OPERATION:  
40W @ < 50VDC  
20W @ > 50 VDC

**MAXIMUM NUMBER HSTIE IN SERIES ON BLN TRUNK**

TABLE 4

SPEED	1200 BAUD	4800 BAUD	9600 - 38.4K57.6K - 115.2K BAUD
SERIES TIE'S	10	7	6
BLN TRUNK DISTANCE	4000ft (1.2km)	4000ft (1.2km)	4000ft (1.2km) / 3280ft (1km)

- THE MUST BE USED TO ISOLATE BLN BETWEEN MEC CONNECTED TO DIFFERENT SERVICE GROUNDS.
- THE MAX BLN DISTANCE APPLIES TO EACH SIDE OF THE TIE.

**GENERAL NOTES:**

- COMPLY WITH LOCAL BUILDING CODES.
- SIZE WIRE FOR LOAD, CURRENT, AND VOLTAGE.
- ALL WIRE TO BE APPROVED OR LISTED FOR THE INTENDED APPLICATION BY AGENCIES SUCH AS UL, NEC, CSA.
- ALWAYS REFER TO LOCAL CODES FOR CONDUIT SHARING.
- WIRING MUST HAVE INSULATION RATED FOR HIGHEST VOLTAGE CIRCUIT IN CONDUIT.
- BLN TRUNK TERMINATOR MUST BE USED AT THE END OF EACH 19.2k OR FASTER BAUD BLN.
- THE BLN TRUNK MUST BE AN UNINTERRUPTED RUN BETWEEN CABINETS. NO SPLICES ALLOWED.
- CM/CMP WIRE IS NOT USABLE FOR CLASS 1 CIRCUITS.

**MBC WIRE SPECIFICATIONS**

TABLE 2

CABLE CONFIGURATION	LOW-VOLTAGE POINT APPLICATIONS	POINT USAGE
GAUGE	TWISTED PAIR OR TSP <sup>1</sup>	TWISTED PAIR (UNJACKETED) OR TSP <sup>1</sup>
CAPACITANCE	#18 TO #22 AWG (STRANDED)	#18 TO #22 AWG (STRANDED)
TWISTS PER FOOT	n.d.	n.d.
SHIELDS	6 MINIMUM	6 MINIMUM
NEC CLASS	NOT REQUIRED (IN CASE OF TSP, 100% FOIL W/ DRAIN WIRE)	NOT REQUIRED (IN CASE OF TSP, 100% FOIL W/ DRAIN WIRE)
CEC CLASS	CM, CMP (75C OR HIGHER)	CM, CMP (75C OR HIGHER)
UL VOLTAGE RATING	FT4, FT6 (75C OR HIGHER)	FT4, FT6 (75C OR HIGHER)
UL TEMP. RATING	NOT SPECIFIED	NOT SPECIFIED
	NOT SPECIFIED	75C (167F)

- EXCEPT NICKEL OR PLATINUM INPUT WHICH MUST BE #18 TO #20 AWG.
- 300 VAC WIRE CAN BE USED IN FIELD PANELS CONTAINING VOLTAGES BELOW 150 VAC.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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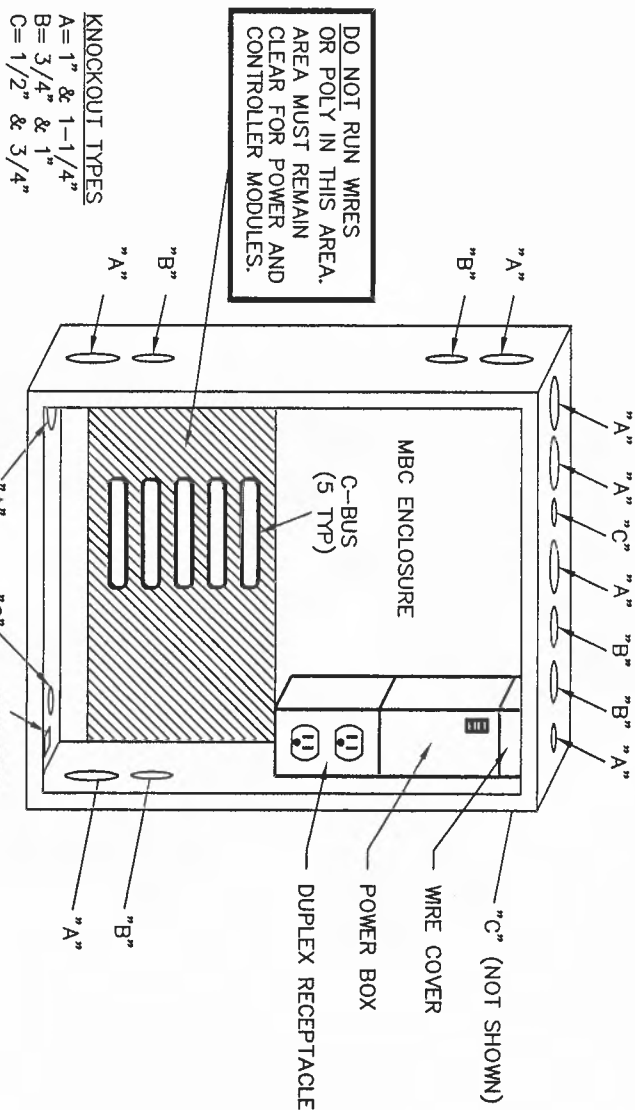
**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-615-0749

**ANN ARBOR MAINTENANCE FACILITY**  
ANN ARBOR, MI  
ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: SFM  
INITIAL RELEASE DATE: 10/27/06  
LAST EDIT DATE: 11/28/07

440P-702374  
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**MWIR**



**MBC CONDUIT PENETRATIONS**

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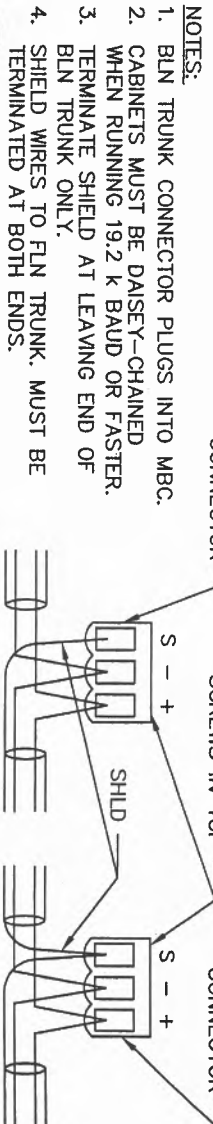
**MBC POWER SOURCE REQUIREMENTS**  
VOLTAGE: 102-132 VAC  
204-264 VAC  
LINE FREQUENCY: 50 / 60 Hz  
POWER: 200 VA (MAX.)

**NOTES:**

- NO MORE THAN SEVEN (7) MBC'S ARE ALLOWED ON A SINGLE 3-WIRE CIRCUIT.
- RECEPTACLE IS PRE-WIRED AND MOUNTED IN FACTORY.

**MBC POWER WIRING**

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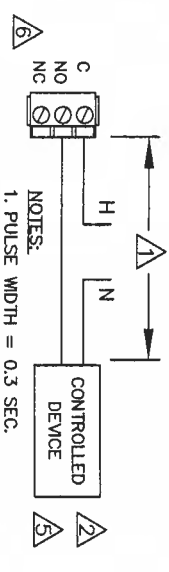


**MBC TRUNK TERMINATIONS**

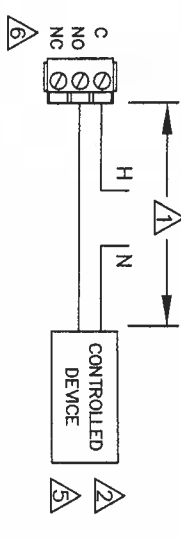
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- NOTES:**
- BLN TRUNK CONNECTOR PLUGS INTO MBC.
  - CABINETS MUST BE DAISEY-CHAINED WHEN RUNNING 19.2 k BAUD OR FASTER.
  - TERMINATE SHIELD AT LEAVING END OF BLN TRUNK ONLY.
  - SHIELD WIRES TO FLN TRUNK, MUST BE TERMINATED AT BOTH ENDS.

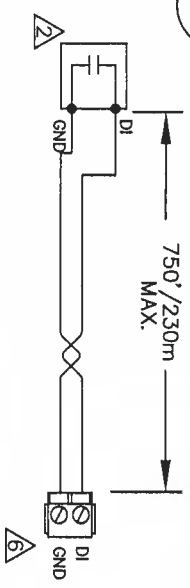




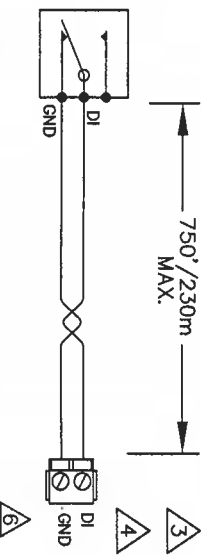
EA DIGITAL OUTPUT (DO) PULSED  
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EB DIGITAL OUTPUT (DO) LATCHED  
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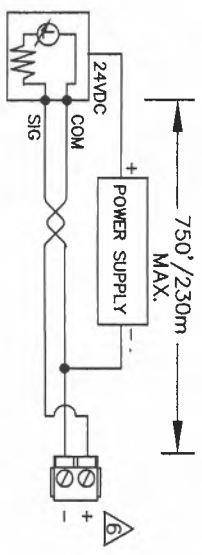


EC DIGITAL INPUT (DI) DRY CONTACT  
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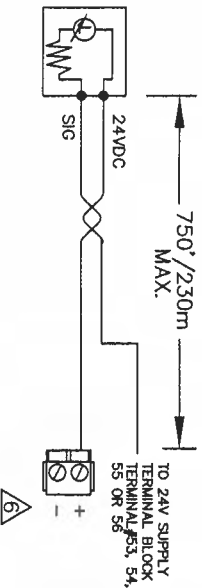


ED DIGITAL INPUT (DI) PULSE ACCUM  
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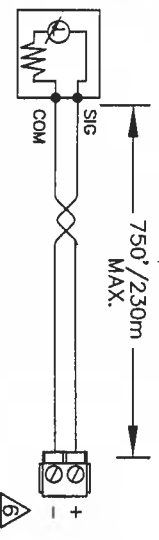
NOTE: ONLY DI05 THROUGH DI08 CAN BE USED FOR A PULSED ACCUMULATING POINT.



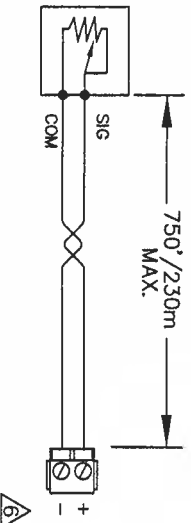
EE ANALOG INPUT (AI) 4-20mA  
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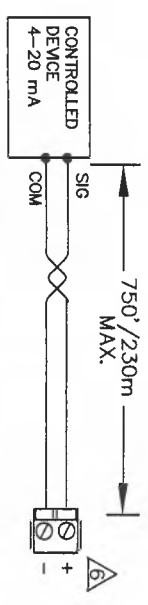
EF ANALOG INPUT (AI) 4-20 mA  
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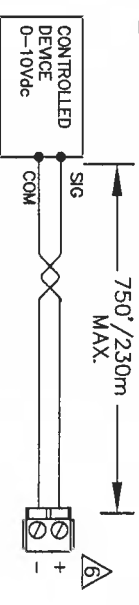
EG ANALOG INPUT (AI) 0-10 Vdc  
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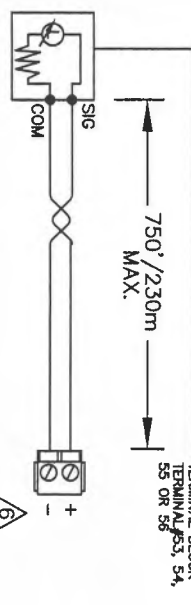
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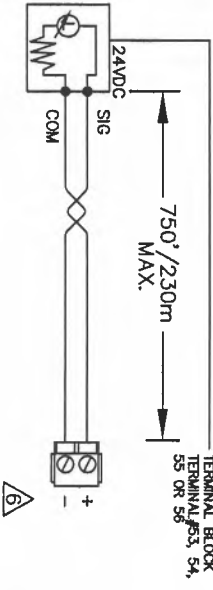
EH ANALOG OUTPUT (AO) 4-20 mA  
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EJ ANALOG OUTPUT (AO) 0-10 Vdc  
00



EL ANALOG INPUT (AI) 0-10 Vdc  
00



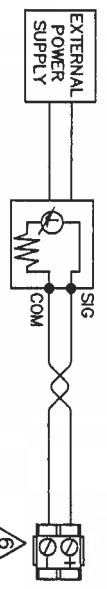
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NOTES:  
1 MAXIMUM WIRE RUN LENGTHS ARE BASED ON THE CURRENT DRAW AND WIRE GAGE. SEE DRAWING EWMR.  
2 SEE CONTROL DRAWINGS FOR NORMAL DE-ENERGIZED CONTACT STATE  
3 DI01 THROUGH DI04 CAN NOT BE USED FOR PULSED ACCUMULATING

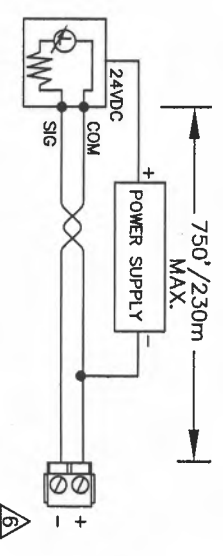
4 FOR PULSED DIGITAL INPUTS:  
MAXIMUM PULSE RATE = 10 PER SECOND (50 ms PER STATE, 100ms PER PULSE)

5 MEC DO CONTACT RATINGS  
AC OPERATION:  
4A @ 240VAC (RESISTIVE)  
3A @ 240VAC (INDUCTIVE)  
SIZE 4 MOTOR STARTER  
DC OPERATION:  
40W @ < 50VDC  
20W @ > 50VDC

6 REFER TO MEC PANEL FOR ACTUAL TERMINATIONS



EI ANALOG INPUT (AI) 0-10 Vdc  
00



EM ANALOG INPUT (AI) 0-10 Vdc  
00

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>CPH</i>	10/27/06	11/28/07

440P-702874  
0  
**ETRM**

**MEC WIRING TYPE AND GAUGE REQUIREMENTS**

TABLE 1

CIRCUIT TYPE	CLASS	WIRE TYPE	MAX. DISTANCE REFER TO NEC	CONDUIT SHARING <sup>2</sup> CHECK LOCAL CODES
AC LINE POWER <sup>1</sup>	POWER	#12-14 THHN		CHECK LOCAL CODES
DIGITAL OUTPUT	1 & 2	TP not required, check job specs & local codes #14 to #22 AWG	SEE TABLE 3	CHECK LOCAL CODES
DIGITAL INPUT	2	TP not required, check job specs & local codes #14 to #22 AWG	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT <sup>4</sup> R/N <sup>5</sup> OR RTD	2	#18 TP <sup>3</sup> or #20 TSP CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT 0-10 V	2	#18-#22 TP <sup>3</sup> or TSP CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT 4-20 mA	2	#18-#22 TP <sup>3</sup> or TSP CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG OUTPUT 0-10 V	2	#18-#22 TP <sup>3</sup> or TSP CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG OUTPUT 4-20 mA	2	#18-#22 TP <sup>3</sup> or TSP CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
MEC EXP TRUNK	2	#24 TSP	200ft (61 m)	CHECK LOCAL CODES
BLN TRUNK	2	#24 TSP	SEE TABLE 4	CHECK LOCAL CODES
BLN TRUNK	2	#22 TS LEVEL	1600ft (500 m)	CHECK LOCAL CODES

- WHEN DAISY-CHAINING POWER TO EXPANSION BLOCKS USE #14 WIRE.
- CONDUIT SHARING RULES: NO CLASS 2 POINT WIRING CAN SHARE PERMIT. (BOTH CLASS 1 AND CLASS 2 WIRING CAN BE RUN IN THE MEC PROVIDING THE CLASS 2 WIRE IS UL LISTED 300V 75°C(167°F) OR HIGHER, OR THE CLASS 2 WIRE IS NEC TYPE CM(FT4)(75°C OR HIGHER) OR CMP(FT6)(75°C OR HIGHER). NEC TYPE CL2 AND CL2P IS NOT ACCEPTABLE UNLESS ALSO UL LISTED AND MARKED 300V 75°C(167°F) OR HIGHER.)
- TWISTED PAIR, NON-JACKETED UL LISTED 75°C(167°F) AND 300V, CABLE CAN BE USED IN PLACE OF CM(FT4) OR CMP(FT6)(BOTH MUST BE RATED 75°C OR HIGHER) CABLE WHEN CONTAINED IN CONDUIT PER LOCAL CODES. SEE THE FIELD PURCHASING GUIDE FOR WIRE.
- WIRE LENGTH AFFECTS POINT INTERCEPT ENTRY. ADJUST INTERCEPT ACCORDINGLY.
- UL RECOGNIZED WIRE (LABELED WITH A BACKWARDS "RU") IS NOT FIELD INSTALLABLE. USE ONLY UL-LISTED WIRE.

**MEC WIRE SPECIFICATIONS TABLE 2**

CABLE CONFIGURATION	LOW-VOLTAGE POINT APPLICATIONS	POINT USAGE
GAUGE	TWISTED PAIR OR TSP	TWISTED PAIR (UNJACKETED) OR TSP
CAPACITANCE	#18 TO #22 AWG (STRAINED) <sup>1</sup>	#18 TO #22 AWG (STRAINED) <sup>1</sup>
TWISTS PER FOOT	n.d.	n.d.
SHIELDS	6 MINIMUM	6 MINIMUM
NEC CLASS	NOT REQUIRED (IN CASE OF TSP, 100% FOIL W/ DRAIN WIRE)	NOT REQUIRED (IN CASE OF TSP, 100% FOIL W/ DRAIN WIRE)
CEC CLASS	CM, CMP (75°C OR HIGHER)	NOT SPECIFIED
UL VOLTAGE RATING	FT4, FT6 (75°C OR HIGHER)	NOT SPECIFIED
UL TEMP. RATING	NOT SPECIFIED	300 VAC <sup>2</sup>

- EXCEPT NICKEL OR PLATINUM INPUT WHICH MUST BE #18 TO #20 AWG.
- 300 VAC WIRE CAN BE USED IN FIELD PANELS CONTAINING VOLTAGES BELOW 150 VAC.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**MAXIMUM DO WIRE RUN LENGTHS**

TABLE 3

NOMINAL INRUSH	STARTER SIZE	WIRE SIZE		
		#18	#16	#14
200 VA	0	500ft (152m)	900ft (274m)	1400ft (427m)
550 VA	1	200ft (61m)	300ft (91m)	500ft (152m)
1150 VA	2	100ft (30m)	150ft (46m)	250ft (76m)
1500 VA	3	70ft (21m)	100ft (30m)	200ft (61m)

**TABLE 3 NOTES:**

- DISTANCES SHOWN ASSURE LESS THAN 10% VOLTAGE DROP ACROSS THE WIRE FOR A TYPICAL STARTER.
- MEC DO CONTACT RATINGS

- 4A @ 250VAC & 30VDC
- 4A @ 250VAC & 30VDC

**MAXIMUM NUMBER HSTIE IN SERIES ON BLN TRUNK**

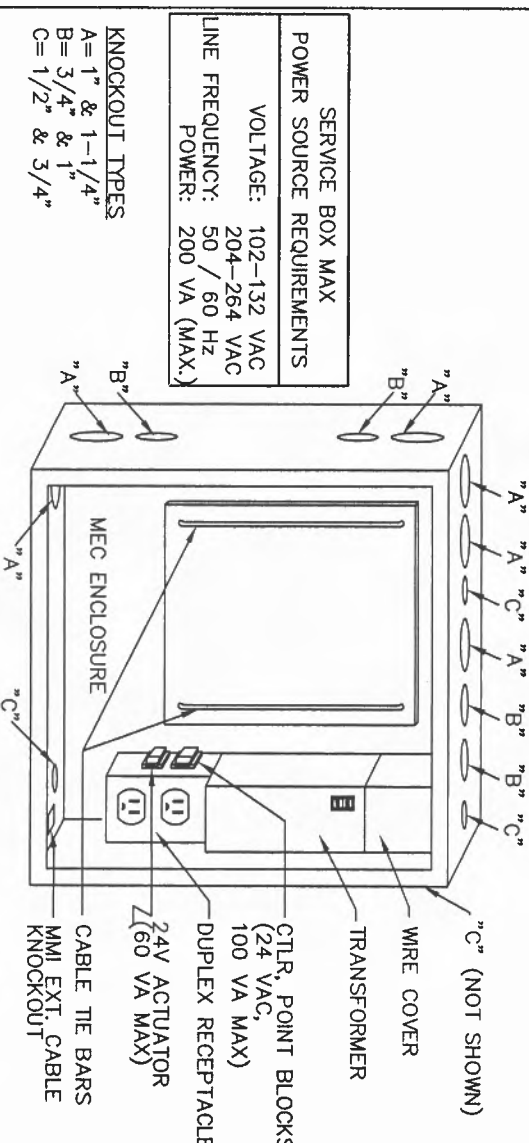
TABLE 4

SPEED	1200 BAUD	4800 BAUD	9600 - 38.4K/57.6K - 115.2K BAUD
SERIES TIE'S	10	7	6
BLN TRUNK DISTANCE	4000ft (1.2km)	4000ft (1.2km)	4000ft (1.2km)

- THE MUST BE USED TO ISOLATE BLN BETWEEN MEC CONNECTED TO DIFFERENT SERVICE GROUNDS.
- THE MAX BLN DISTANCE APPLIES TO EACH SIDE OF THE TIE.

**GENERAL NOTES:**

- COMPLY WITH LOCAL BUILDING CODES.
- SIZE WIRE FOR LOAD, CURRENT, AND VOLTAGE.
- ALL WIRE TO BE APPROVED OR LISTED FOR THE INTENDED APPLICATION BY AGENCIES SUCH AS UL, NEC, CSA.
- ALWAYS REFER TO LOCAL CODES FOR CONDUIT SHARING.
- WIRING MUST HAVE INSULATION RATED FOR HIGHEST VOLTAGE CIRCUIT IN CONDUIT.
- BLN TRUNK TERMINATOR MUST BE USED AT THE END OF EACH 19.2k OR FASTER BAUD BLN.
- THE BLN TRUNK MUST BE AN UNINTERRUPTED RUN BETWEEN CABINETS. NO SPLICES ALLOWED.
- CM/CMP WIRE IS NOT USABLE FOR CLASS 1 CIRCUITS.
- ALL POINT BLOCKS WIRED TO A MEC MUST BE DAISY-CHAINED. THE TOTAL WIRE LENGTH FROM THE MEC TO THE LAST POINT BLOCK IN THE CHAIN MUST BE NO LONGER THEN 200 FT (61m)



**MEC CONDUIT PENETRATIONS**

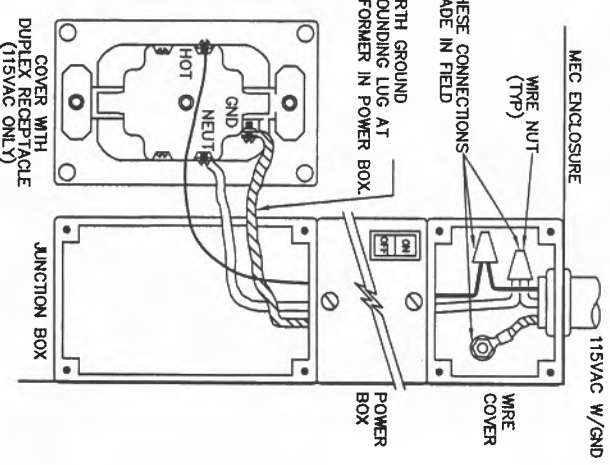
MEC FAMILY VA RATINGS	VA RATING
MEC	35
ANALOG POINT BLOCK, 4A1, 4A0	20
ANALOG POINT BLOCK, 8A1	18
DIGITAL POINT BLOCK 4D1, 4D0	14
DIGITAL POINT BLOCK 8D1, 4D0	18

**NOTES:**

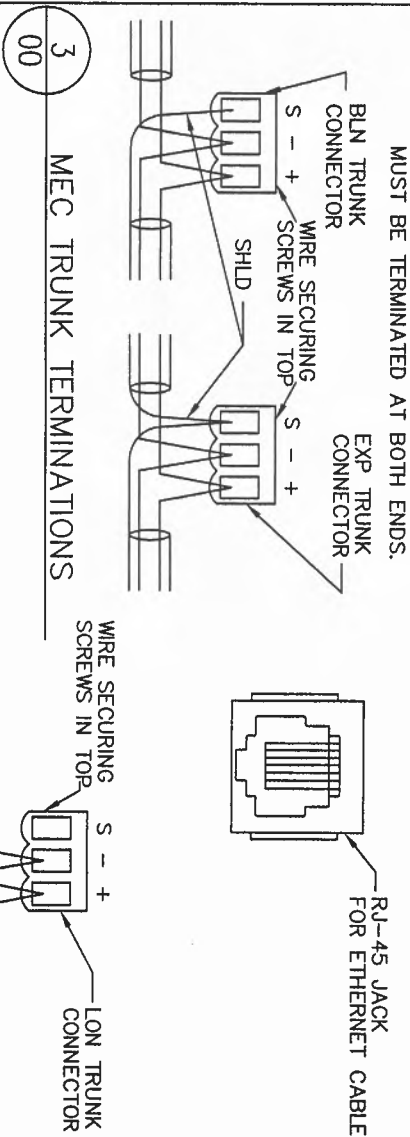
- NO MORE THAN SEVEN (7) FULLY LOADED MEC CABINETS ALLOWED ON A SINGLE 3-WIRE CIRCUIT.
- RECEPTACLE IS PRE-WIRED AND MOUNTED IN FACTORY, FOR 115VAC SERVICE BOX ONLY.
- MEC AND ANALOG POINT BLOCK PROVIDE 24VDC SENSOR SUPPLY WITH 180mA MAX.

**MEC POWER WIRING**

- BLN TRUNK CONNECTOR PLUGS INTO MEC.
- CABINETS MUST BE DAISY-CHAINED WHEN RUNNING 19.2 k BAUD OR FASTER.
- TERMINATE SHIELD AT LEAVING END OF BLN TRUNK ONLY.
- SHIELD WIRES TO EXPANSION BLOCKS. MUST BE TERMINATED AT BOTH ENDS.



**MEC ON ETHERNET CONNECTOR**



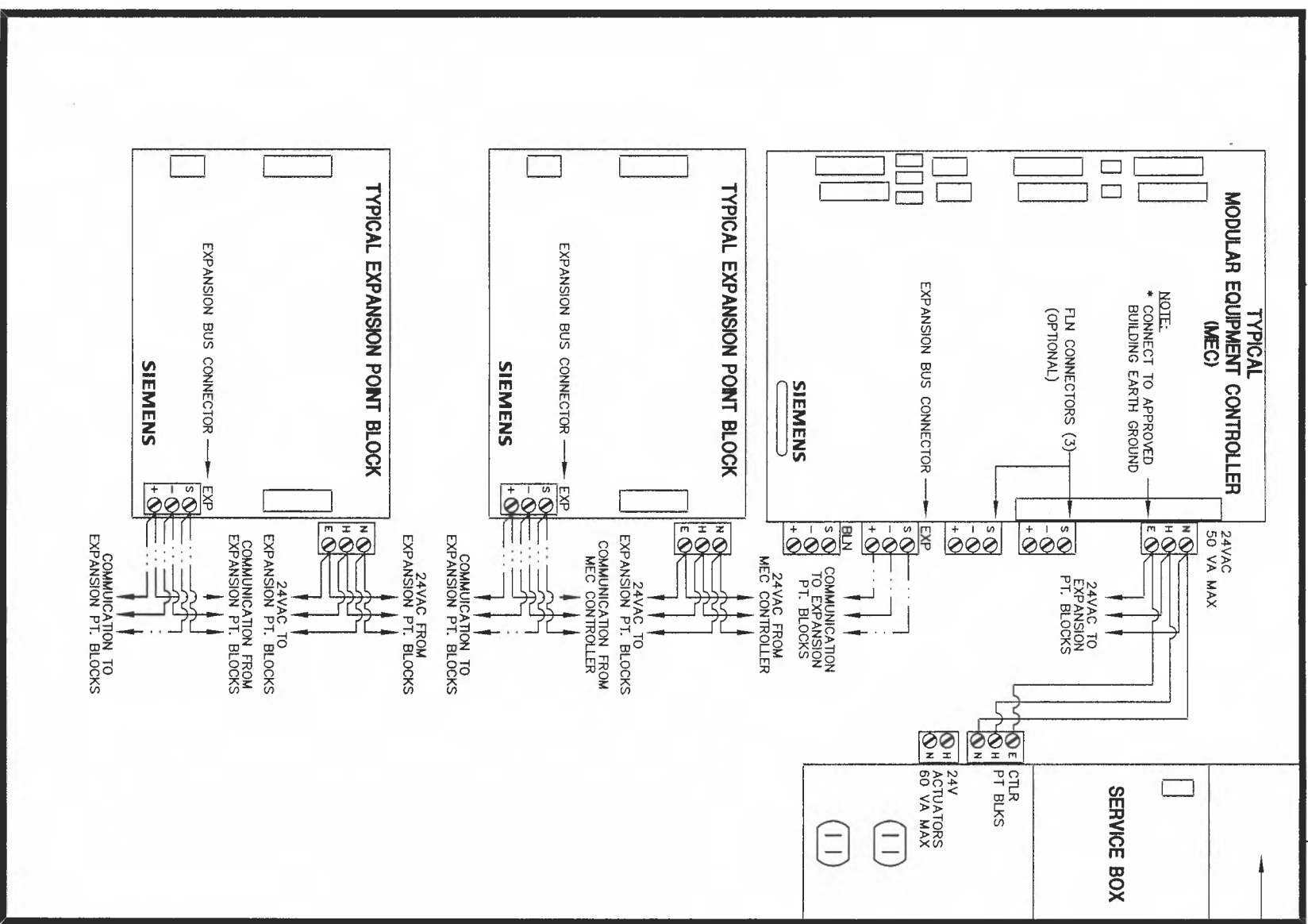
**MEC TRUNK TERMINATIONS**

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	CHECKED BY	INITIAL RELEASE DATE	LAST EDIT DATE
SFM	SFM	10/27/06	11/28/07

440P-702374  
0  
**EWIR**



NOTE:  
 \* PROVIDE 120VAC IN RIGHT CORNER OF CABINET.  
 \* ACCOMMODATE SERVICE BOX COVER.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-456-3800  
 FAX: 888-815-0749

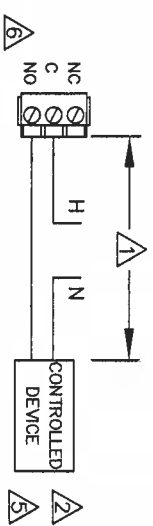
**ANN ARBOR MAINTENANCE FACILITY  
 ANN ARBOR, MI**

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SFM	SFM	<i>2/11</i>		10/27/08	11/28/07

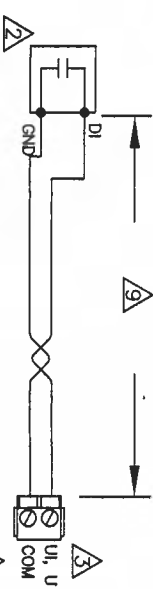
MEC POWER/COMMUNICATION

440P-702374  
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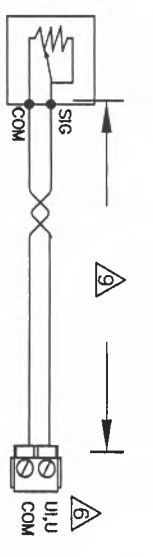
**MECPC**



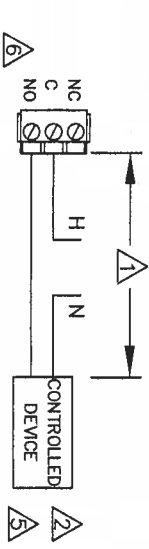
PA 00 DIGITAL OUTPUT (DO) PULSED



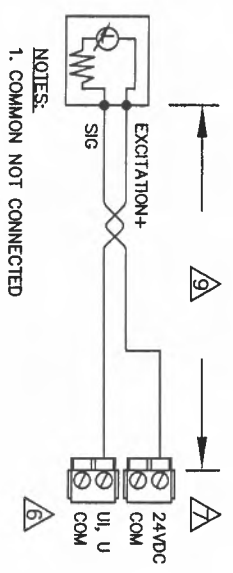
PE 00 DIGITAL INPUT (UI,U) Dry Contact



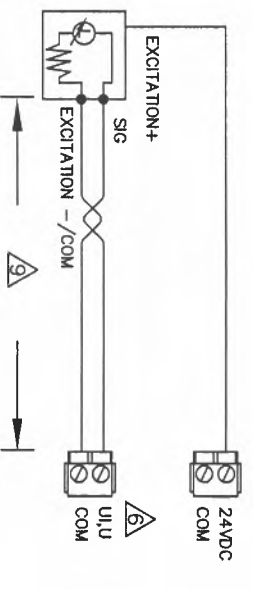
PI 00 ANALOG INPUT (UI,U) THERMISTOR



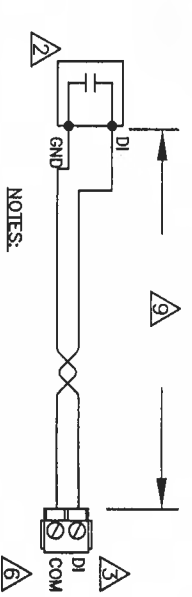
PB 00 DIGITAL OUTPUT (DO) LATCHED



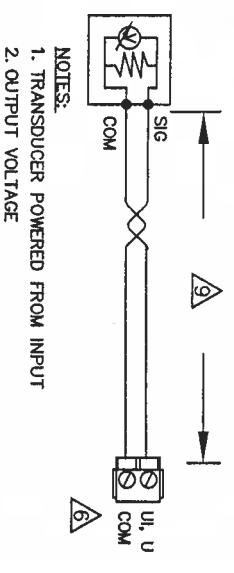
PF 00 ANALOG INPUT (UI,U) 4-20 mA



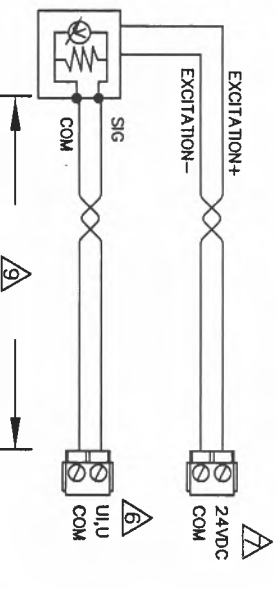
PJ 00 ANALOG INPUT (UI,U) 0-10VDC



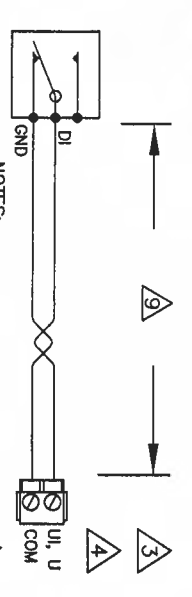
PC 00 DIGITAL INPUT (DI) DRY CONTACT



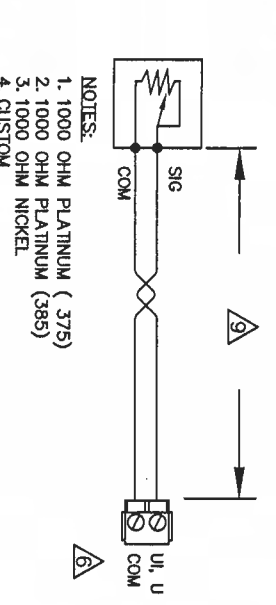
PG 00 ANALOG INPUT (UI,U) 0-10 Vdc SELF POWERED TRANSDUCER



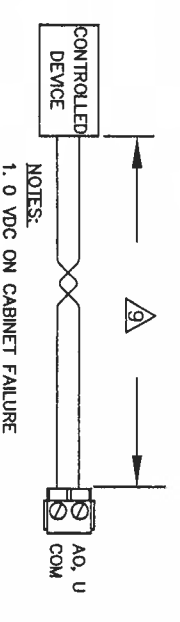
PK 00 ANALOG INPUT (UI,U) 0-10 Vdc 4-WIRE INTERNAL POWERED



PD 00 DIGITAL INPUT (UI,U) Pulse Accu.



PH 00 ANALOG INPUT (UI,U) RTD



PL 00 ANALOG OUTPUT (AO,U) 0-10VDC

NOTES:

- 1 MAXIMUM WIRE RUN LENGTHS ARE BASED ON THE CURRENT DRAW AND WIRE GAGE. SEE DRAWING PWR.
- 2 SEE CONTROL DRAWINGS FOR NORMAL DE-ENERGIZED CONTACT STATE
- 3 DI CAN NOT BE USED FOR PULSED ACCUMULATING
- 4 FOR PULSED DIGITAL INPUTS: MAXIMUM PULSE RATE = 10 PER SECOND (50 ms PER STATE, 100ms PER PULSE)
- 5 PXCC DO CONTACT RATINGS  
AC OPERATION:  
4A @ 240VAC (RESISTIVE)  
3A @ 240VAC (INDUCTIVE)  
SIZE 4 MOTOR STARTER  
DC OPERATION:  
40W @ < 50VDC  
20W @ > 50VDC
- 6 REFER TO PXCC PANEL FOR ACTUAL TERMINATIONS AND POINT ADDRESSES COMMON TERMINAL MAY BE SHARED BY 2 POINTS AND ORDER MAY BE REVERSED ON ADJACENT POINTS
- 7 REFER TO DRAWING P1 ON PWR FOR MAXIMUM CURRENT PROVIDED BY THE PXCC 24VDC SENSOR SUPPLY
- 8 EXTERNAL POWER SUPPLY CAN EITHER BE A 24VDC POWER SUPPLY OR A 24VAC TRANSFORMER DEPENDING ON THE SENSOR SELECTED. FOR MULTIPLE POWER SUPPLIES SEE 125-3002 APOGEE WIRING GUIDELINES FOR FIELD PANELS AND EQUIPMENT CONTROLLERS.
- 9 50mA OR LESS - 750ft/230m  
50mA TO 100mA - 375ft/115m  
100mA TO 150mA - 250ft/76m  
150mA TO 200mA - 187ft/57m  
200mA TO 250mA - 150ft/46m

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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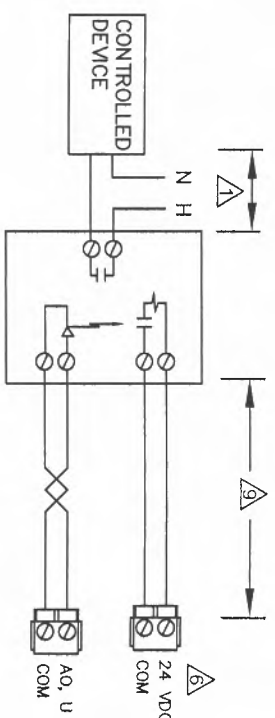
45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

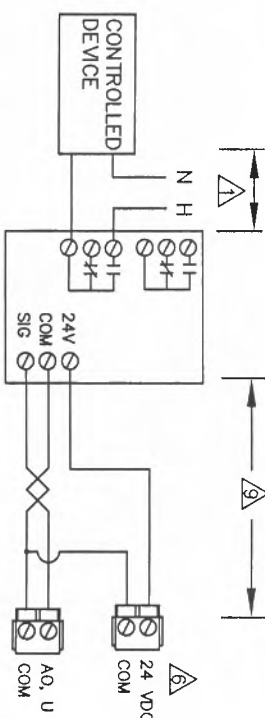
ENGINEER	DRAWER	CHECKED BY	INITIAL	RELEASE DATE	LAST EDIT DATE
SFM	SFM	<i>cpu</i>		10/27/06	11/28/07

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**PTRM1**



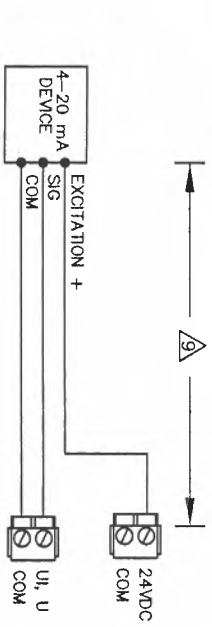
PM DIGITAL OUTPUT (AO,U) LATCHED VOLTAGE TO SOLID STATE RELAY

NOTES:  
1. 0 VDC ON CABINET FAILURE

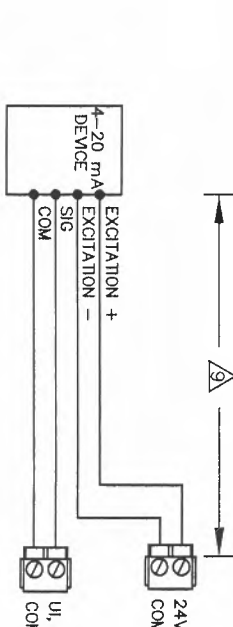


PN DIGITAL OUTPUT (AO,U) Sequenced VOLTAGE TO SEQUENCING MODULE

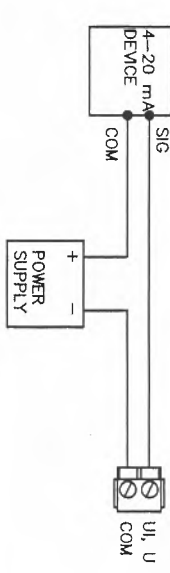
NOTES:  
1. 0 VDC ON CABINET FAILURE  
2. MAY BE MULTI-STAGE



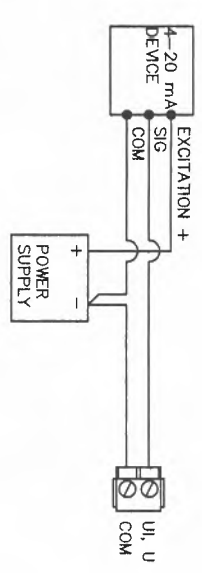
PO ANALOG INPUT (UI,U) 4-20mA 3-WIRE INTERNAL POWERED



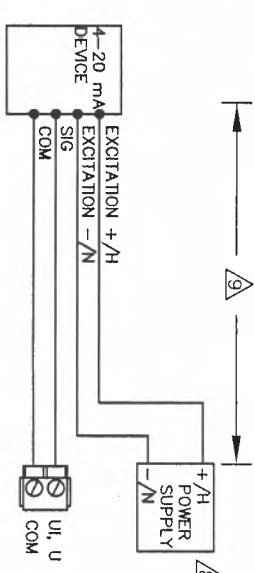
PP ANALOG INPUT (UI,U) 4-20mA 4-WIRE INTERNAL POWERED



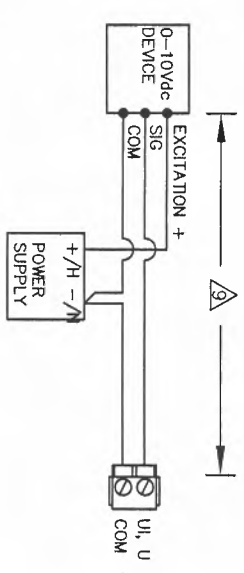
PQ ANALOG INPUT (UI,U) 4-20mA 2-WIRE EXTERNAL POWERED



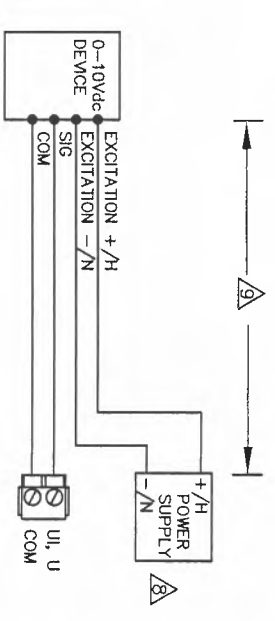
PR ANALOG INPUT (UI,U) 4-20mA 3-WIRE EXTERNAL POWERED



PS ANALOG INPUT (UI,U) 4-20mA 4-WIRE EXTERNAL POWERED



PT ANALOG INPUT (UI,U) 0-10VDC 3-WIRE EXTERNAL POWERED



PU ANALOG INPUT (UI,U) 0-10VDC 4-WIRE EXTERNAL POWERED

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749  
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ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJL</i>	10/27/06	11/28/07

440P-702374  
0  
PTRM2

PXCC WIRING TYPE AND GAUGE REQUIREMENTS

TABLE 1

CIRCUIT TYPE	CLASS	WIRE TYPE	MAX. DISTANCE REFER TO NEC	CONDUIT SHARING <sup>2</sup>
AC LINE POWER <sup>1</sup>	POWER	#12-14 THHN		CHECK LOCAL CODES
DIGITAL OUTPUT	1 & 2	TP not required, check job specs & local codes #18 to #24 AWG	SEE TABLE 3	CHECK LOCAL CODES
DIGITAL INPUT	2	TP not required, check job specs & local codes #18 to #24 AWG	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT <sup>4</sup> 100K/10K Thermistor 1K Ni OR RTD	2	#18-#24 TP <sup>3/8</sup> or TSP <sup>5</sup> CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT 0-10 V	2	#18-#24 TP <sup>3/8</sup> or TSP <sup>5</sup> CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG INPUT 4-20 mA	2	#18-#24 TP <sup>3/8</sup> or TSP <sup>5</sup> CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG OUTPUT 0-10 V	2	#18-#24 TP <sup>3/8</sup> or TSP <sup>5</sup> CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ANALOG OUTPUT 4-20 mA	2	#18-#24 TP <sup>3/8</sup> or TSP <sup>5</sup> CM(FT4) or CMP(FT6)	750ft (230 m)	CHECK LOCAL CODES
ETHERNET BLN	2	#24 (4) TP <sup>6</sup> CAT5 OR BETTER	295ft (90 m)	CHECK LOCAL CODES
BLN TRUNK	2	#24 TSP	SEE TABLE 4	CHECK LOCAL CODES

MAXIMUM DO WIRE RUN LENGTHS

TABLE 3

NOMINAL INRUSH	STARTER SIZE	WIRE SIZE		
		#18	#16	#14
200 VA	0	500ft (152m)	900ft (274m)	1400ft (427m)
550 VA	2	200ft (61m)	300ft (91m)	500ft (152m)
1150 VA	3	100ft (30m)	150ft (46m)	250ft (76m)
1500 VA	4	70ft (21m)	100ft (30m)	200ft (61m)

TABLE 3 NOTES:

- DISTANCES SHOWN ASSURE LESS THAN 10% VOLTAGE DROP ACROSS THE WIRE FOR A TYPICAL STARTER.
- PXCC DO CONTACT RATINGS

- 4A @ 250VAC & 30VDC
- SIZE 4 MOTOR STARTER

MAXIMUM NUMBER HSIE IN SERIES ON BLN TRUNK

TABLE 4

SPEED	1200 BAUD	4800 BAUD	9600 - 38.4K/57.6K - 115.2K BAUD	3280ft (1km)
SERIES TIE'S	10	7	6	6
BLN TRUNK DISTANCE	4000ft (1.2km)	4000ft (1.2km)	4000ft (1.2km)	3280ft (1km)

- THE MUST BE USED TO ISOLATE BLN BETWEEN PXCC CONNECTED TO DIFFERENT SERVICE GROUNDS OR ON BOTH SIDES OF THE BLN CABLE THAT EXITS BUILDING.
  - THE MAX BLN DISTANCE APPLIES TO EACH SIDE OF THE TIE.
- GENERAL NOTES:
- COMPLY WITH LOCAL BUILDING CODES
  - SIZE WIRE FOR LOAD, CURRENT, AND VOLTAGE.
  - ALL WIRE TO BE APPROVED OR LISTED FOR THE INTENDED APPLICATION BY AGENCIES SUCH AS UL, NEC, CSA.
  - ALWAYS REFER TO LOCAL CODES FOR CONDUIT SHARING.
  - WIRING MUST HAVE INSULATION RATED FOR HIGHEST VOLTAGE CIRCUIT IN CONDUIT.
  - THE BLN TRUNK MUST BE AN UNINTERRUPTED RUN BETWEEN CABINETS. NO SPLICES ALLOWED.
  - CM/CMP/MM/MMP WIRE IS NOT USABLE FOR CLASS 1 CIRCUITS.
  - FOR EXTENDED TEMPERATURE INSTALLATIONS USE ONLY COPPER WIRE LISTED FOR 90°C OR HIGHER

- WHEN DAISY-CHAINING 24VAC POWER TO CONTROLLERS USE #14 WIRE.
- CONDUIT SHARING RULES: ONLY WHERE LOCAL CODES PERMIT. BOTH CLASS 1 AND CLASS 2 WIRING CAN BE RUN TO THE PXCC PROVIDED THE CLASS 2 WIRE IS UL LISTED 300V 75°C(167T) OR HIGHER OR THE CLASS 2 WIRE IS NEC TYPE CM (FT4) (75°C OR HIGHER) OR CMP(FT6) (75°C OR HIGHER), NEC TYPE CL2 AND CL2P IS NOT ACCEPTABLE UNLESS ALSO UL LISTED AND MARKED 300V 75°C (167T) OR HIGHER
- TWISTED PAIR, NON-JACKETED UL LISTED 75°C(167T) AND 300V, CABLE CAN BE USED IN PLACE OF CM(FT4) OR CMP(FT6)(BOTH MUST BE RATED 75°C OR HIGHER) CABLE WHEN CONTAINED IN CONDUIT PER LOCAL CODES. SEE THE FIELD PURCHASING GUIDE FOR WIRE.
- WIRE LENGTH AFFECTS POINT INTERCEPT ENTRY. ADJUST INTERCEPT ACCORDINGLY FOR EACH WIRE GAUGE AND SENSOR TYPE.
- SHIELDED TWISTED PAIR (TSP) IS NOT REQUIRED FOR ELECTRICAL NOISE LEVELS UP TO 10 V/M. AT HIGHER LEVELS TSP MAY BE NEEDED. TERMINATE SHIELD ON ENCLOSURE AND TAPE BACK ON POINT END.
- FOR 24AWG INSTALL CATEGORIES OR BETTER CABLE PER ANSII/TIA/EIA-568-B1 OR HIGHER. USE SOLID COPPER BETWEEN JACK BOXES. USE STRANDED COPPER PATCH CABLES 13ft (4m) TO CONNECT PXCC AND 20ft (6m) TO CONNECT SWITCH OR HUB.

PXCC WIRE SPECIFICATIONS

TABLE 2

LOW-VOLTAGE POINT APPLICATIONS	POINT USAGE	BLN TRUNK	EMM
CABLE CONFIGURATION	TWISTED PAIR (UNJACKETED) OR TSP	TWISTED SHIELDED PAIR	(4) TWISTED PAIR
GAUGE	#18 TO #22 AWG (STRANDED)	24 AWG (STRANDED)	24AWG(STRANDED)
CAPACITANCE	n.a.	12.5 pF/ft OR LESS	13 pF/ft OR LESS
TWISTS PER FOOT	6 MINIMUM	6 MINIMUM	CATEGORY 5 Min
SHIELDS	NOT REQUIRED (IN CASE OF TSP, 100% FOIL W/ DRAIN WIRE)	100% FOIL W/ DRAIN WIRE	NOT REQUIRED
NEC CLASS	CM, CMP (75°C OR HIGHER)	CM, CMP (75°C OR HIGHER)	MM, MMP
CEC CLASS	FT4, FT6 (75°C OR HIGHER)	FT4, FT6 (75°C OR HIGHER)	NOT SPECIFIED
UL VOLTAGE RATING	NOT SPECIFIED	300 VAC <sup>2</sup>	NOT SPECIFIED
UL TEMP. RATING	NOT SPECIFIED	75°C (167T)	NOT SPECIFIED

- UL RECOGNIZED WIRE (LABELED WITH A BACKWARDS 'RU') IS NOT FIELD INSTALLABLE. USE ONLY UL-LISTED WIRE.
- 300 VAC WIRE CAN BE USED IN FIELD PANELS CONTAINING 150 VAC.

REVISION HISTORY

NO.	DATE	DESCRIPTION
1	11/28/2007	KJ AS-BUILT DRAWING

SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

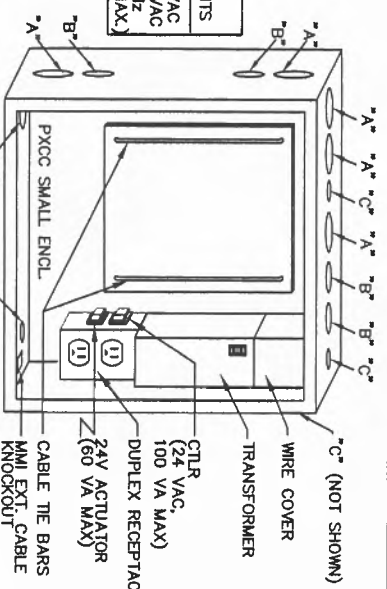
ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: SFM  
INITIAL RELEASE DATE: 10/27/06  
LAST EDIT DATE: 11/28/07

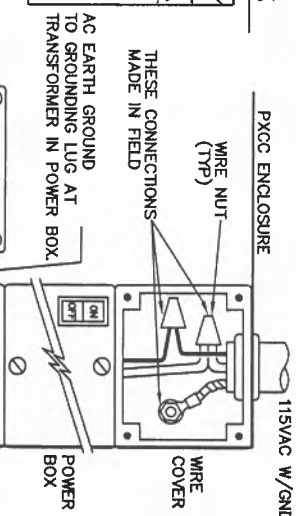
440P-702374  
0

PWIR



PXCC CONDUIT PENETRATIONS

PXCC FAMILY	VA RATINGS & SENSOR SUPPLY
PRODUCT	24VAC VA RATING 24VDC mA
PX COMPACT 16	18 100
PX COMPACT 24	20 100



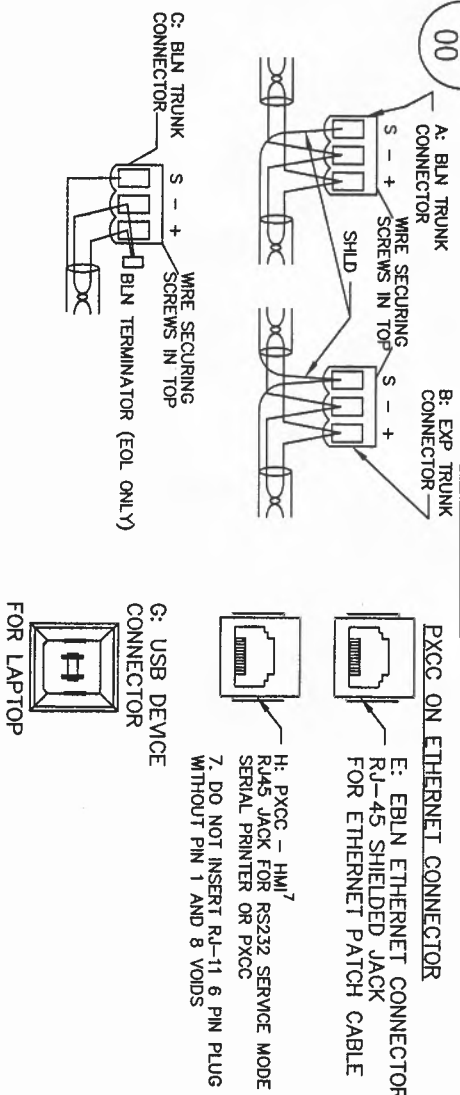
- NOTES:
- NO MORE THAN SEVEN (7) FULLY LOADED PXCC CABINETS ALLOWED ON A SINGLE 3-WIRE CIRCUIT.
  - RECEPTACLE IS PRE-WIRED AND MOUNTED IN FACTORY, FOR 115VAC SERVICE BOX ONLY.

PXCC POWER WIRING

TABLE 5

- COMMUNICATION CONNECTORS PLUG INTO PXCC.
- BLN MUST BE DAISEY-CHAINED WHEN RUNNING 19.2 k BAUD OR FASTER AND TRUNK TERMINATORS USED AT BOTH ENDS OF LINE P3C.
- TERMINATE SHIELD AT LEAVING END OF BLN TRUNK ONLY.
- USE BLN SHIELD TERMINATION P3A WHEN 24VAC E TERMINAL IS EARTH GROUNDED.
- USE BLN SHIELD TERMINATION P3B WHEN 24VAC E TERMINAL IS OPEN.

PXCC COMMON TERMINATIONS



**Siemens Building Technologies  
BAU**

**Valve Submittal - Water**

Job Name: ANN ARBOR MAINTENANCE FACILITY  
Job Number: 44OP-702374

Revision Date: 11/28/07  
Submittal Date: 10/27/06  
Page: 1  
Engineer: SFM

Device Number	Qty	Product Number	Valve Size (in)	Config	Body Style	Cv	Failsafe	Design P. Drop (psi)	Flow (gpm)	Inlet Press (psi)	Press Drop (psi)	Document Number	Comment
<b>Mechanical System: VALVES</b>													
<b>VALVE SCHEDULE</b>													
V-1	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.00	--	2.52	154 010	VB 1-1
V-2	1	259-02034	0.50	2 Way	Globe	1.00	NO-NSR	5.00	1.70	--	2.89	154 010	VB 1-2
V-3	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.00	--	2.52	154 010	VB 1-3
V-4	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.00	--	2.52	154 010	VB 1-4
V-5	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.00	--	2.52	154 010	VB 1-5
V-6	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.00	--	2.52	154 010	VB 1-6
V-7	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.30	--	4.26	154 010	VB 1-7
V-8	1	259-02030	0.50	2 Way	Globe	0.40	NO-NSR	5.00	0.50	--	1.56	154 010	VB 1-8
V-9	1	259-02030	0.50	2 Way	Globe	0.40	NO-NSR	5.00	0.50	--	1.56	154 010	VB 1-9
V-10	1	259-02030	0.50	2 Way	Globe	0.40	NO-NSR	5.00	0.60	--	2.25	154 010	VB 1-10
V-11	1	259-02030	0.50	2 Way	Globe	0.40	NO-NSR	5.00	0.55	--	1.89	154 010	VB 1-11
V-12	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.20	--	3.63	154 010	VB 1-12
V-13	1	259-02030	0.50	2 Way	Globe	0.40	NO-NSR	5.00	0.80	--	4.00	154 010	VB 1-13
V-14	1	259-02030	0.50	2 Way	Globe	0.40	NO-NSR	5.00	0.70	--	3.06	154 010	VB 1-14
V-15	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.00	--	2.52	154 010	VB 1-15
V-16	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.00	--	2.52	154 010	VB 1-16
V-17	1	259-02034	0.50	2 Way	Globe	1.00	NO-NSR	5.00	1.30	--	1.69	154 010	VB 1-17
V-18	1	259-02030	0.50	2 Way	Globe	0.40	NO-NSR	5.00	0.60	--	2.25	154 010	VB 1-18
V-19	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.10	--	3.05	154 010	VB 1-19
V-20	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.20	--	3.63	154 010	FT 1-1
V-21	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.20	--	3.63	154 010	FT 1-2
V-22	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.10	--	3.05	154 010	FT 1-3
V-23	1	259-02032	0.50	2 Way	Globe	0.63	NO-NSR	5.00	1.10	--	3.05	154 010	FT 1-4

NOTES: All control valves and wells shall be installed by the heating contractor.  
Failsafe: NSR - No Spring Return SR - Spring Return NO - Normal Open NC - Normal Close

BAU

Damper Submittal

Revision Date: 11/28/07

Job Name: ANN ARBOR MAINTENANCE FACILITY

Job Number: 440P-702374

Submittal Date: 10/27/06

Damper Manufacturer: RUSKIN

Eng: 1

Page: 1

Dev	Qty	Damper Model	Duct Width (in)	Duct Height (in)	Blid Cnf	Blade Width (in)	Seals		Nrm Pos	Act Mnt	Act Model	Act Qty	Actuator Description	Comments	Siemens Ordered
							E	B							
<b>System: DAMPER</b>															
<b>DAMPER SCHEDULE</b>															
1	1	CD-35	32.00	48.00	Par	6.00	N	Y	NC	Exl	GCA	1	120 VAC 2POS	B100 COMBUSTION AIR DMPR	N
2	1	CD-35	30.00	18.00	Par	6.00	N	Y	NO	Exl	GCA	1	24 VAC 2POS	ERU 2-1 EXHAUST DAMPER	N
3	1	CD-35	30.00	18.00	Par	6.00	N	Y	NO	Exl	GCA	1	24 VAC 2POS	ERU 2-2 EXHAUST DAMPER	N
4	1	CD-35	30.00	18.00	Par	6.00	N	Y	NO	Exl	GCA	1	24 VAC 2POS	ERU 2-3 EXHAUST DAMPER	N
5	1	CD-35	30.00	18.00	Par	6.00	N	Y	NO	Exl	GCA	1	24 VAC 2POS	ERU 2-4 EXHAUST DAMPER	N

NOTES: Duct size shown, deduct 1/4 in. for fabrication.

All shaft dimensions horizontal unless otherwise noted.

Blade Configuration: OPP - Opposed      PAR - Parallel

Seals: E - Edge      B - Blade

Actuator Mounting: FRA - Framed      EXT - Extended      JAC - Jackshaft

Approved By:

Date: / /



Job Name: City of Ann Arbor Maintenance Facility  
Terminal Equipment Controller Schedule  
Job Number: 44OP-702374  
Engineer: Steven Murphy

TEC SCHEDULE

Unit Tag	SysName	Serves	Field Panel	FLN	Address	Application	V/A Usage	Power Trunk	Duct Shape	Duct Size	Duct Area	STPT Dial	Minimum Flow	Maximum Flow	Valve Count	Comments
VB 1-10	OB.01.RTU1.101	OFFICE 136	OB.01.BLR.ROOM.100	FLN 1 (1)	1	2023	8VA	1-1	RND	5	0.14	YES	31	32	1	
VB 1-9	OB.01.RTU1.102	OFFICE 137	OB.01.BLR.ROOM.100	FLN 1 (1)	2	2023	8VA	1-1	RND	5	0.14	YES	65	210	1	
VB 1-8	OB.01.RTU1.103	OFFICE 139	OB.01.BLR.ROOM.100	FLN 1 (1)	3	2023	8VA	1-1	RND	5	0.14	YES	65	210	1	
VB 1-7	OB.01.RTU1.104	OFFICE 140	OB.01.BLR.ROOM.100	FLN 1 (1)	4	2023	8VA	1-1	RND	5	0.14	YES	65	305	1	
VB 1-6	OB.01.RTU1.105	CONFERENCE ROOM 141	OB.01.BLR.ROOM.100	FLN 1 (1)	5	2023	8VA	1-1	RND	8	0.35	YES	160	750	2	Finned Tube FT 1-1
VB 1-5	OB.01.RTU1.106	CONFERENCE ROOM 142	OB.01.BLR.ROOM.100	FLN 1 (1)	6	2023	8VA	1-1	RND	8	0.35	YES	160	750	2	Finned Tube FT 1-2
VB 1-2	OB.01.RTU1.107	OPEN OFFICE 135 WEST	OB.01.BLR.ROOM.100	FLN 1 (1)	7	2023	8VA	1-1	RND	14	1.07	YES	500	1800	1	
VB 1-1	OB.01.RTU1.108	OPEN OFFICE 135 EAST	OB.01.BLR.ROOM.100	FLN 1 (1)	8	2023	8VA	1-1	RND	10	0.55	YES	255	900	1	
VB 1-4	OB.01.RTU1.109	REFERENCE LIBRARY143	OB.01.BLR.ROOM.100	FLN 1 (1)	9	2023	8VA	1-1	RND	10	0.55	YES	255	900	1	
VB 1-19	OB.01.RTU1.110	RESTROOM 147	OB.01.BLR.ROOM.100	FLN 1 (1)	10	2023	8VA	1-2	RND	6	0.20	YES	90	410	1	
VB 1-12	OB.01.RTU1.111	LOBBY/WAITING/VEST. 149, 150	OB.01.BLR.ROOM.100	FLN 1 (1)	11	2023	8VA	1-2	RND	9	0.44	YES	250	1000	3	Finned Tube FT 1-3 & 1-4
VB 1-11	OB.01.RTU1.112	CORRIDOR 109	OB.01.BLR.ROOM.100	FLN 1 (1)	12	2023	8VA	1-2	RND	7	0.27	YES	125	500	1	
VB 1-18	OB.01.RTU1.113	CREW ROOM FOR & HORT 151	OB.01.BLR.ROOM.100	FLN 1 (1)	13	2023	8VA	1-2	RND	6	0.20	YES	90	400	1	
VB 1-13	OB.01.RTU1.114	CREW ROOM SOLID WASTE 156	OB.01.BLR.ROOM.100	FLN 1 (1)	14	2023	8VA	1-2	RND	10	0.55	YES	255	800	1	
VB 1-17	OB.01.RTU1.115	CREW ROOM PARK OPS160	OB.01.BLR.ROOM.100	FLN 1 (1)	15	2023	8VA	1-3	RND	9	0.44	YES	210	840	1	
VB 1-14	OB.01.RTU1.116	CREW ROOM RADIO/S&S 155	OB.01.BLR.ROOM.100	FLN 1 (1)	16	2023	8VA	1-3	RND	7	0.27	YES	75	600	1	
VB 1-16	OB.01.RTU1.117	CREW ROOM STREETS152	OB.01.BLR.ROOM.100	FLN 1 (1)	17	2023	8VA	1-3	RND	10	0.55	YES	255	960	1	
VB 1-15	OB.01.RTU1.118	CREW ROOM UTILITIES 154	OB.01.BLR.ROOM.100	FLN 1 (1)	18	2023	8VA	1-3	RND	10	0.55	YES	255	920	1	

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AEM 1	1	538-920	SIEMENS	N/A	AEM 200, 120 VAC
	1	538-900	SIEMENS	149 802	AEM ACCESSORY KIT
AEM 2	1	538-920	SIEMENS	N/A	AEM 200, 120 VAC
	1	538-900	SIEMENS	149 802	AEM ACCESSORY KIT
AEM 3	1	538-920	SIEMENS	N/A	AEM 200, 120 VAC
	1	538-900	SIEMENS	149 802	AEM ACCESSORY KIT

**REVISION HISTORY**

1 11/28/2007 KJ AS-BUILT DRAWING

**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ct. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/28/07

**DDC COMMUNICATIONS RISER**

440P-702374

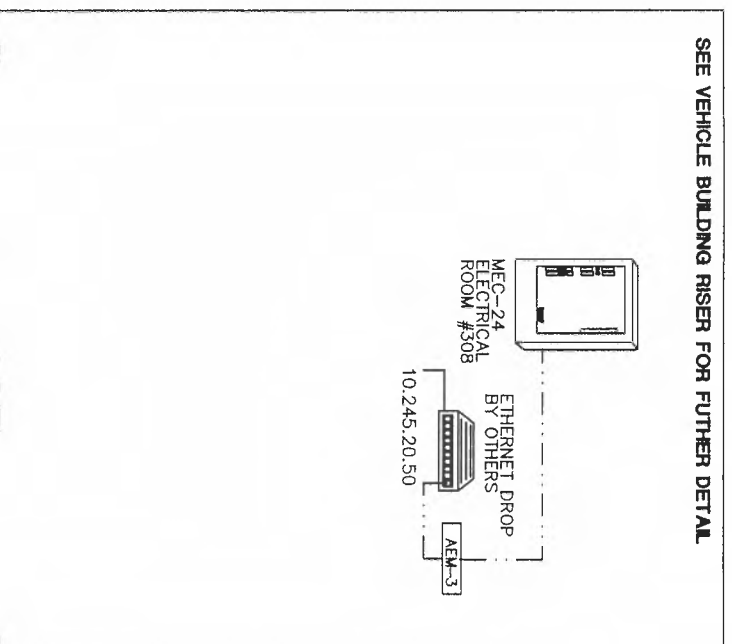
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**R-1A**

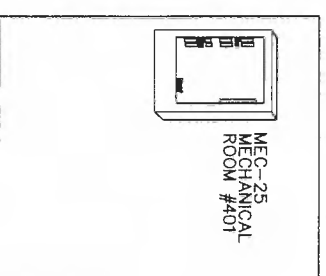
REFER TO COMPUTER CUTSHEET FOR FURTHER INFORMATION

SYSTEM
SERVER (CPU-1)
DELL OPTIPLEX GX620 MT
INTEL PENTIUM 4 PROCESSOR 521 WITH HT
GENUINE WINDOWS XP PROFESSIONAL, SP2
1.0GB DDR2 NON-ECC SDRAM, 533MHZ
DELL USB ENHANCED MULTIMEDIA KEYBOARD
DELL 17" ULTRASHARP 1707 FLAT PANEL
MOUSE & KEYBOARD
INSIGHT ADVANCED
LAPTOP (CPU-2)
DELL LATITUDE D820
INTEL CORE DUO T2400 1.83GHZ
GENUINE WINDOWS XP PROFESSIONAL, SP2
PRINTER
FX-890 DOT MATRIX PRINTER
BACKUP POWER SUPPLY
DELL BACK-UPS 1000VA

SEE VEHICLE BUILDING RISER FOR FURTHER DETAIL



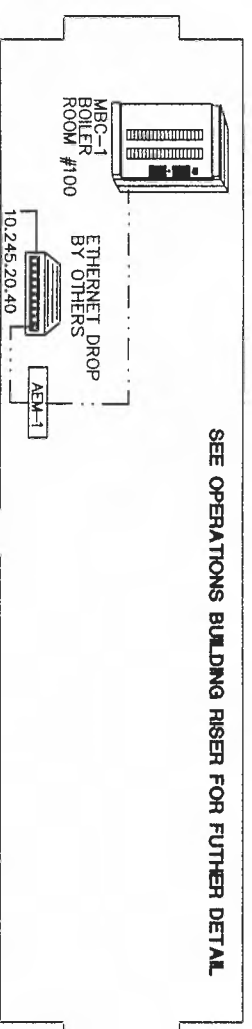
SEE TRUCK/AUTO WASH RISER FOR FURTHER DETAIL



AUTO/TRUCK WASH

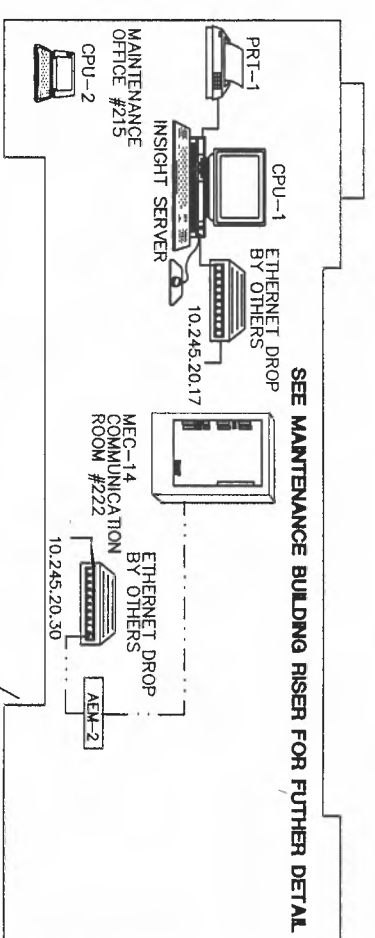
VEHICLE BUILDING

SEE OPERATIONS BUILDING RISER FOR FURTHER DETAIL



OPERATIONS BUILDING

SEE MAINTENANCE BUILDING RISER FOR FURTHER DETAIL



MAINTENANCE BUILDING

(1) BACNET LIGHTING PANEL  
10.245.20.35

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone 734-466-3800  
Fax 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	SFM	10/27/08	12/03/07

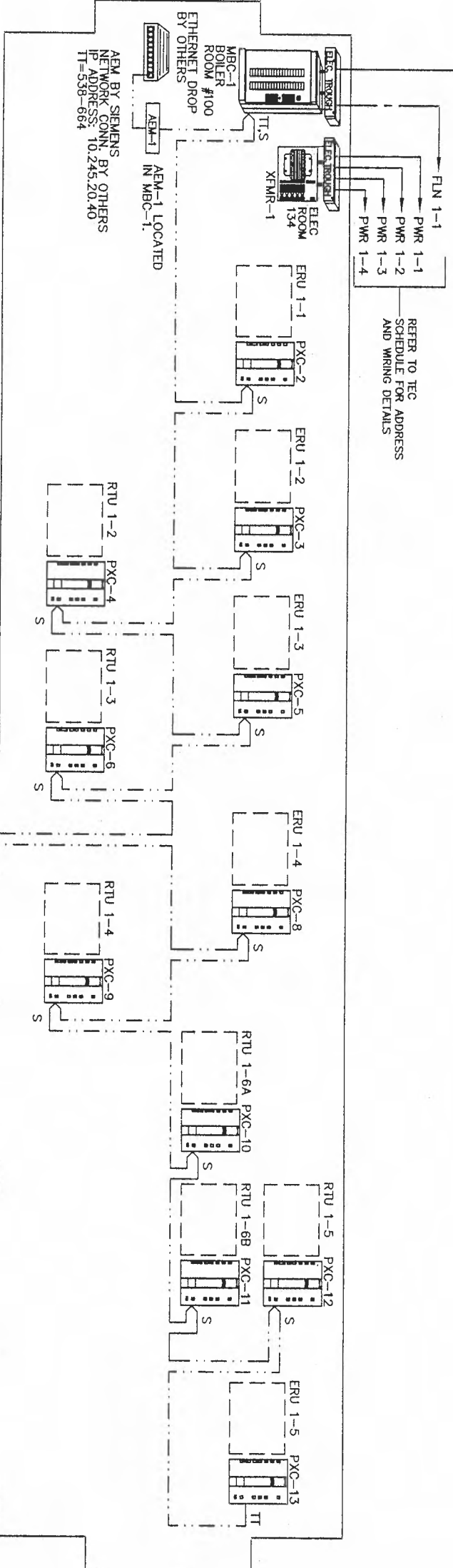
DDC COMMUNICATIONS RISER

440P-702374

R-1

120VAC FROM  
EMERGENCY PANEL UPS-1  
TELE-COMMUNICATIONS #122.

REFER TO TEC  
SCHEDULE FOR ADDRESS  
AND WIRING DETAILS



AEM BY SIEMENS  
NETWORK CONN. BY OTHERS  
IP ADDRESS: 10.245.20.40  
IT=538-664

AEM-1 LOCATED  
IN MBC-1.

### OPERATIONS BUILDING

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-456-3800  
Fax: 888-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>SFM</i>	10/27/06	11/28/07

440P-702374  
100

**1-1**

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
AE 1	1	GCA226.1U	SIEMENS		155 174	2 PT SR,115V,ME/D/S
CS 1-2	2	H608	VERIS		1006cut016	CUR SW SPLTCOR-ADJ SETPT W/LED
D						SEE DAMPER SUBMITTAL
FSS 1-2	2	BY OTHERS				PROVIDED BY OTHERS
RE 1-3	3	RIBUIC	FUNCTIONAL DEVICES		1208cut013	RIB 120VAC 24VAC/DC SPDT
TTE 1-4	4	544-577	SIEMENS	S600-58	149 261	IMA TEMP SENS (-40/240F)
TTE 5	1	544-578	SIEMENS	S600-58	149 261	O/AIR TEMP SENS (-40/240F)
TTE 6	1	BY OTHERS				PROVIDED BY OTHERS

The hot water system consists of two hot water boilers with headered hot water distribution pumps. The system is DDC controlled with electric actuation.

The system operates as follows (All suggested set points and settings are adjustable.):

**Pump Alternation**

Pumps alternate to equalize equipment runtime. Selection of the lead and second pump is evaluated on a weekly basis. The pump with the least runtime is the lead and the remaining pump is second.

**Combustion Air**

The combustion air damper is hardware interlocked to open when the sequencing panel is started. The end switch on the combustion air damper is hardware interlocked to prevent the sequencing panel from being enabled until the damper is opened.

**Heating Control**

At the beginning of the heating season, as defined by the heating system enable point being energized (outdoor air temperature falls below 65 deg F), the boilers are started.

If the heating system enable point is on and the outdoor air temperature is below 65 degrees F, the lead heating distribution pump starts. As necessary, the second distribution pump starts to satisfy the supply water set point. After each pump is started, a time delay of 15-minutes occurs before the next pump can start.

The second pump destages when the supply water temperature is within two degrees of the set point for 30 minutes. The lead distribution pump remains on until the outdoor air temperature is above 67 degrees F or the heating system enable point is off. After each pump destages, a time delay of 15 minutes occurs before the next one destages.

The supply water set point is reset via Boiler Sequencing Panel. The heating water supply set point is reset based on outdoor air temperature. When the outdoor air temperature is 0 degrees F, the set point is 180 degrees F and when the outdoor air temperature is 65 degrees F, the set point is 130 degrees F.

Boiler staging and sequencing to be controlled through Boiler Sequencing Panel.  
The boiler control system, provided by the boiler manufacturer, is factory wired except for field installed devices (combustion air damper interlocks, flow switches, low water cut off, etc.). Flame safeguard controls are included with the boiler.

The DDC system uses current switches to confirm the pumps are in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

The DDC system monitors the boiler controls for a common alarm condition (i.e. low water cut off, flame failure, etc.).

The DDC system generates an alarm when the difference between the Boiler inlet and outlet temperatures is less than 20 degrees F for a period of five minutes while the boiler system is energized.

**Emergency Power**

Heating hot water pumps HWP-1 and HWP-2 to be controlled through Building Management System not to operate until 2 minutes after generator is running.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

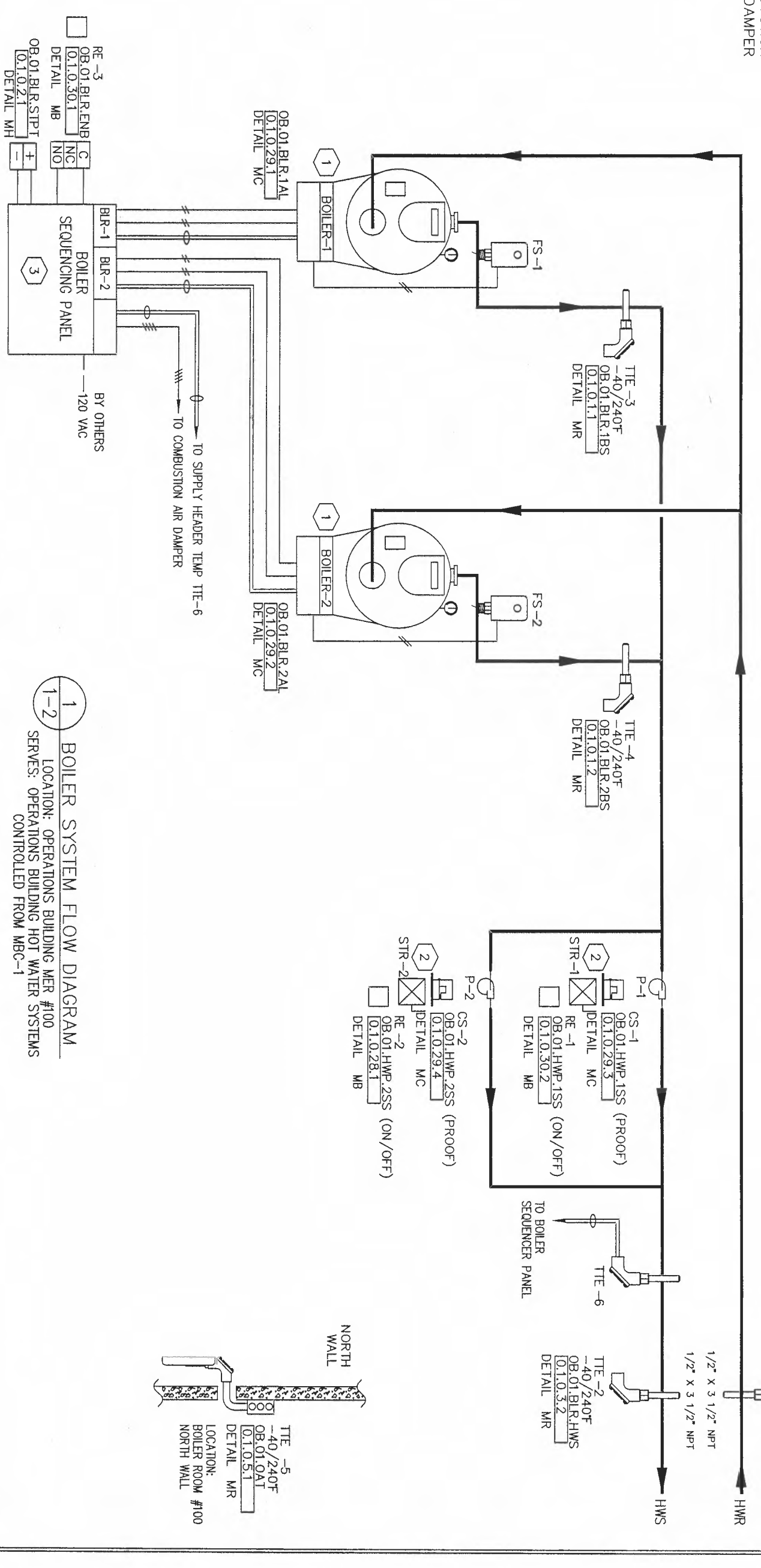
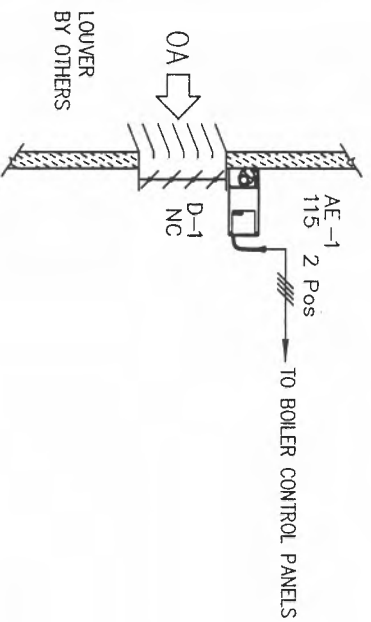
ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	CPA	10/27/06	11/28/07

**BOILER CONTROL**

440P-702374

100

**1-2A**



- INSTALLATION NOTES:**
- 1 SEE BOILER WIRING DETAIL ON BOILER WIRING DRAWING
  - 2 SEE PUMP MOTOR STARTER WIRING DETAIL ON BOILER WIRING DRAWING, RELAY AND CSR MOUNTED AT STARTER PROVIDED BY OTHERS. SEE SEQUENTIAL BY OTHERS FOR COMPLETE DETAIL & SEQUENCE
  - 3

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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RE-3	OB.01.BLR.ENB	C
	01.0.30.1	NC
	DETAIL	MB
OB.01.BLR.STPT		
	01.0.21	
	DETAIL	MH

BLR-1	BLR-2
BOILER SEQUENCING PANEL	
BY OTHERS	
120 VAC	

1-2 BOILER SYSTEM FLOW DIAGRAM  
 LOCATION: OPERATIONS BUILDING MER #100  
 SERVES: OPERATIONS BUILDING HOT WATER SYSTEMS  
 CONTROLLED FROM MBC-1

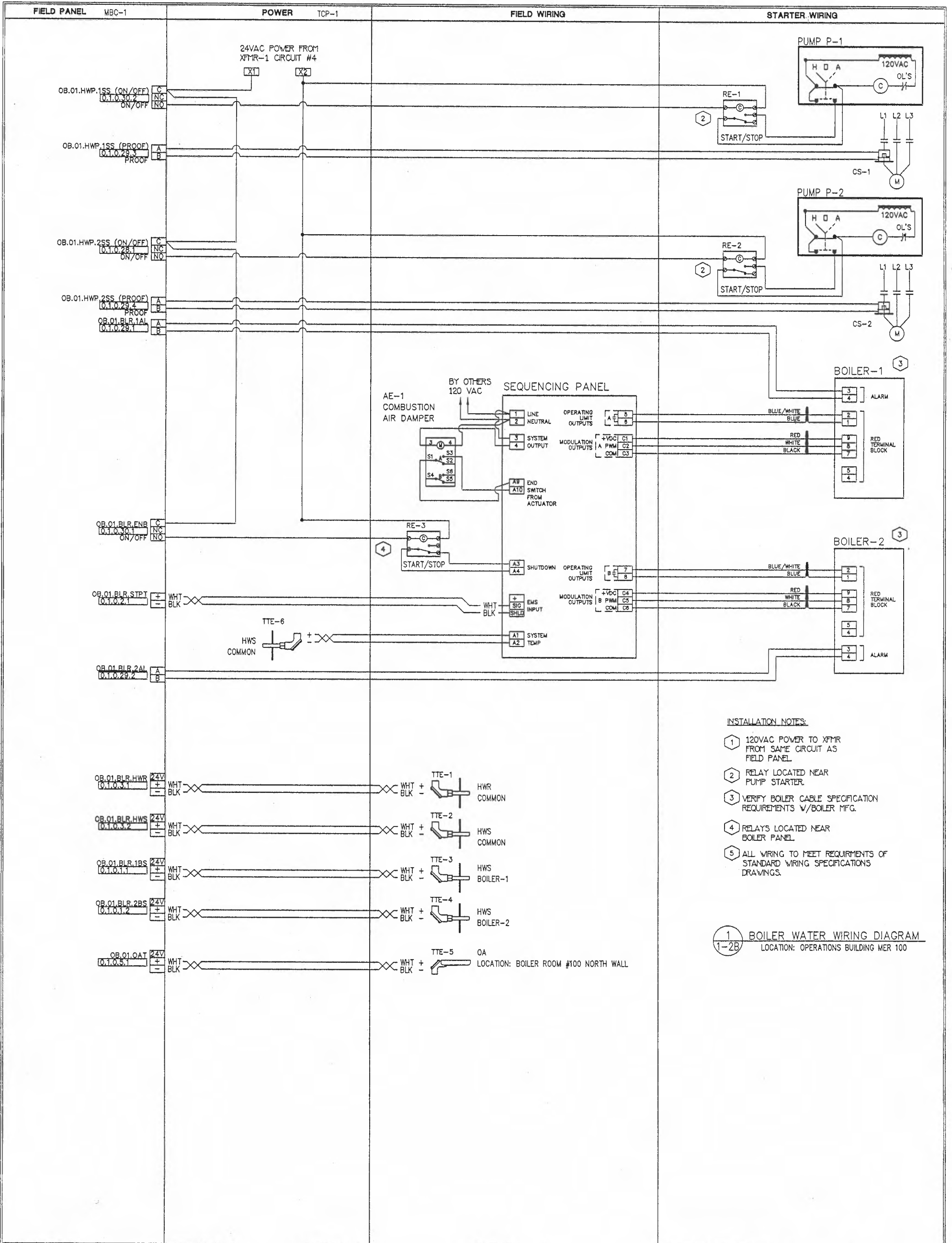
**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-456-3800  
 Fax: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

<b>ANN ARBOR, MI</b>	ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
	SFM	SFM	CS	10/27/06	11/28/07

440P-702374  
 100  
 1-2



**INSTALLATION NOTES:**

- ① 120VAC POWER TO XFMR FROM SAME CIRCUIT AS FIELD PANEL
- ② RELAY LOCATED NEAR PUMP STARTER.
- ③ VERIFY BOILER CABLE SPECIFICATION REQUIREMENTS W/BOILER MFG.
- ④ RELAYS LOCATED NEAR BOILER PANEL.
- ⑤ ALL WIRING TO MEET REQUIREMENTS OF STANDARD WIRING SPECIFICATIONS DRAWINGS.

① BOILER WATER WIRING DIAGRAM  
1-2B LOCATION: OPERATIONS BUILDING MER 100

REVISION HISTORY			
1	11/28/2007	KJ	AS-BUILT DRAWING

**SIEMENS**  
45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
Siemens Building Technologies  
BAU  
PHONE: 734-456-3800  
FAX: 866-815-0749

ANN ARBOR MAINTENANCE FACILITY ANN ARBOR, MI				
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
8FM	8FM	<i>wfu</i>	10/27/06	11/28/07
<b>BOILER CONTROL WIRING</b>				

440P-702374  
100  
**1-2B**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
CS 1	1	H608	VERIS	1006aut016	CUR SW SPLITCOR-ADJ SETPT W/LED
DPTF 1	1	FBO	FBO		FURNISHED BY OTHERS
LIDE 1	1	134-1504	SIEMENS	155 016	TSTAT, LOW TEMP,15/55,MANUAL
SD 1-2	2	FBO	FBO		FURNISHED BY OTHERS
SPP 1	1	FBO	FBO		FURNISHED BY OTHERS
TCP 7	1	A-20H16ALPP	HOFMAN		20"X16"X16" NEMA 4 ENCLOSURE
TTE 1-2	2	544-339	SIEMENS	149 261	D/PT TEMP SENSOR,RTD-40/240F
Panel Mounted Devices					
PS 7	1	PSH75AN	FUNCTIONAL DEVICES	1208cu1034	PMRSPLY 75VA MLT-TAP W/O OULTI
PXC 7	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24PT, RS-485, ROOFTOP

The variable volume roof top unit consists of a mixed air section with outdoor air damper, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

The room temperature set point shall be referenced from the minimum value of VAV terminal unit room sensors.

#### Warm-Up

The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

#### Occupied

The fan starts the gas heating and DX cooling stage in sequence without overlap to maintain the room temperature setpoint. When the outside air dry bulb temperature is below the economizer changeover value the DX cooling is disabled and the fan will run for free cooling to maintain the room temperature setpoint. When the outside air dry bulb temperature is above the economizer changeover value, DX cooling is enabled to maintain the room temperature setpoint.

#### Supply Duct and Building Pressurization Control

Supply fan variable frequency drive shall modulate to maintain a constant duct static pressure of 1.5 inches of water as sensed in the supply duct located in Corridor #153 outside room #156.

#### Unoccupied

The supply fan is off, the DX cooling is off, gas heating is off.

#### Night Heating

The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space temperature of 65 degrees F (adj). The DX cooling remains off.

#### Safety

Smoke detector in the return air stream de-energizes the supply fan upon activation.

If low temperature detector detects air less than 35 degrees F the supply fan shall be de-energized. The outdoor air damper (by RTU controls) shall close to protect the booster coils down stream of the unit.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

#### Monitoring

DDC system shall monitor the rooftop supply air temperature.

DDC system shall monitor the rooftop return air temperature.

#### Emergency Power

RTU 1-1 to be interlocked through Building Management System to operate only in the heat/exhaust mode when powered by the generator.

RTU 1-1 to be controlled through Building Management System not to operate until 5 minutes after generator is running.

### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	CJY	10/27/06	11/28/07

### RTU 1-1 CONTROL DIAGRAM

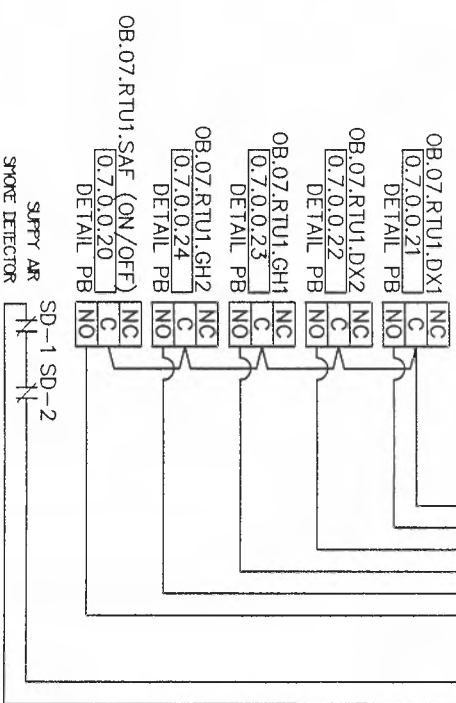
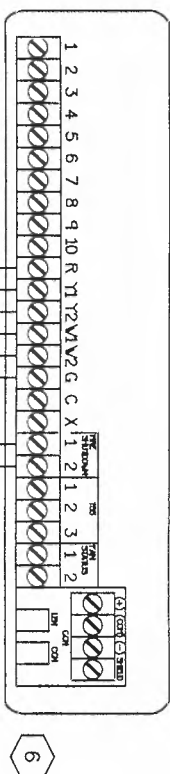
440P-702374

100

1-3A

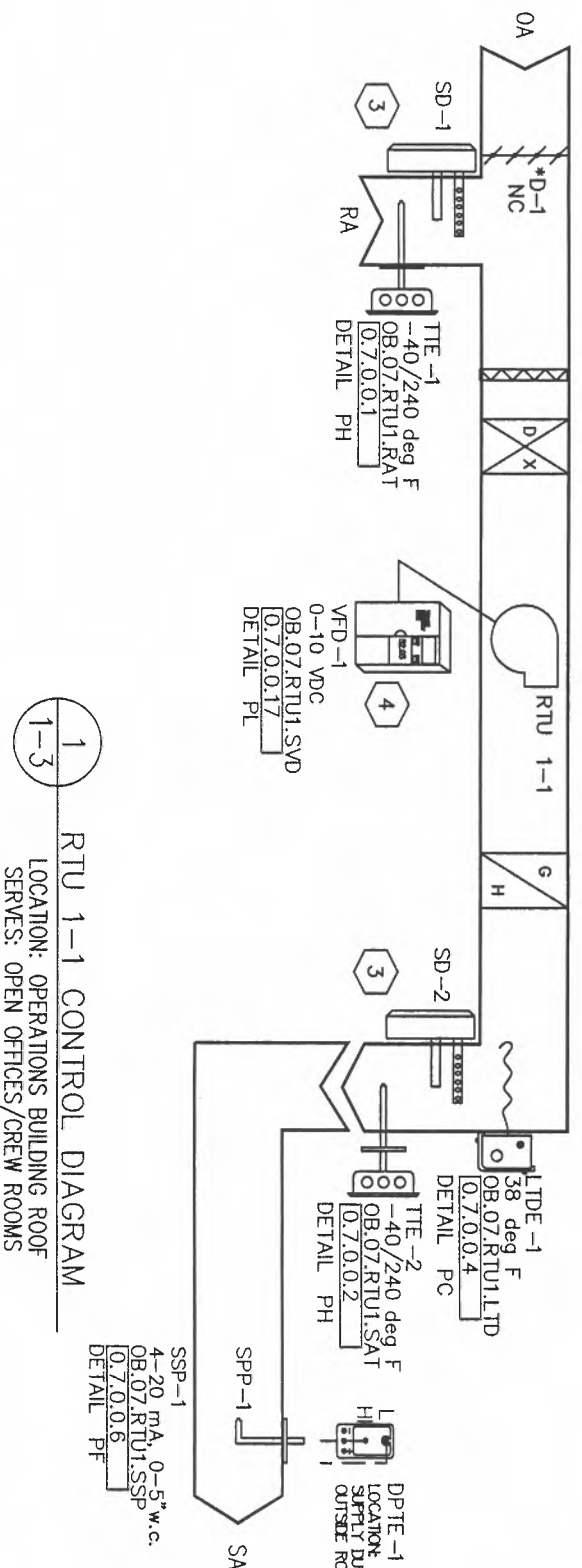


ROOF TOP LOW VOLTAGE TERMINAL STRIP

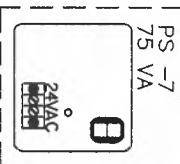


NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL ARE BY OTHERS

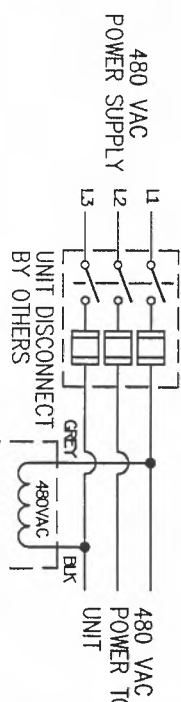
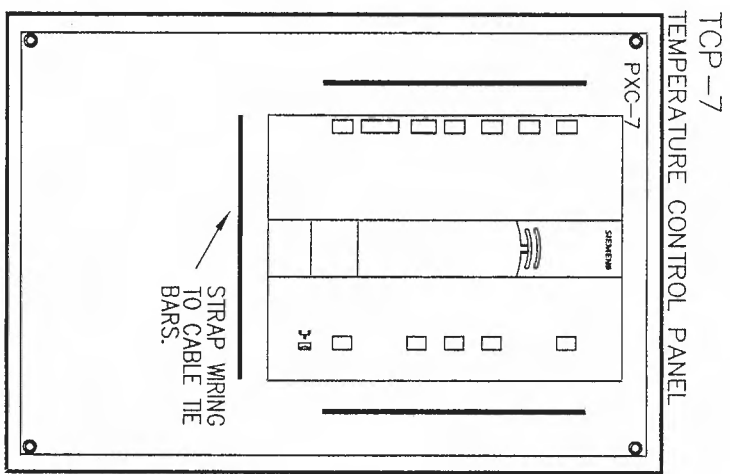
CS-1  
OB.07.RTU1.SAF (PROOF)  
0.7.0.0.3  
DETAIL PC



NOTE: FIELD VERIFY SPACE AVAILABILITY TO MOUNT POWER SUPPLY IN RTU CONTROL ENCLOSURE



- INSTALLATION NOTES:**
- TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU.
  - WIRE POWER SUPPLY AFTER UNIT DISCONNECT.
  - SMOKE DETECTOR PROVIDED, MOUNTED AND WRED BY DIVISION 16.
  - VFD IS CONTROLLED AND MODULATED BY RTU CONTROLLER.
  - STATIC PRESSURE SENSOR BY OTHERS AND MONITORED BY RTU CONTROLLER.
  - FIELD VERIFY ALL RTU TERMINATIONS.



POWER SUPPLY WIRING DETAIL

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

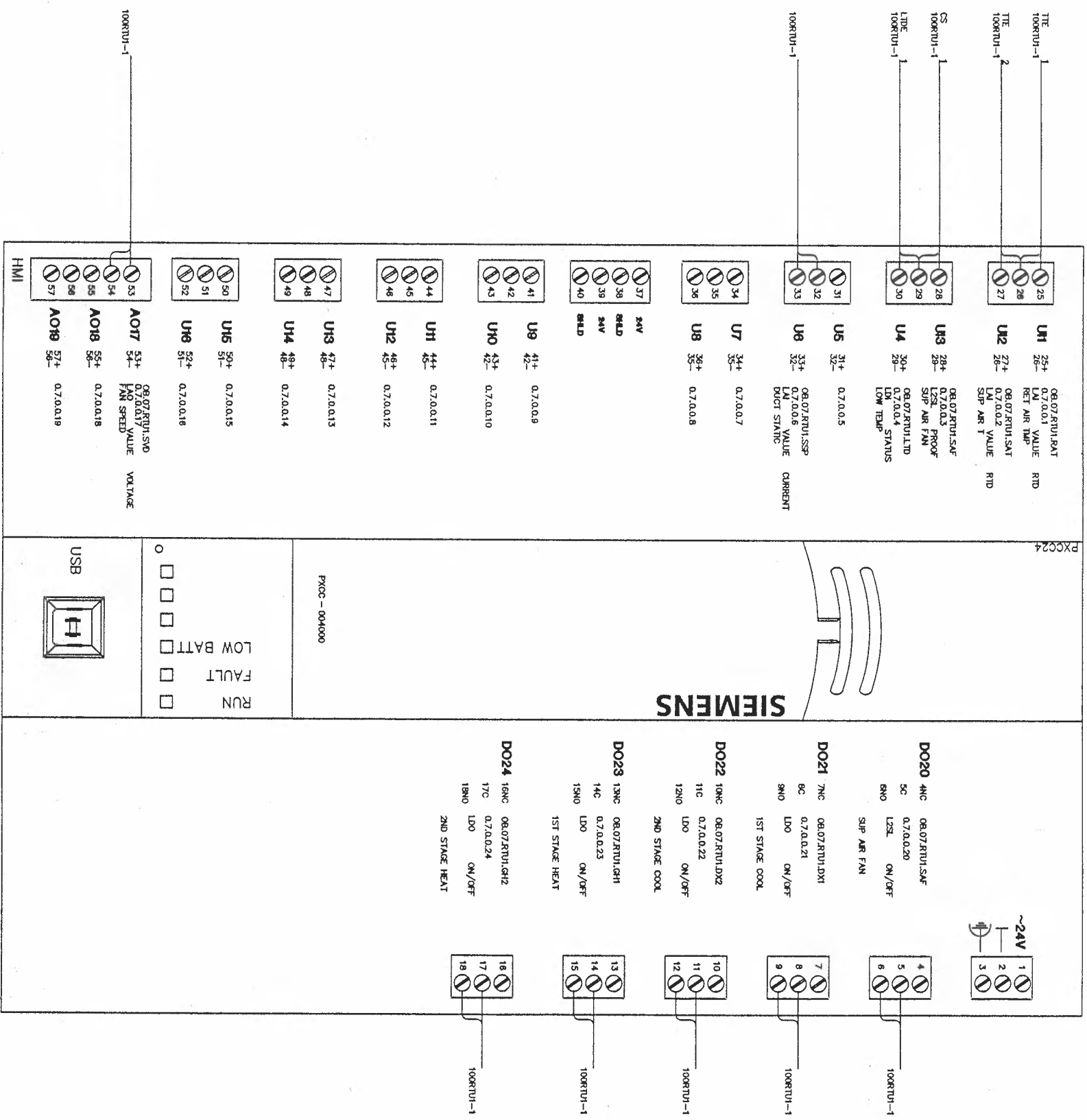
45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone- 734-458-3800  
Fax- 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI  
ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: *2714*  
INITIAL RELEASE: 10/27/06  
LAST EDIT DATE: 11/28/07

440P-702374  
100

1-3



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

440P-702374  
100  
1-4

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
CS 1	1	H608	VERIS		1006cut016	CUR SW SPLITCOR-ADJ SETPT W/LED
SD 1-2	2	FBO	FBO			FURNISHED BY OTHERS
TOP 4	1	A-20H16ALPP	HOFMAN			20"X16"X6" NEMA 4 ENCLOSURE
TTE 1-2	2	544-339	SIEMENS	S600-58	149 261	D/PT TEMP SENSOR,RTD,-40/240F
TTE 3	1	544 780FA	SIEMENS		149 312	RM SNSR W/STPT IND OVRD-BEDGE
	1	544-782A	SIEMENS		149 359	SINGLE GOOF MOUNTING PLATE KIT
Panel Mounted Devices						
PS 4	1	PSH75AN	FUNCTIONAL DEVICES		1208cut034	PMRSPLY 75VA MLI-TAP W/O OULT
PXC 4	1	PXC24-PRA	SIEMENS		149454	PXC COMPACT,24PT,RS485,ROOFTOP

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

**Warm-Up**  
The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

**Occupied**  
The fan starts the gas heating and DX cooling stage in sequence without overlap to maintain the room temperature setpoint. When the outside air dry bulb temperature is below the economizer changeover value the DX cooling is disabled and the fan will run for free cooling to maintain the room temperature setpoint. When the outside air dry bulb temperature is above the economizer changeover value, DX cooling is enabled to maintain the room temperature setpoint.

**Unoccupied**  
The supply fan is off, the DX cooling is off, gas heating is off.

**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space

temperature of 65 degrees F (adj). The DX cooling remains off.

**Safety**

Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Monitoring**

DDC system shall monitor the rooftop supply air temperature. DDC system shall monitor the rooftop return air temperature.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 968-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	CSM	10/27/06	11/28/07

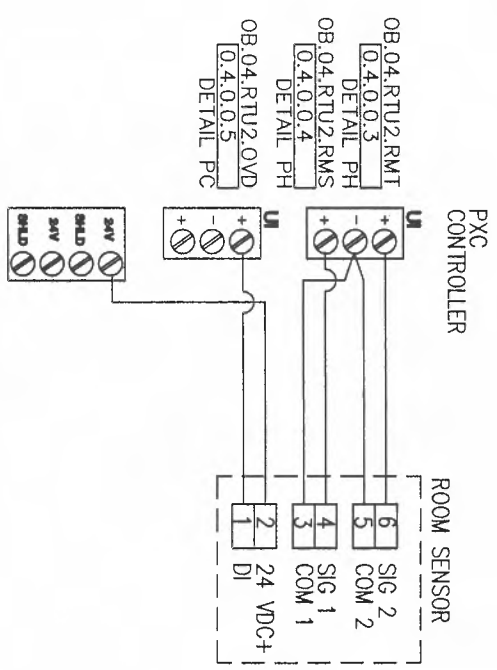
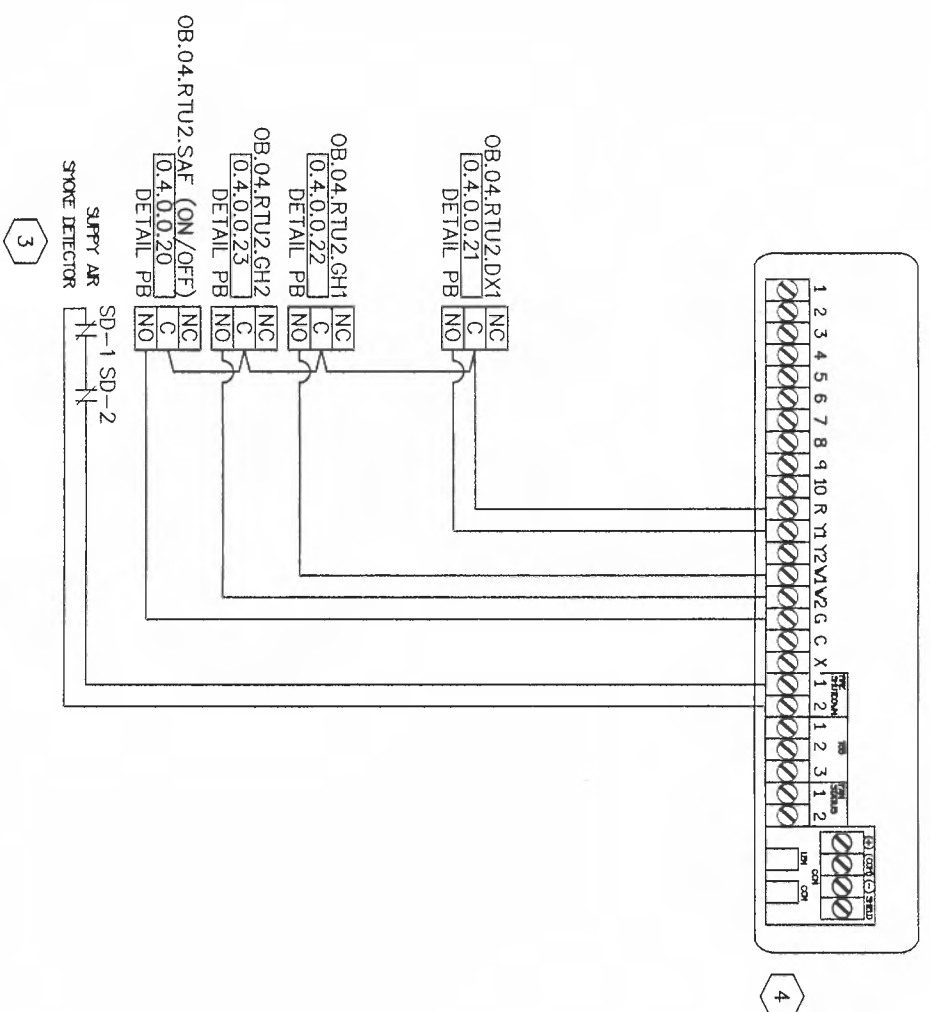
**RTU 1-2 CONTROL DIAGRAM**

440P-702374

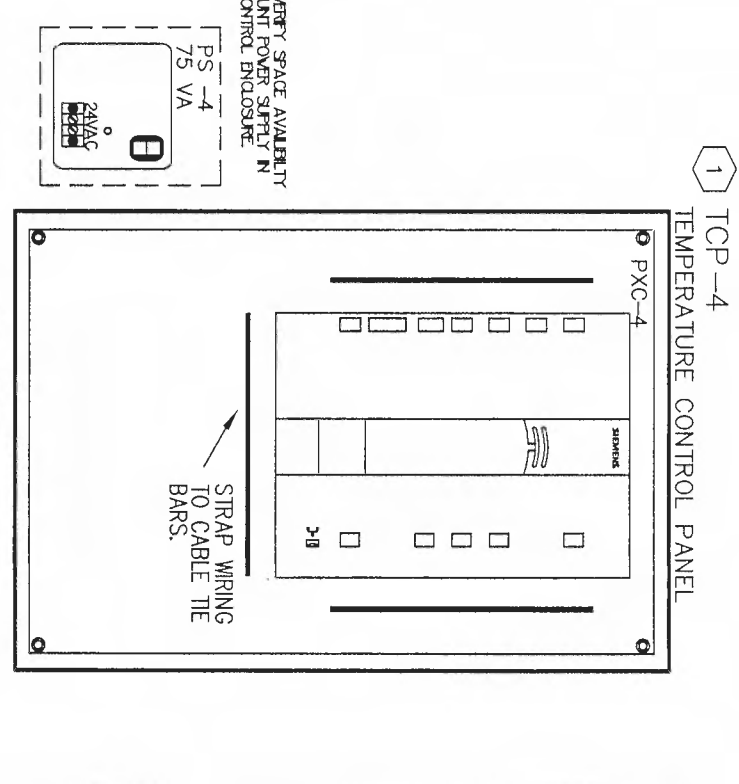
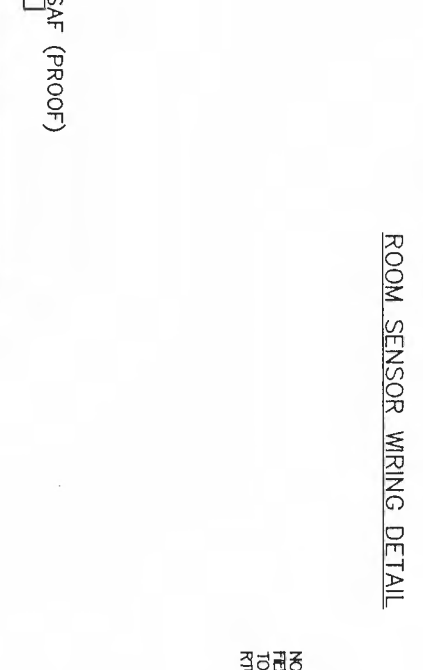
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**1-5A**

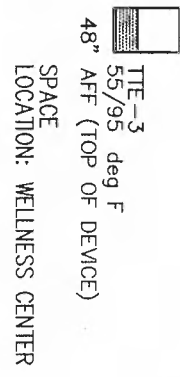
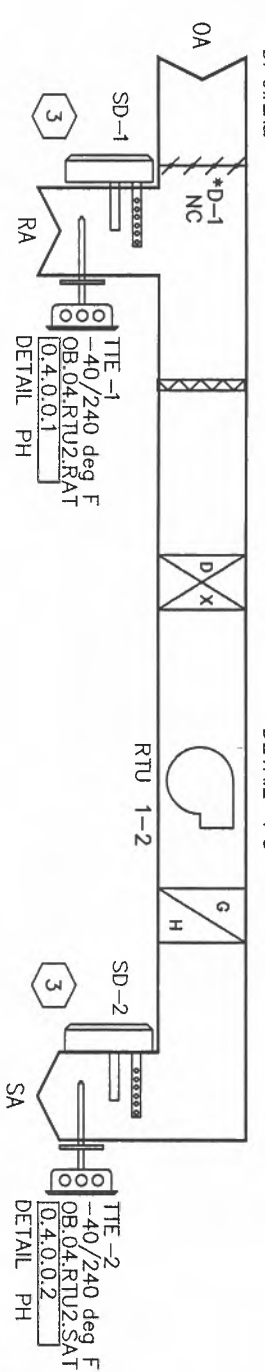
ROOF TOP LOW VOLTAGE TERMINAL STRIP



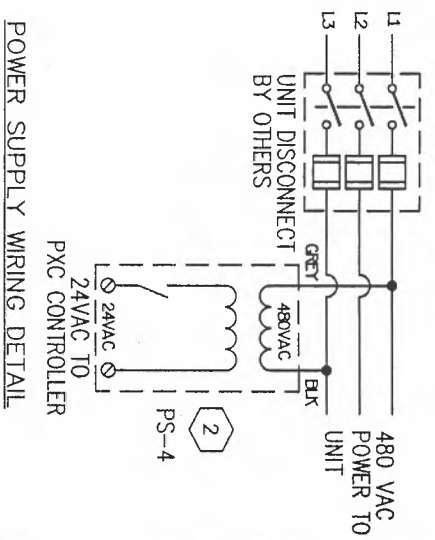
- INSTALLATION NOTES:**
- TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU.
  - WIRE POWER SUPPLY AFTER UNIT DISCONNECT.
  - SMOKE DETECTOR PROVIDED, MOUNTED AND WRED BY DIVISION 16.
  - FIELD VERIFY ALL RTU TERMINATIONS.



NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL ARE BY OTHERS.



1 RTU 1-2 CONTROL DIAGRAM  
 1-5 LOCATION: OPERATIONS BUILDING ROOF  
 SERVICES: ARCHIVE STRG., WELLNESS CENTER, FIRST AID



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

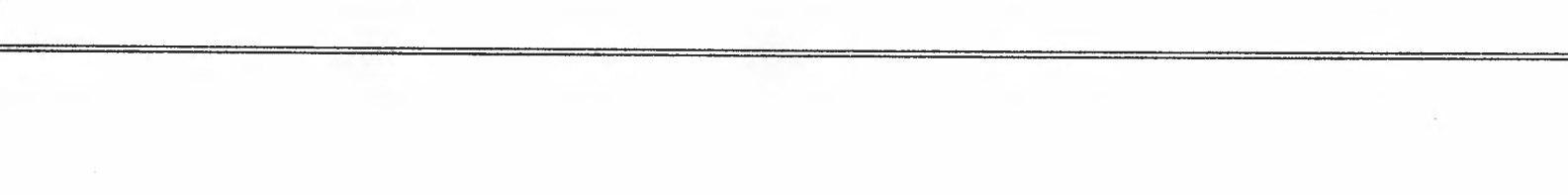
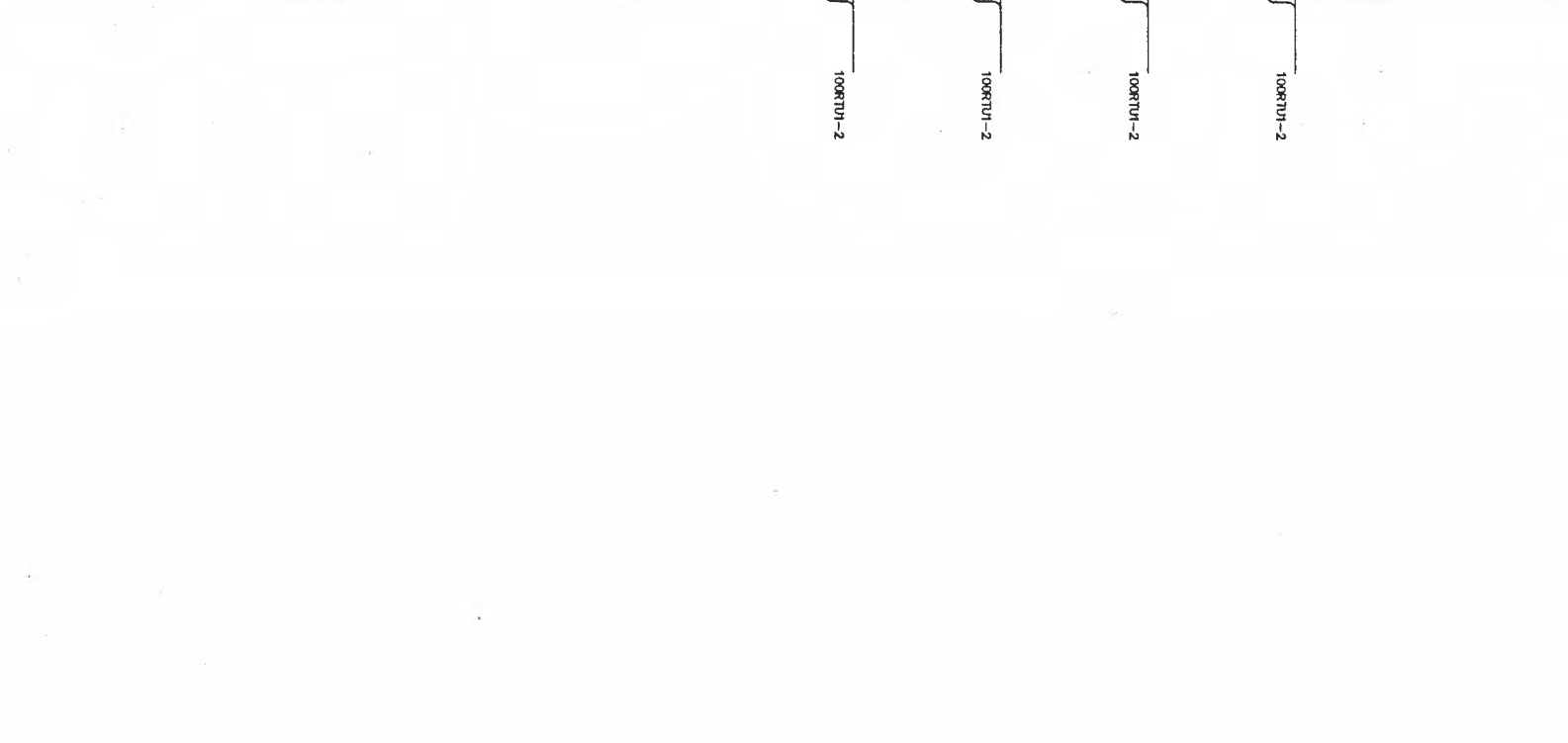
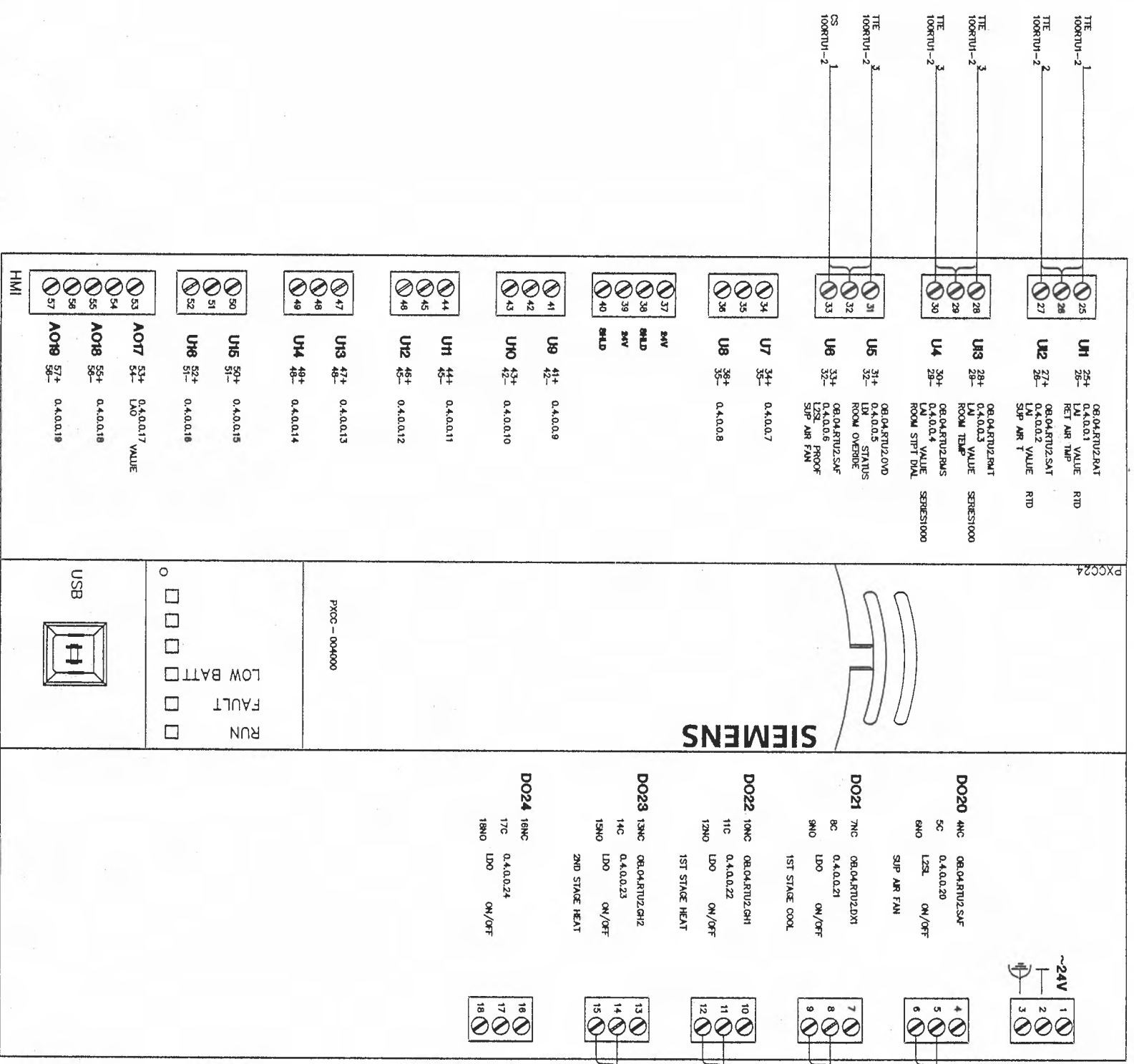
45470 Commerce Ctr. Dr.  
 Plymouth Twp, MI 48170  
 USA  
 PHONE: 734-458-3800  
 FAX: 866-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI  
 ENGINEER: SFM  
 DRAFTER: SFM  
 CHECKED BY: 12/14  
 INITIAL RELEASE DATE: 10/27/06  
 LAST EDIT DATE: 11/28/07

440P-702374  
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1-5



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

440P-702374  
100  
1-6

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
CS 1	1	H608	VERIS		1006cut016	CUR SW SPLITCOOR-ADJ SEPT W/LED
SD 1-2	2	FB0	FB0			FURNISHED BY OTHERS
TCP 6	1	A-20H16ALPP	HOFFMAN			20"X16"X6" NEMA 4 ENCLOSURE
TTE 1-2	2	544-339	SIEMENS	S600-58	149 261	D/PT TEMP SENSOR,RTD,-40/240F
TTE 3	1	544 780FA	SIEMENS		149 312	RM SNR W/SIPT IND OVRD-BEGE
	1	544-782A	SIEMENS		149 359	SINGLE GOOD MOUNTING PLATE KIT
Panel Mounted Devices						
PS 6	1	PSH75AN	FUNCTIONAL DEVICES		1208cut034	PWRSPLY 75VA MLT-TAP W/O OULLT
PXC 6	1	PXC24-PR.A	SIEMENS		149454	PXC COMPACT,24PT,RS485,ROOFTOP

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj.). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

**Warm-Up**  
The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

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**Unoccupied**  
The supply fan is off, the DX cooling is off, gas heating is off.

**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space

temperature of 65 degrees F (adj.). The DX cooling remains off.

**Safety**  
Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Monitoring**  
DDC system shall monitor the rooftop supply air temperature.  
DDC system shall monitor the rooftop return air temperature.

## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

## ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	2/14	10/27/06	11/28/07

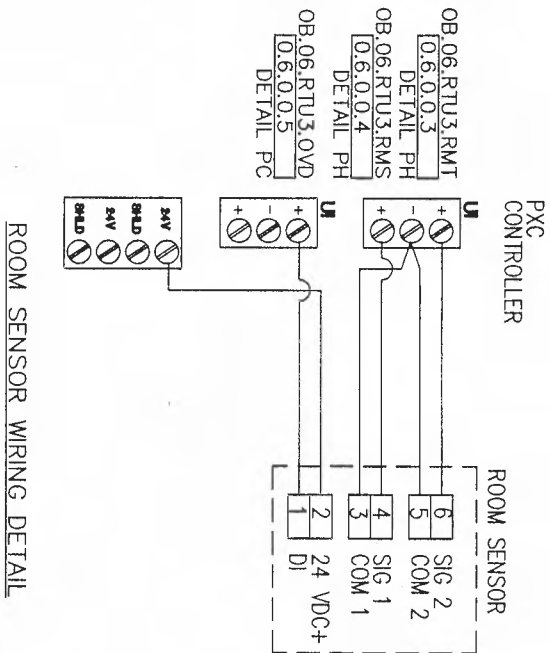
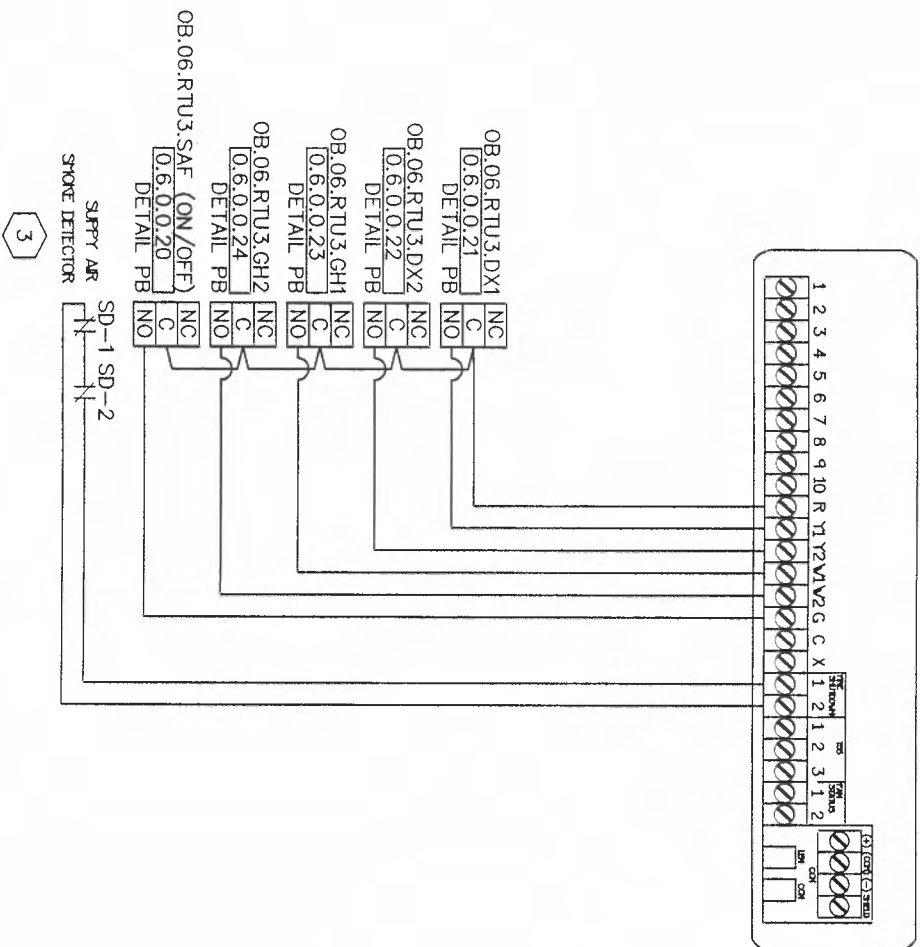
## RTU 1-3 CONTROL DIAGRAM

440P-702374

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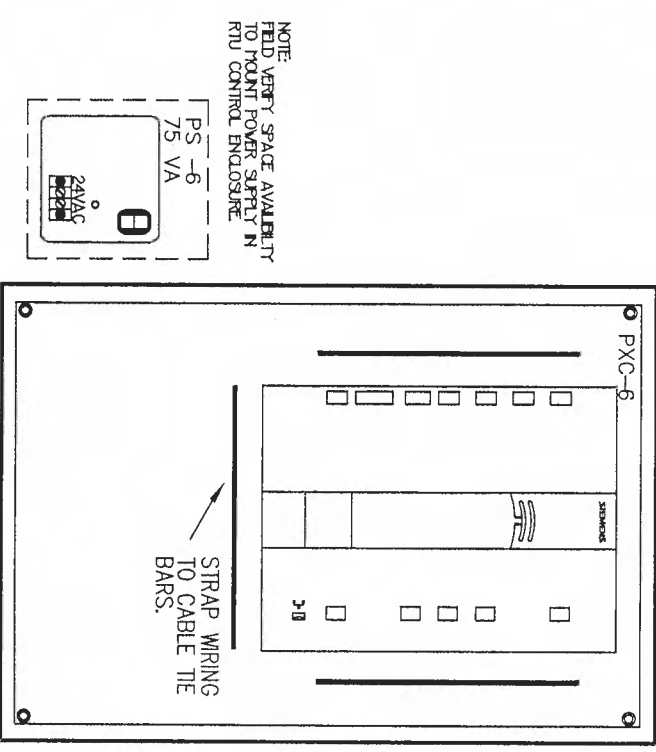
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ROOF TOP LOW VOLTAGE TERMINAL STRIP

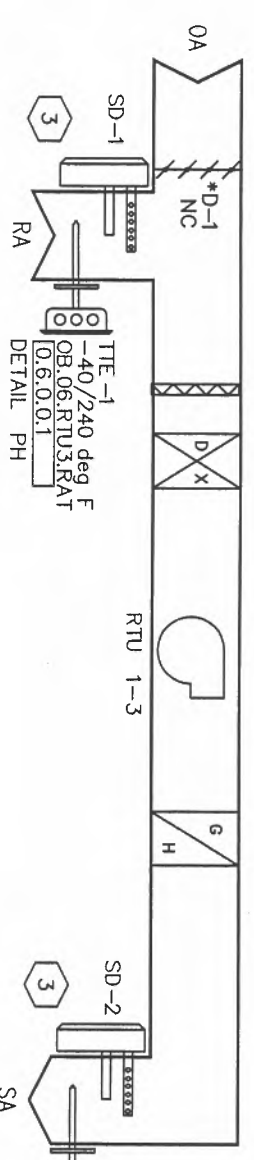


- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU.
  - 2 WIRE POWER SUPPLY AFTER UNIT DISCONNECT.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL RTU TERMINATIONS.

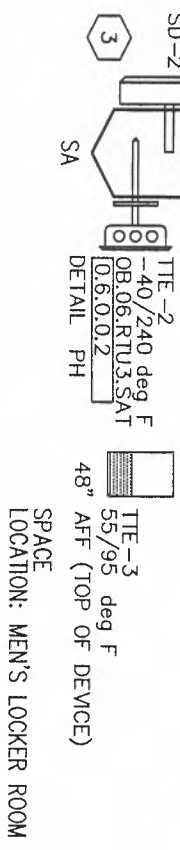
1 TCP-6 TEMPERATURE CONTROL PANEL



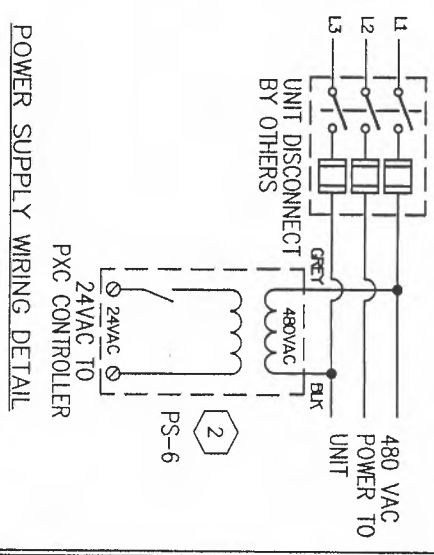
NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL ARE BY OTHERS



1 RTU 1-3 CONTROL DIAGRAM  
LOCATION: OPERATIONS BUILDING ROOF  
SERVES: MEN'S LOCKER ROOM



SPACE LOCATION: MEN'S LOCKER ROOM



POWER SUPPLY WIRING DETAIL

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

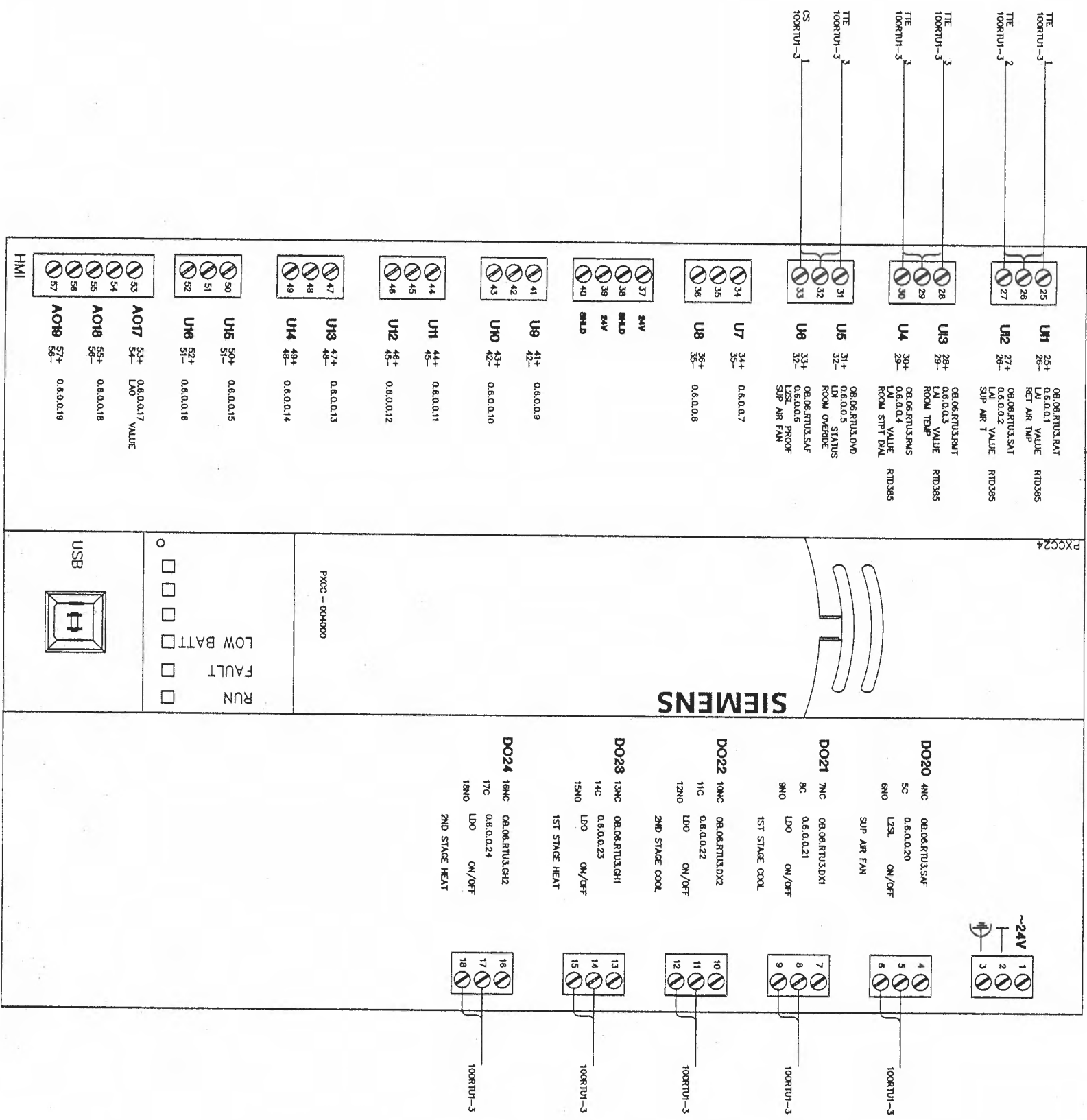
45470 Commerce Ctr. Dr.  
Plymouth Twp., MA 01870  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI  
ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: 2/2/11  
INITIAL RELEASE DATE: 10/27/08  
LAST EDIT DATE: 11/28/07

440P-702374  
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1-7



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Cr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-456-3800  
Fax: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**  
**ANN ARBOR, MI**

ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: *WJL*  
INITIAL RELEASE: 10/27/06  
LAST EDIT DATE: 11/28/07

440P-702374  
100  
**1-8**



Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
CS 1	1	H608	VERIS		1006cui016	CUR SW SPLITCOR-ADJ SETPT W/LED
SD 1-2	2	FBO	FBO			FURNISHED BY OTHERS
TOP 9	1	A-20H16ALPP	HOFFMAN			20"x16"x6" NEMA 4 ENCLOSURE
TTE 1-2	2	544-339	SIEMENS	S600-58	149 261	D/P/T TEMP SENSOR,RTD,-40/240F
TTE 3	1	544 780FA	SIEMENS		149 312	RM SNSR W/STPT IND OVRD-BEIGE
	1	544-782A	SIEMENS		149 359	SINGLE GOOF MOUNTING PLATE KIT
Panel Mounted Devices						
PS 9	1	PSH75AN	FUNCTIONAL DEVICES		1208-cui034	PWRSPLY 75VA MLT-TAP W/O OULTI
PXC 9	1	PXC24-PR A	SIEMENS		149454	PXC COMPACT,24PT,RS485,ROOFTOP

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj.). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

**Warm-Up**  
The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

**Occupied**  
The fan starts the gas heating and DX cooling stage in sequence without overlap to maintain the room temperature setpoint. When the outside air dry bulb temperature is below the economizer changeover value the DX cooling is disabled and the fan will run for free cooling to maintain the room temperature setpoint. When the outside air dry bulb temperature is above the economizer changeover value, DX cooling is enabled to maintain the room temperature setpoint.

**Unoccupied**  
The supply fan is off, the DX cooling is off, gas heating is off.

**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space

temperature of 65 degrees F (adj.). The DX cooling remains off.

**Safety**  
Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Monitoring**  
DDC system shall monitor the rooftop supply air temperature.  
DDC system shall monitor the rooftop return air temperature.

## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

## ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	LSYH	10/27/06	11/28/07

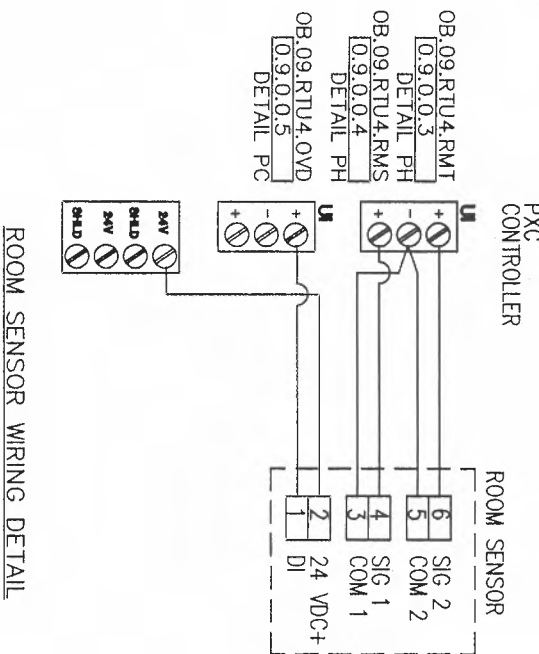
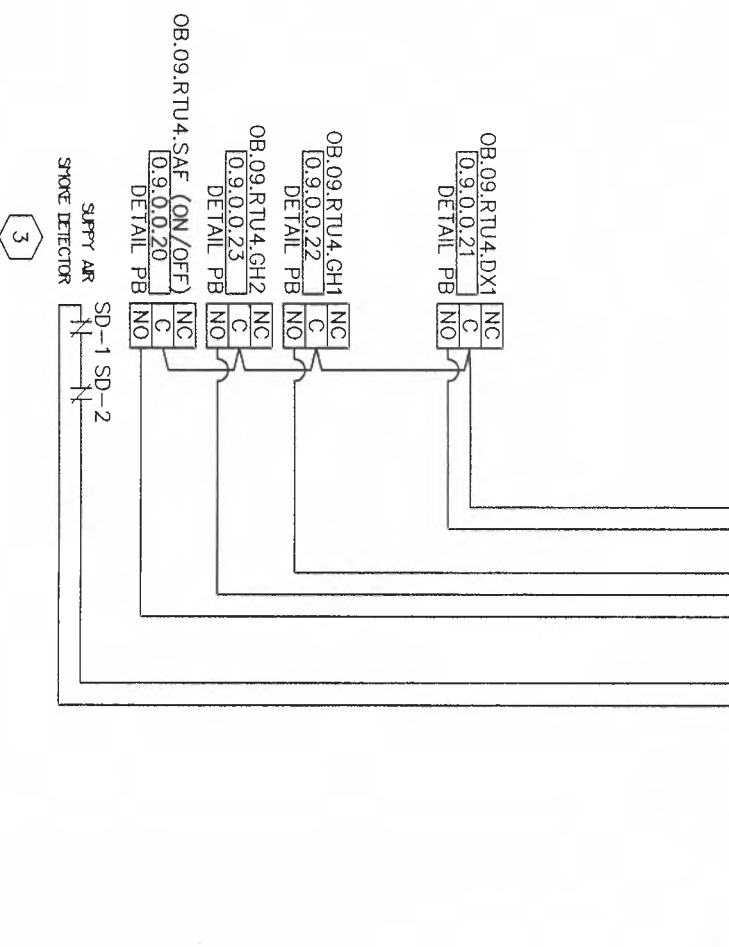
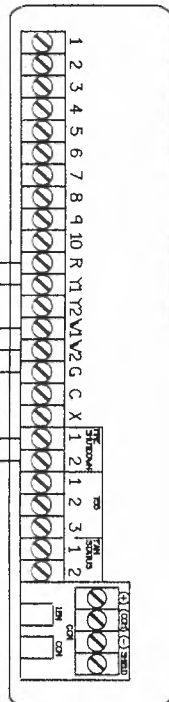
## RTU 1-4 CONTROL DIAGRAM

440P-702374

100

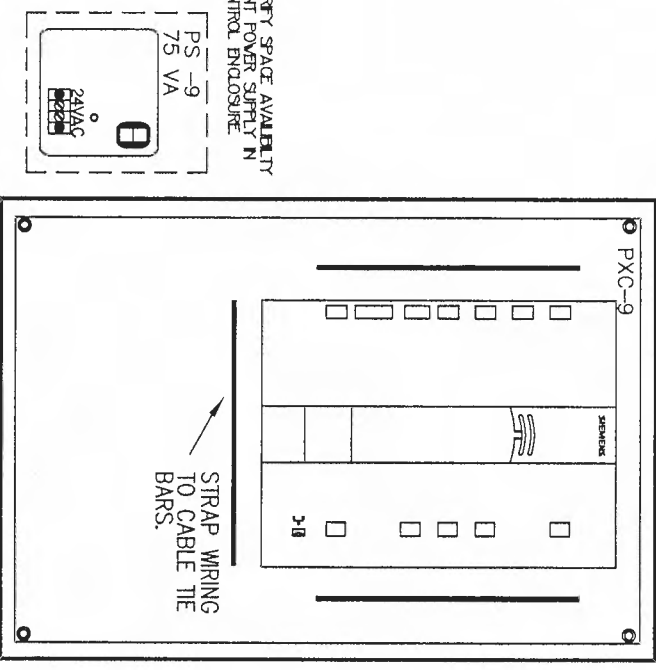
# 1-9A

ROOF TOP LOW VOLTAGE TERMINAL STRIP

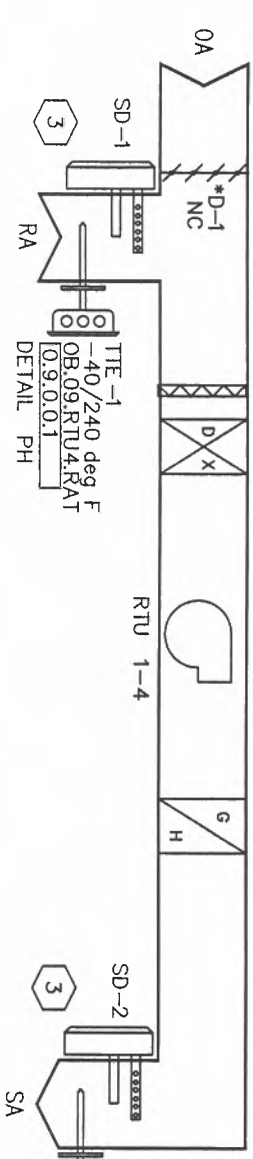


- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU.
  - 2 WIRE POWER SUPPLY AFTER UNIT DISCONNECT.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL RTU TERMINATIONS.

1 TCP-9 TEMPERATURE CONTROL PANEL

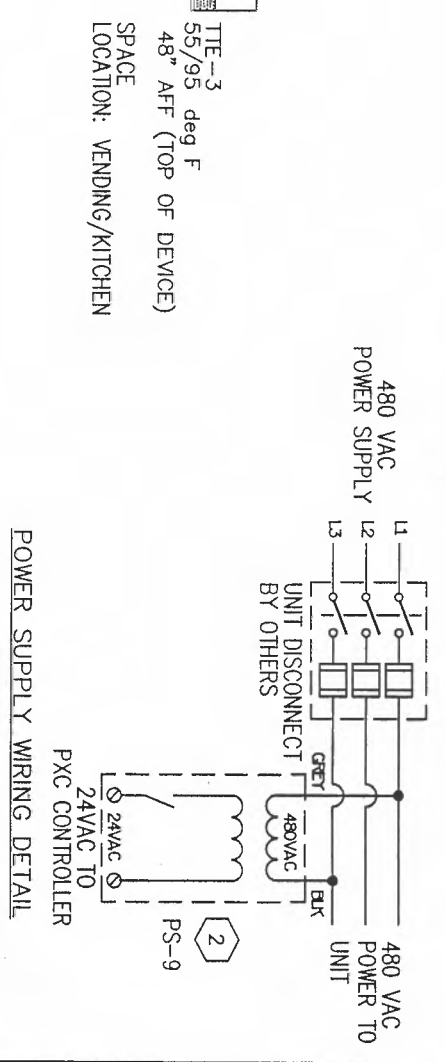


NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL ARE BY OTHERS.



1-9 RTU 1-4 CONTROL DIAGRAM

LOCATION: OPERATIONS BUILDING ROOF  
SERVES: WOMEN'S LOCKER, VENDING, KITCHEN, IT TECH



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

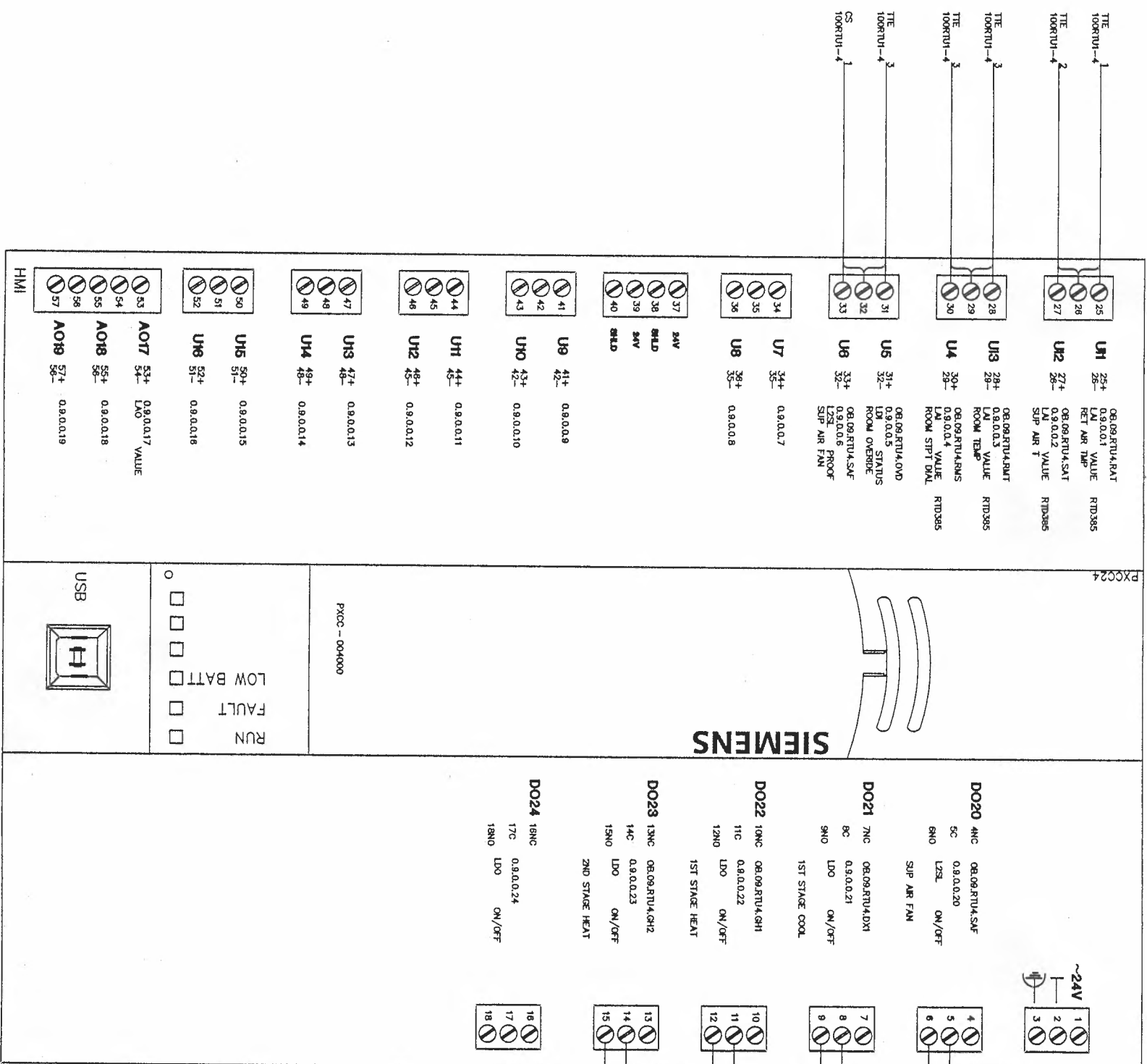
ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

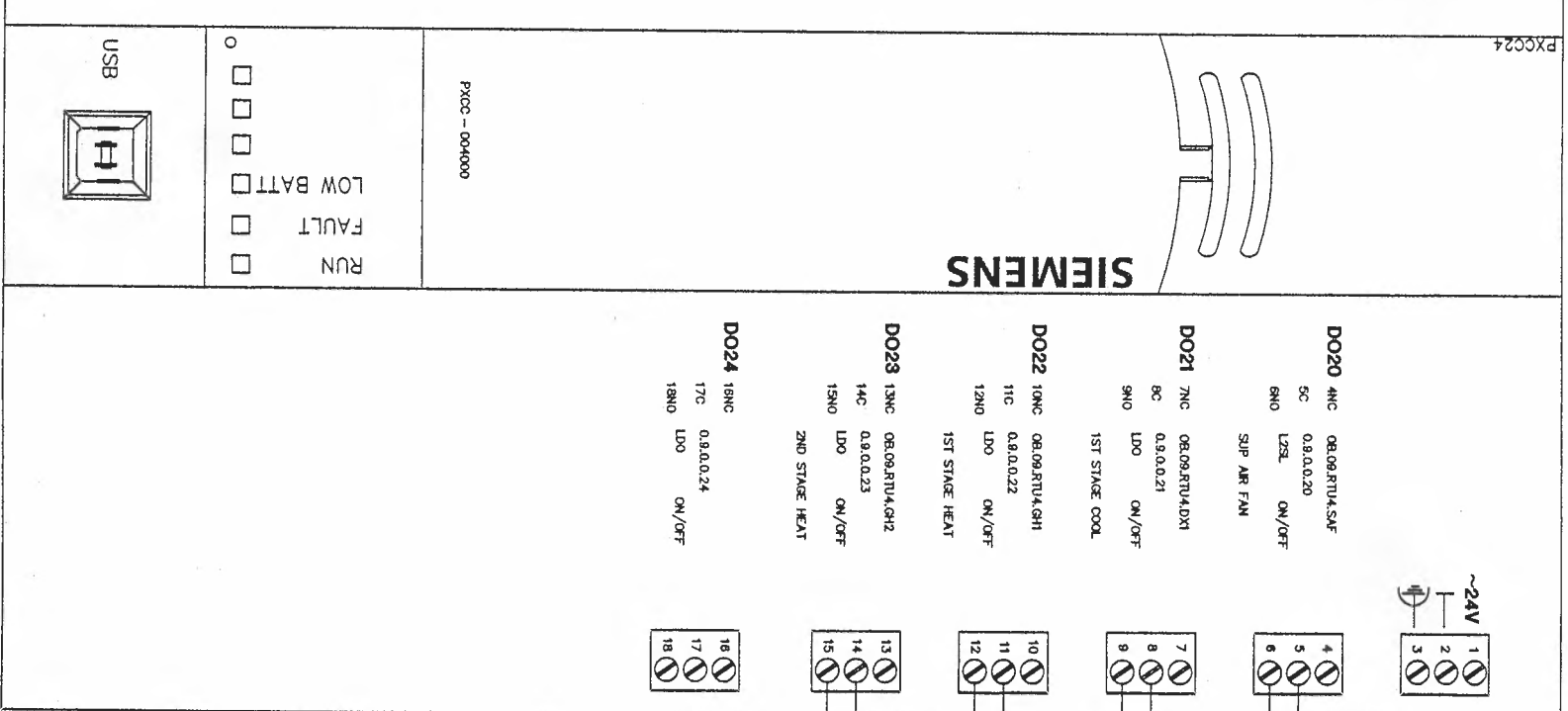
ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	CL/CL	10/27/06	11/28/07

RTU 1-4 CONTROL DIAGRAM

440P-702374  
100  
1-9



U1	25+	08.09.RTU4.RAT	08.0.0.1	RTD385
	26-	LN VALUE		
	27+	RET AIR TMP		
U2	26-	08.09.RTU4.SAT	08.0.0.2	RTD385
	27+	LN VALUE		
	28+	SIP AIR T		
U3	28+	08.09.RTU4.RMT	08.0.0.3	RTD385
	29-	LN VALUE		
	30+	ROOM TEMP		
U4	29+	08.09.RTU4.RMS	08.0.0.4	RTD385
	30+	LN VALUE		
	31+	ROOM STPT DVAL		
U5	31+	08.09.RTU4.OND	08.0.0.5	
	32-	LN STATUS		
	33+	ROOM OVERIDE		
U6	32-	08.09.RTU4.SAF	08.0.0.6	
	33+	LN PROCOF		
	34+	SIP AIR FAN		
U7	34+		08.0.0.7	
	35-			
U8	35-		08.0.0.8	
U9	41+		08.0.0.9	
	42-			
U10	43+		08.0.0.10	
	44-			
U11	44+		08.0.0.11	
	45-			
U12	48+		08.0.0.12	
	49-			
U13	47+		08.0.0.13	
	48-			
U14	48+		08.0.0.14	
	49-			
U15	50+		08.0.0.15	
	51-			
U16	52+		08.0.0.16	
	53-			
A017	53+		08.0.0.17	
	54-		LAO VALUE	
A018	55+		08.0.0.18	
	56-			
A019	57+		08.0.0.19	
	58-			



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
M. 48170 USA  
Phone- 734-456-3800  
Fax- 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: WYU  
INITIAL RELEASE: 10/27/06  
LAST EDIT DATE: 11/28/07

440P-702374  
100  
**1-10**

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
<b>Field Mounted Devices</b>						
CS 1	1	H608	VERIS		1006cu016	CUR SW SPLITCOOR-ADU SETPT W/LED
SD 1-2	2	FBO	FBO			FURNISHED BY OTHERS
TOP 12	1	A-20H16ALPP	HOFMAN			20"X16"X6" NEMA 4 ENCLOSURE
TTE 1-2	2	544-339	SIEMENS	S600-58	149 261	D/P/T TEMP SENSOR,RTD,-40/240F
TTE 3	1	544 780FA	SIEMENS		149 312	RM SNSR W/SIPT IND OVRD-BEIGE
	1	544-782A	SIEMENS		149 359	SINGLE GOOF MOUNTING PLATE KIT
<b>Panel Mounted Devices</b>						
PS 12	1	PSH75AN	FUNCTIONAL DEVICES		1208cu034	PWRSPLY 75VA MLT-TAP W/O OULT
PXC 12	1	PXC24-PRA	SIEMENS		149454	PXC COMPACT,24PT,RS485,ROOFTOP

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj.). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

**Warm-Up**  
The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

**Occupied**  
The fan starts the gas heating and DX cooling stage in sequence without overlap to maintain the room temperature setpoint. When the outside air dry bulb temperature is below the economizer changeover value the DX cooling is disabled and the fan will run for free cooling to maintain the room temperature setpoint. When the outside air dry bulb temperature is above the economizer changeover value, DX cooling is enabled to maintain the room temperature setpoint.

**Unoccupied**  
The supply fan is off, the DX cooling is off, gas heating is off.

**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space

temperature of 65 degrees F (adj.). The DX cooling remains off.

**Safety**  
Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Monitoring**  
DDC system shall monitor the rooftop supply air temperature. DDC system shall monitor the rooftop return air temperature.

## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

## ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

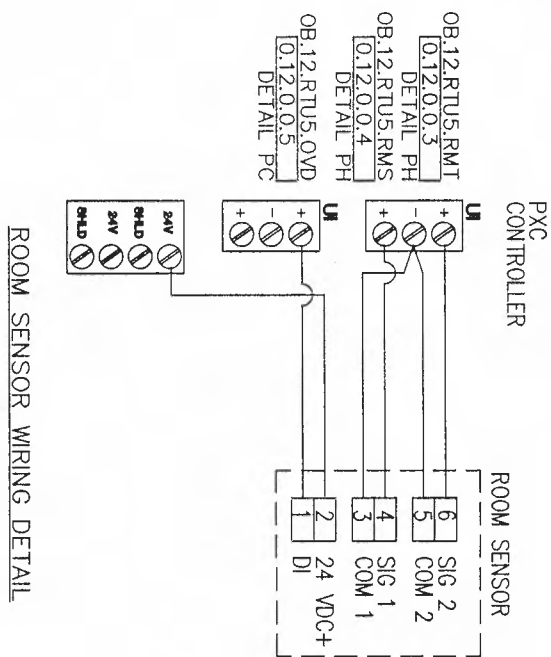
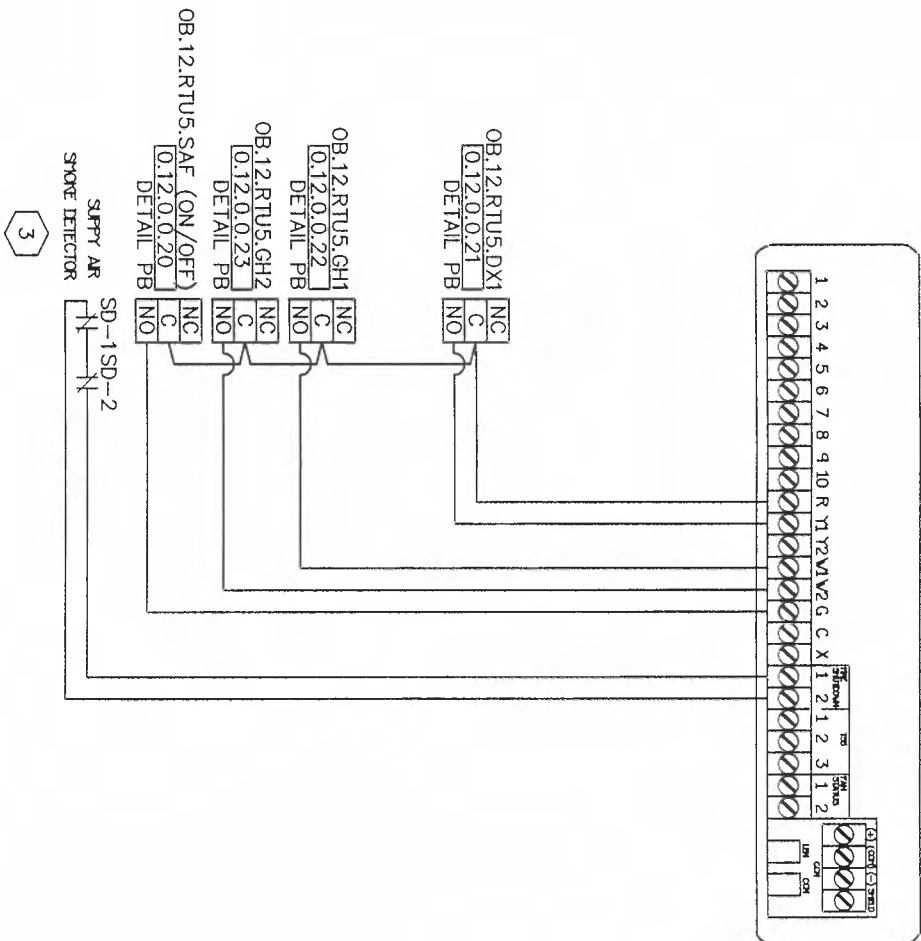
ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	cyk	10/27/08	11/28/07

## RTU 1-5 CONTROL DIAGRAM

440P-702374  
100

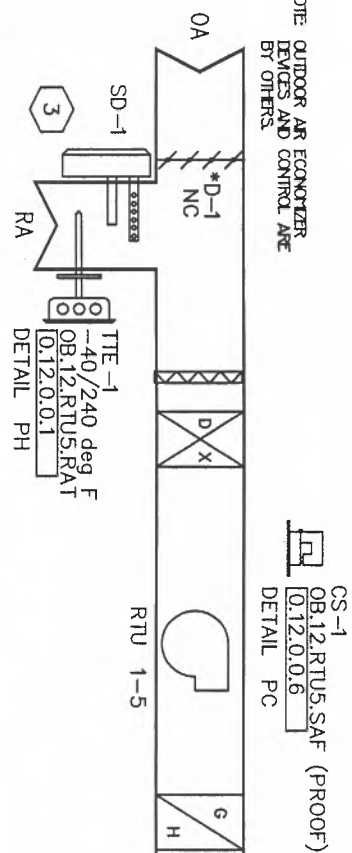
1-11A

ROOF TOP LOW VOLTAGE TERMINAL STRIP



- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU.
  - 2 WIRE POWER SUPPLY BEFORE AFTER DISCONNECT.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL RTU TERMINATIONS.

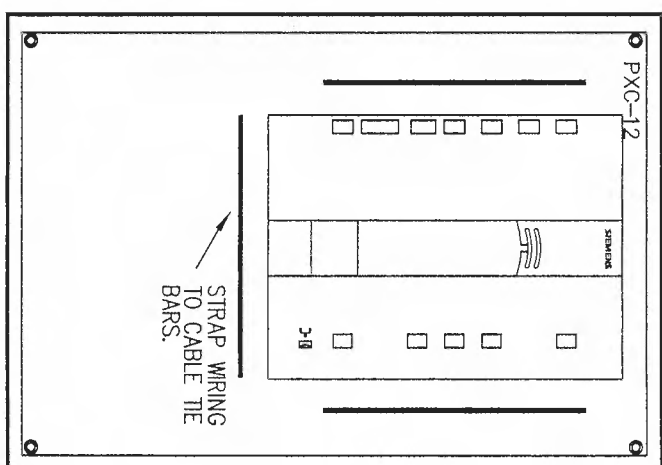
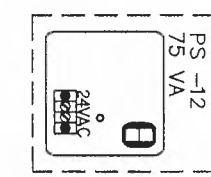
NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL WIRE BY OTHERS



**1**  
**1-11**  
RTU 1-5 CONTROL DIAGRAM  
LOCATION: OPERATIONS BUILDING ROOF  
SERVES: RADIO/ELECTRONICS, SIGN COMP, SIGN SHOP

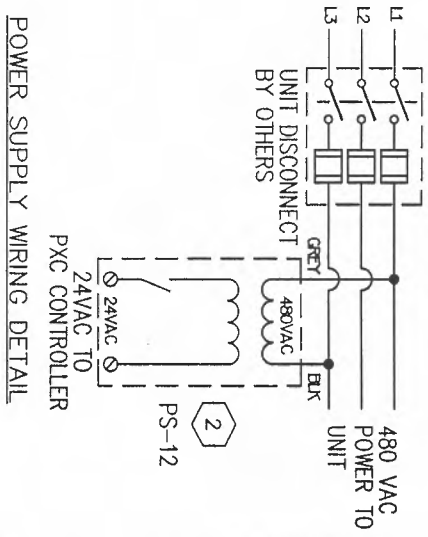
CS-1  
OB.12.RTU5.SAF (PROOF)  
DETAIL PC

NOTE:  
FIELD VERIFY SPACE AVAILABILITY TO MOUNT POWER SUPPLY IN RTU CONTROL ENCLOSURE



**1**  
**TCP-12**  
TEMPERATURE CONTROL PANEL

TTE-3  
55/95 deg F  
48" AFF (TOP OF DEVICE)  
SPACE  
LOCATION: RADIO/ELECTRONICS



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-456-3800  
Fax: 866-815-0749

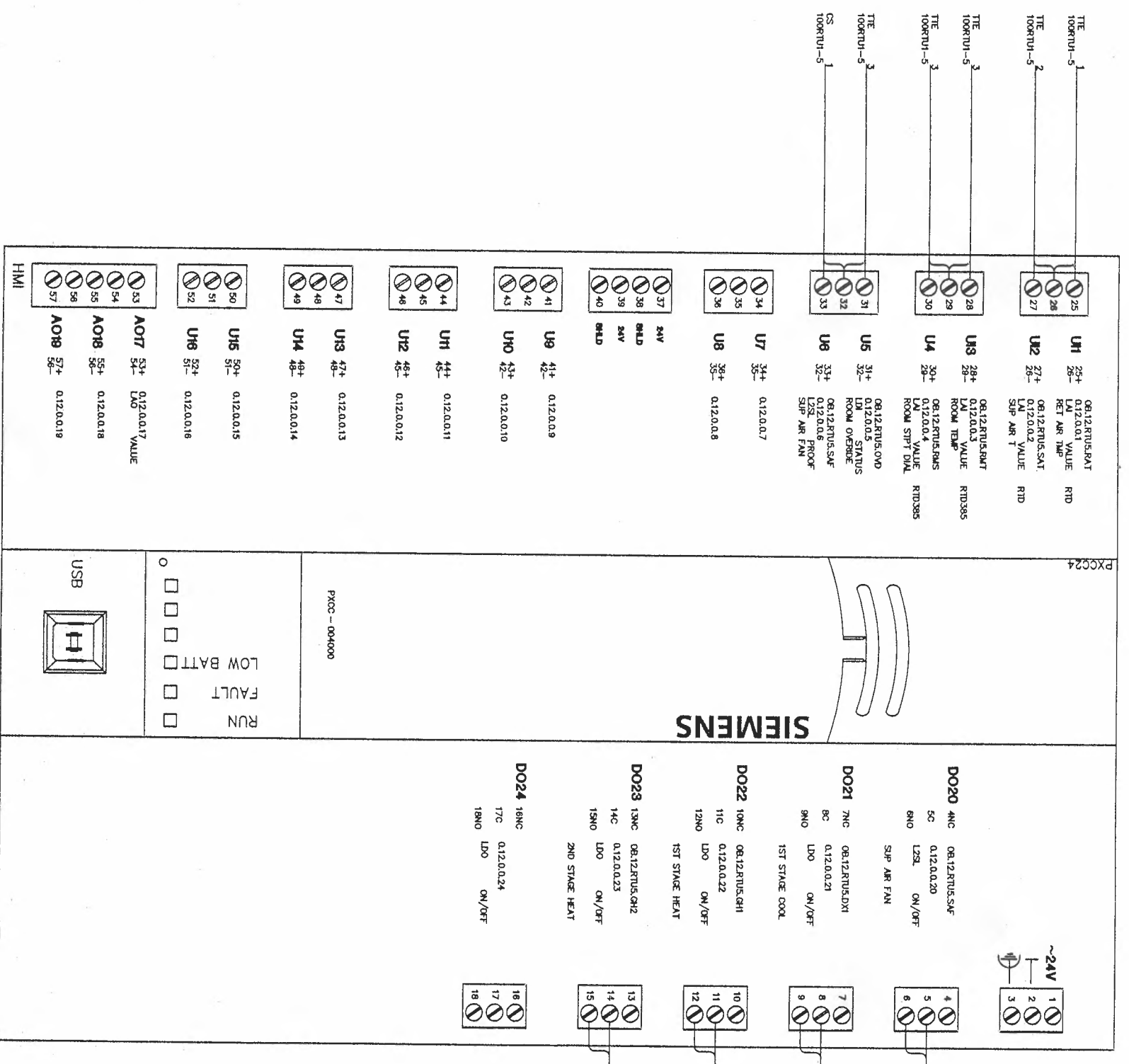
**ANN ARBOR MAINTENANCE FACILITY**  
**ANN ARBOR, MI**

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE DATE
SFM	SFM	W/L	10/27/06
			11/28/07

**RTU 1-5 CONTROL DIAGRAM**

440P-702374  
100

**1-11**



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
M. 48170 USA  
Phone- 734-456-3800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>[Signature]</i>	10/27/06	11/28/07

**RTU 1-5 CONTROLLER**

440P-702374  
100

**1-12**

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
<b>Field Mounted Devices</b>						
CS 1	1	H608	VERIS		1006cut016	CUR SW SPLTCOR-ADU STPPT W/LED
SD 1-2	2	FBO	FBO			FURNISHED BY OTHERS
TOP 10	1	A-20H16ALPP	HOFFMAN			20"X16"X6" NEMA 4 ENCLOSURE
TTE 1-2	2	544-339	SIEMENS		S600-58	D/P/T TEMP SENSOR,RD,-40/240F
TTE 3	1	544 780FA	SIEMENS		149 312	RM SNSR W/SPT IND OVRD-BEGE
	1	544-782A	SIEMENS		149 359	SINGLE GOOD MOUNTING PLATE KIT
<b>Panel Mounted Devices</b>						
PS 10	1	PSH75AN	FUNCTIONAL DEVICES		1208cut034	PWRSPLY 75VA MLT-TAP W/O OUTLT
PXC 10	1	PXC24-PR.A	SIEMENS		149454	PXC COMPACT,24PT,RS485,ROOFTOP

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

**Warm-Up**  
The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

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**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space

temperature of 65 degrees F (adj). The DX cooling remains off.

**Safety**  
Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Monitoring**  
DDC system shall monitor the rooftop supply air temperature.  
DDC system shall monitor the rooftop return air temperature.

**Emergency Power**  
Rooftop RTU 1-6A and RTU 1-6B shall be software interlocked through the Building Management System to run only one at a time.

Rooftop RTU 1-6A to be controlled through the Building Management System not to operate until 2 minutes after generator is running.

REVISION HISTORY		
1	11/28/2007	KJ AS-BUILT DRAWING

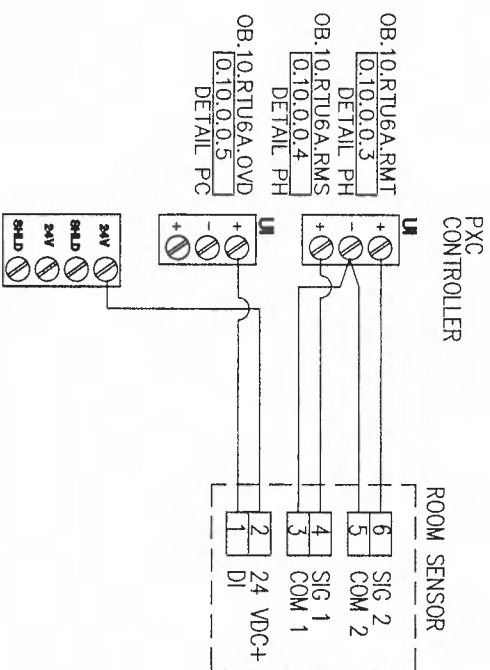
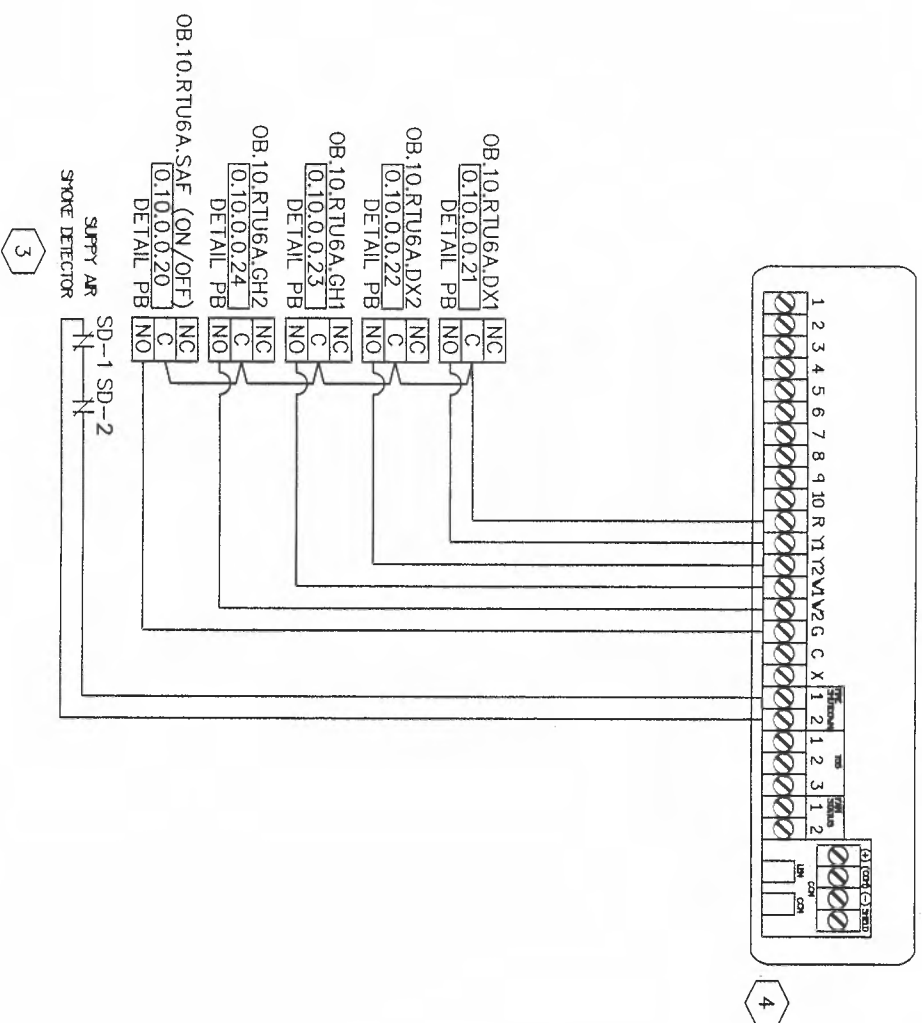
**SIEMENS**  
Siemens Building Technologies  
BAU

45470 Commerce Cir. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

ANN ARBOR MAINTENANCE FACILITY			
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE
SFM	SFM	1/7/14	10/27/06
			LAST EDIT DATE
			11/28/07
RTU 1-6A CONTROL DIAGRAM			

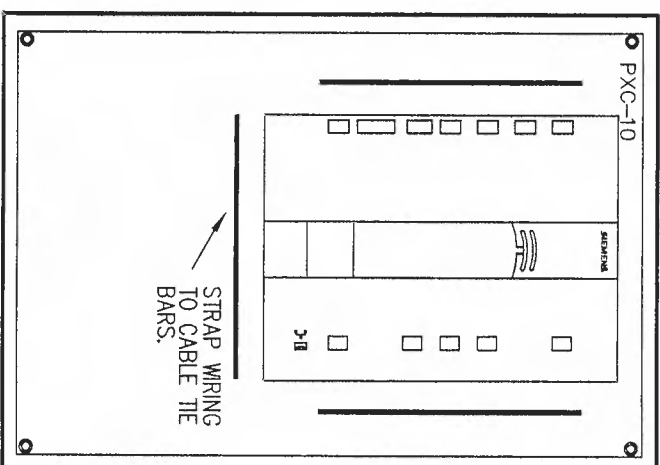
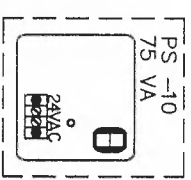
440P-702374  
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**1-13A**

ROOF TOP LOW VOLTAGE TERMINAL STRIP



ROOM SENSOR WIRING DETAIL

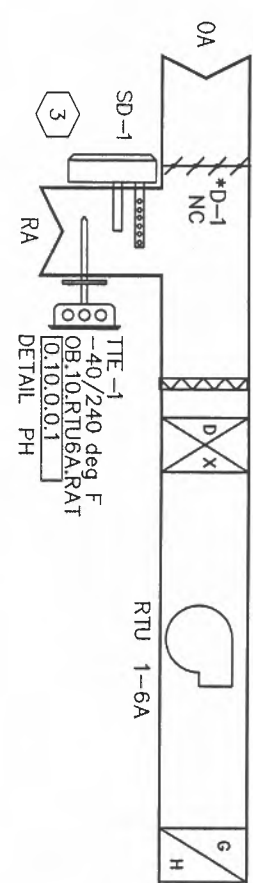
NOTE: VERIFY SPACE AVAILABILITY TO MOUNT POWER SUPPLY IN RTU CONTROL ENCLOSURE.



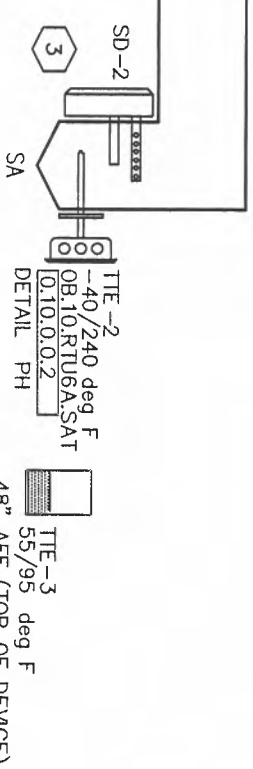
1 TCP-10 TEMPERATURE CONTROL PANEL.

- INSTALLATION NOTES:
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU.
  - 2 WIRE POWER SUPPLY AFTER UNIT DISCONNECT.
  - 3 SMOKE DETECTOR PROVIDED MOUNTED AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL RTU TERMINATIONS.

NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL ARE BY OTHERS.

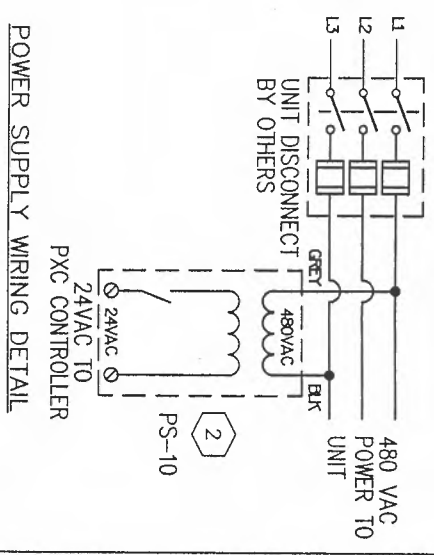


CS-1 OB:10.RTU6A.SAF (PROOF) 0:10.0.0.6 DETAIL PC



TTE-3 55/95 deg F 48" AFF (TOP OF DEVICE) SPACE LOCATION: TELE-COMMUNICATIONS ROOM

1 RTU 1-6A CONTROL DIAGRAM 1-13 LOCATION: OPERATIONS BUILDING ROOF SERVES: SIGNAL CONTROL, SOLID-STATE, TELE COMM.



POWER SUPPLY WIRING DETAIL

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE DATE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/28/07

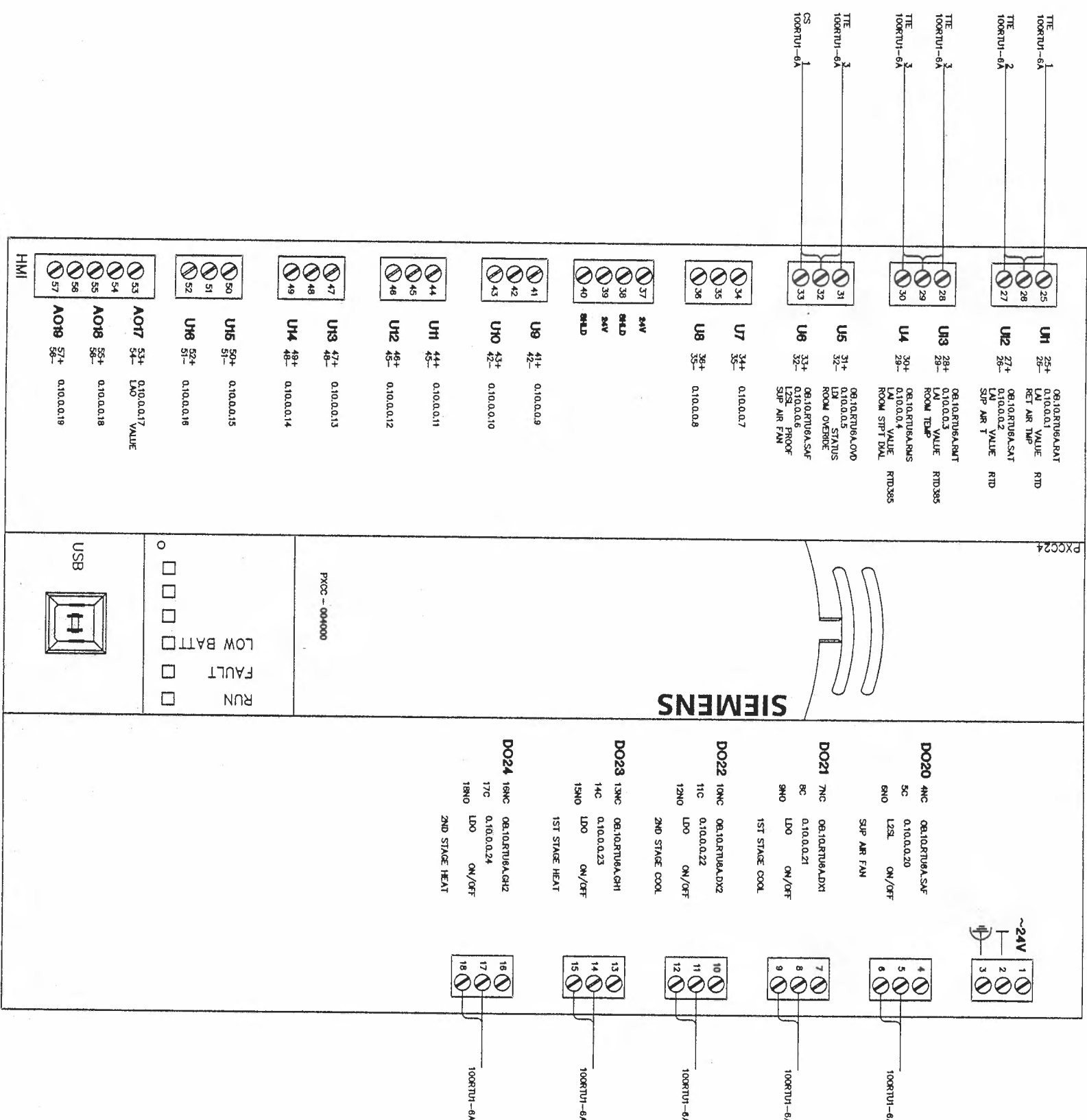
RTU 1-6A CONTROL DIAGRAM

440P-702374

100

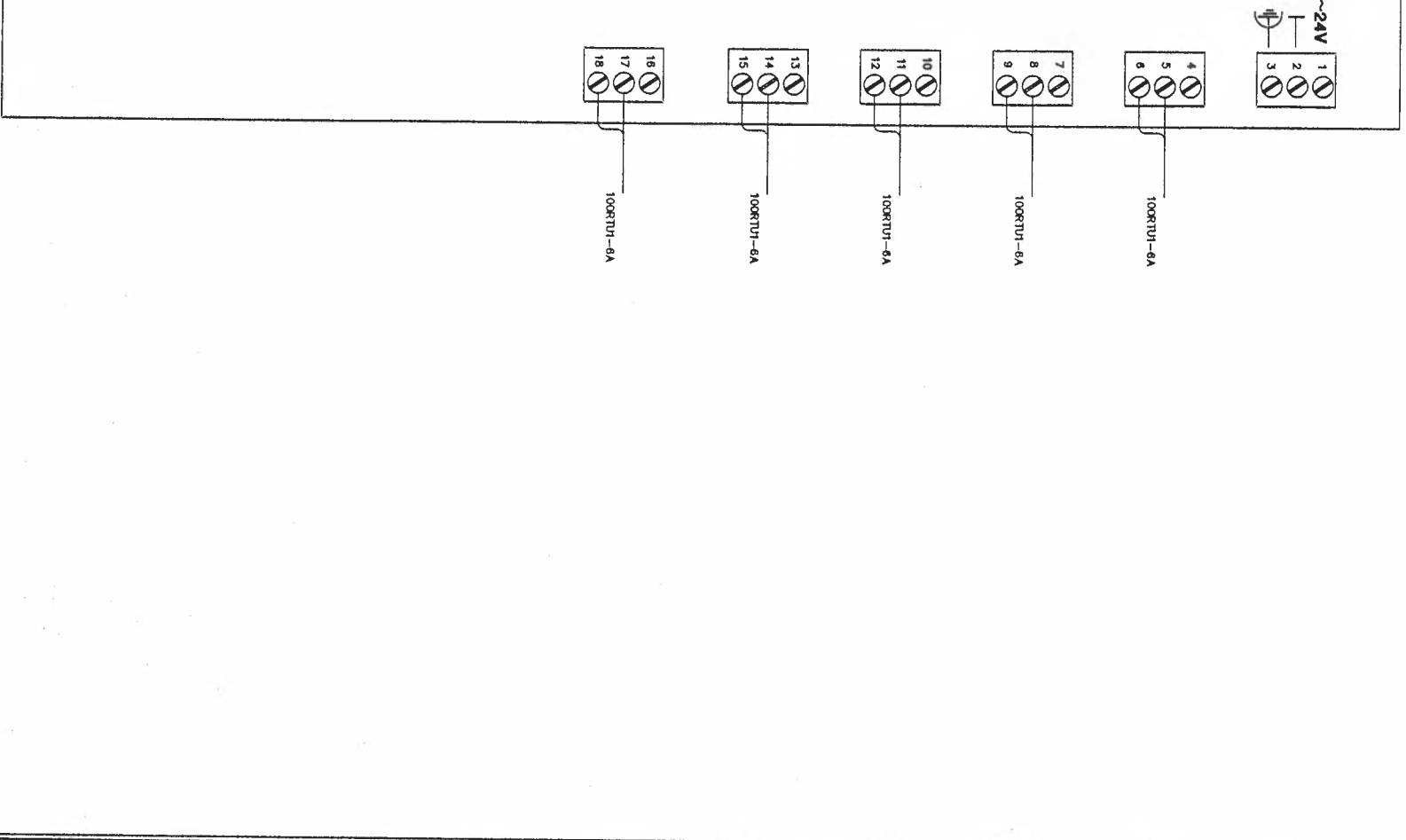
1-13





Module	Terminal	Signal	Value
U1	25+	0E:10RTU6A.BAT	0:10.0.01
U1	26-	LAN VALUE	
U1	27+	RET AIR TEMP	
U2	27+	0E:10RTU6A.SAT	0:10.0.02
U2	28-	LAN VALUE	
U2	29+	SFP AIR 1	
U3	28+	0E:10RTU6A.BAT	0:10.0.03
U3	29-	LAN VALUE	
U3	30+	ROOM TEMP	
U4	29+	0E:10RTU6A.BMS	0:10.0.04
U4	30-	LAN VALUE	
U4	31+	ROOM STP1 DVAL	
U5	31+	0E:10RTU6A.LDOW	0:10.0.05
U5	32-	STATUS	
U5	33+	ROOM OVERIDE	
U8	33+	0E:10RTU6A.SAF	0:10.0.06
U8	34-	SFP AIR FAN	
U7	34+	0:10.0.07	
U8	35+	0:10.0.08	
U9	41+	0:10.0.09	
U9	42-	0:10.0.10	
U11	44+	0:10.0.11	
U11	45-	0:10.0.12	
U12	46+	0:10.0.12	
U13	47+	0:10.0.13	
U13	48-	0:10.0.14	
U15	50+	0:10.0.15	
U15	51-	0:10.0.16	
U16	52+	0:10.0.17	
U16	53-	0:10.0.18	
U17	54+	0:10.0.19	
U17	55-	0:10.0.20	
U17	56+	0:10.0.21	
U17	57-	0:10.0.22	

PXC24  
  
 PYCC - 004000  
 RUN  
 FAULT  
 LOW BATT  
 USB



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
 BAU  
 45470 Commerce Ct. Dr.  
 Plymouth Twp.  
 M. 48170 USA  
 Phone: 734-456-3800  
 Fax: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI  
 ENGINEER  
 DRAFTER  
 CHECKED BY  
 INITIAL RELEASE  
 LAST EDIT DATE  
 SFM SFM  
 10/27/06 11/28/07  
**RTU 1-6A CONTROLLER**

440P-702374  
100

**1-14**

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
CS 1	1	H608	VERIS		1006cut1016	CUR SW SPLITCOR-ADJ SEPT W/LED
SD 1-2	2	FBO	FBO			FURNISHED BY OTHERS
TCP 11	1	A-20H16ALPP	HOFTMAN			20"X16"X6" NEMA 4 ENCLOSURE
TTE 1-2	2	544-339	SIEMENS	S600-58	149 261	D/P/T TEMP SENSOR,RTD,-40/240F
Panel Mounted Devices						
PS 11	1	PSH75AN	FUNCTIONAL DEVICES		1208cut1034	PWRSPLY 75VA MLT-TAP W/O OULTI
PXC 11	1	PXC24-PRA	SIEMENS		149454	PXC COMPACT,24PT,RS485,ROOFTOP

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

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The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

**Warm-Up**  
The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

**Occupied**  
The fan starts the gas heating and DX cooling stage in sequence without overlap to maintain the room temperature setpoint. When the outside air dry bulb temperature is below the economizer changeover value the DX cooling is disabled and the fan will run for free cooling to maintain the room temperature setpoint. When the outside air dry bulb temperature is above the economizer changeover value, DX cooling is enabled to maintain the room temperature setpoint.

**Unoccupied**  
The supply fan is off, the DX cooling is off, gas heating is off.

**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space temperature of 65 degrees F (adj). The DX cooling remains off.

**Safety**  
Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Emergency Power**  
Rooftop RTU 1-6A and RTU 1-6B shall be software interlocked through the Building Management System to run only one at a time.

## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

## ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>csj</i>	10/27/08	11/28/07

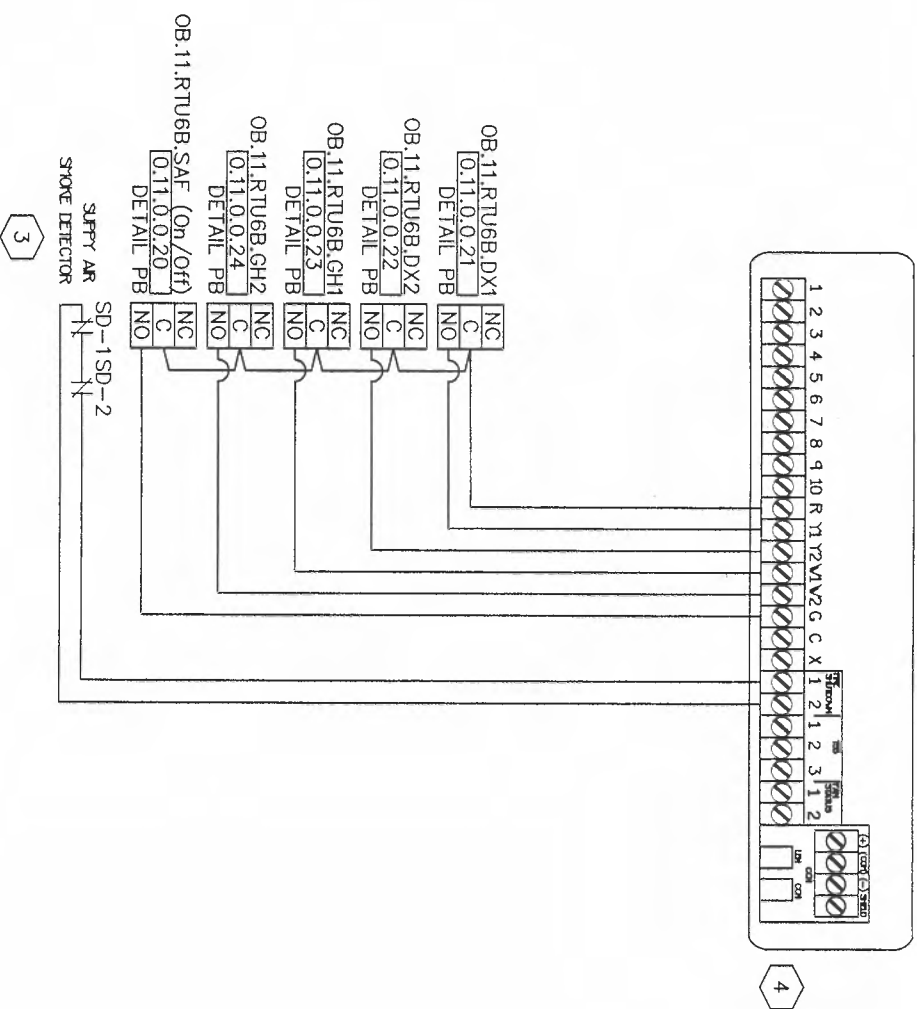
## RTU 1-6B CONTROL DIAGRAM

440P-702374

100

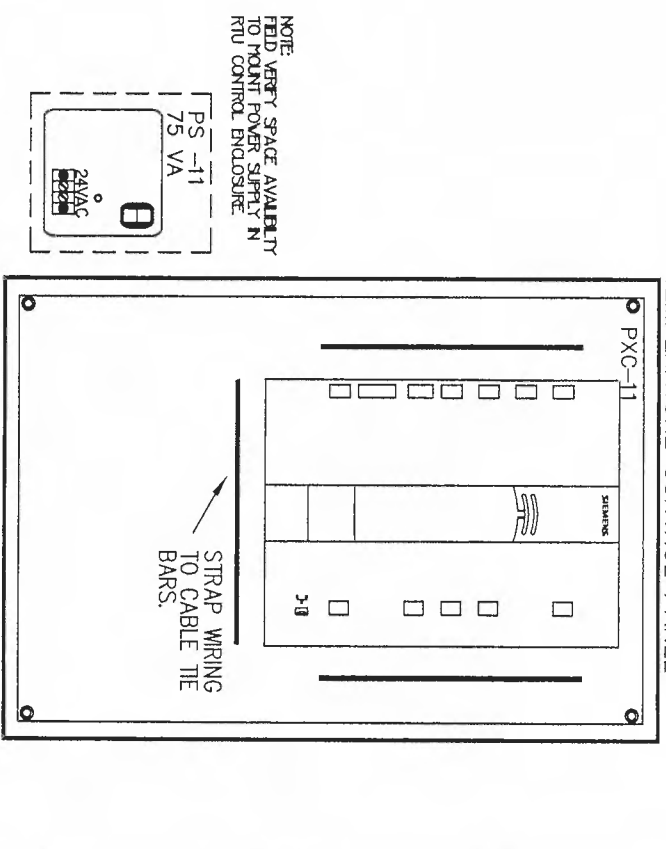
# 1-15A

ROOF TOP LOW VOLTAGE TERMINAL STRIP

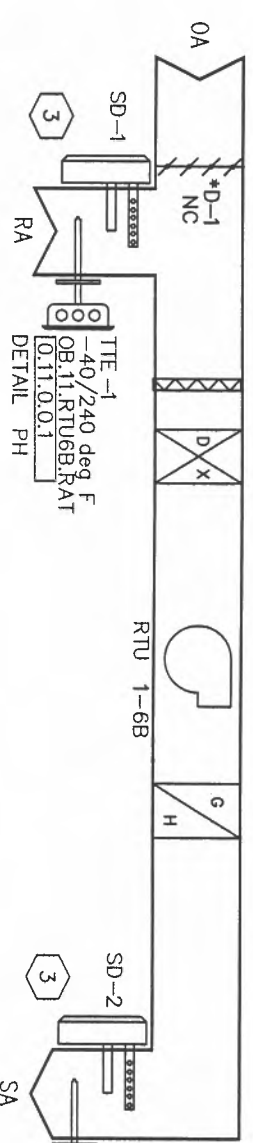


- INSTALLATION NOTES:**
- TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU
  - WIRE POWER SUPPLY AFTER UNIT DISCONNECT.
  - SMOKE DETECTOR PROVIDED, MOUNTED AND WREID BY DIVISION 16.
  - FIELD VERIFY ALL RTU TERMINATIONS

1 TCP-11 TEMPERATURE CONTROL PANEL

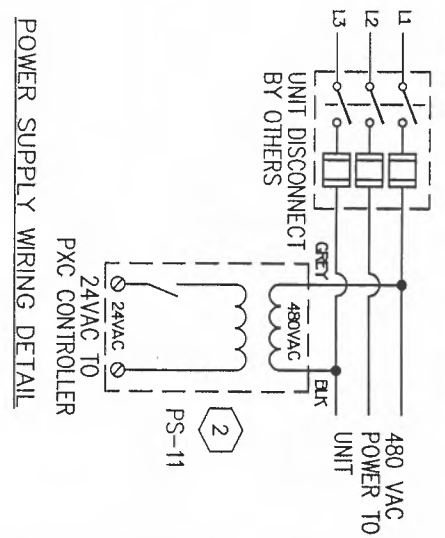


NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL ARE BY OTHERS.



1 RTU 1-6B CONTROL DIAGRAM  
1-15 LOCATION: OPERATIONS BUILDING ROOF  
SERVES: SIGNAL CONTROL, SOLID-STATE, TELE COMM.

NOTE: SHARE RTU-6A ROOM SENSOR  
\*TTE-3 55/95 deg F  
48" AFF (TOP OF DEVICE)  
SPACE LOCATION: TELE-COMMUNICATIONS ROOM



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

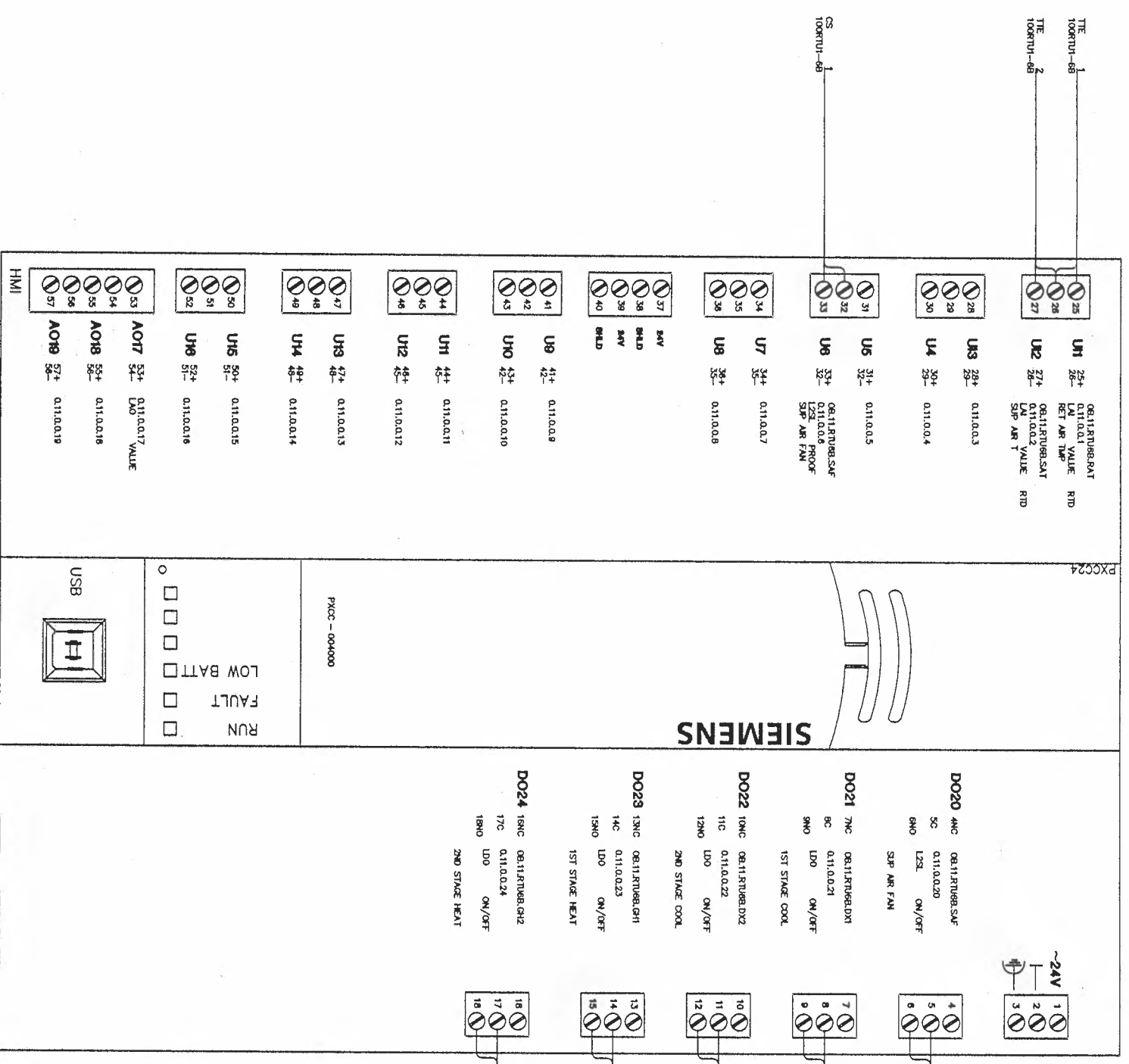
45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749  
Siemens Building Technologies  
BAU

ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJH</i>	10/27/06	11/28/07

RTU 1-6B CONTROL DIAGRAM

440P-702374  
100  
1-15



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-466-9800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL	RELEASE	LAST EDIT	DATE
SFM	SFM	<i>[Signature]</i>				
				10/27/06	12/03/07	

RTU 1-6B CONTROLLER

440P-702374  
100

**1-16**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1	1	GCA126-1P	SIEMENS	154001	2 PT SR,24V,MEG/S/PLNM.
AE 2	1	GCA161-1P	SIEMENS	154001	MOD(V) SR,24V, MED. PLNM
AE 3	1	GCA126-1P	SIEMENS	154001	2 PT SR,24V,MEG/S/PLNM.
CS 1-2	2	HE08	VERIS	1006aut016	CLR SW SPLICOR-ADJ SEPT W/LED
DPS 1-2	2	141-0518	SIEMENS	155 052	SWITCH,AIR FLOW,1.0/12 WG
SD 1	1	FB0	N/A	N/A	FURNISHED BY OTHERS
TCP 2	1	A-20H16ALDP	HOFMAN	N/A	20"X16"X16" NEMA 4 ENCLOSURES
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR,18"PRB,RTD -40/240F
TTE 5	1	544-780FA	SIEMENS	149168	RM SNSR W/STPT,IND,OVROD,BEDGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOD MOUNTING PLATE KIT
Panel Mounted Devices					
PS 2	1	PSH75A75AN	FUNCTIONAL DEVICES	1208cut145	DUAL PWRSPLY 75A/75A MLT-TAP
PXC 2	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP
TB 1	1	TS1.5/10MP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj.).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### Occupied

The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face

position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

#### Unoccupied

The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

#### Night Heating

Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

#### Safety

Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

#### Emergency Power

Rooftop ERU 2-1 to be controlled through the Building Management System not to operate until 2 minutes after generator is running.

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-9800  
FAX: 866-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	2/7/14	10/27/06	11/28/07

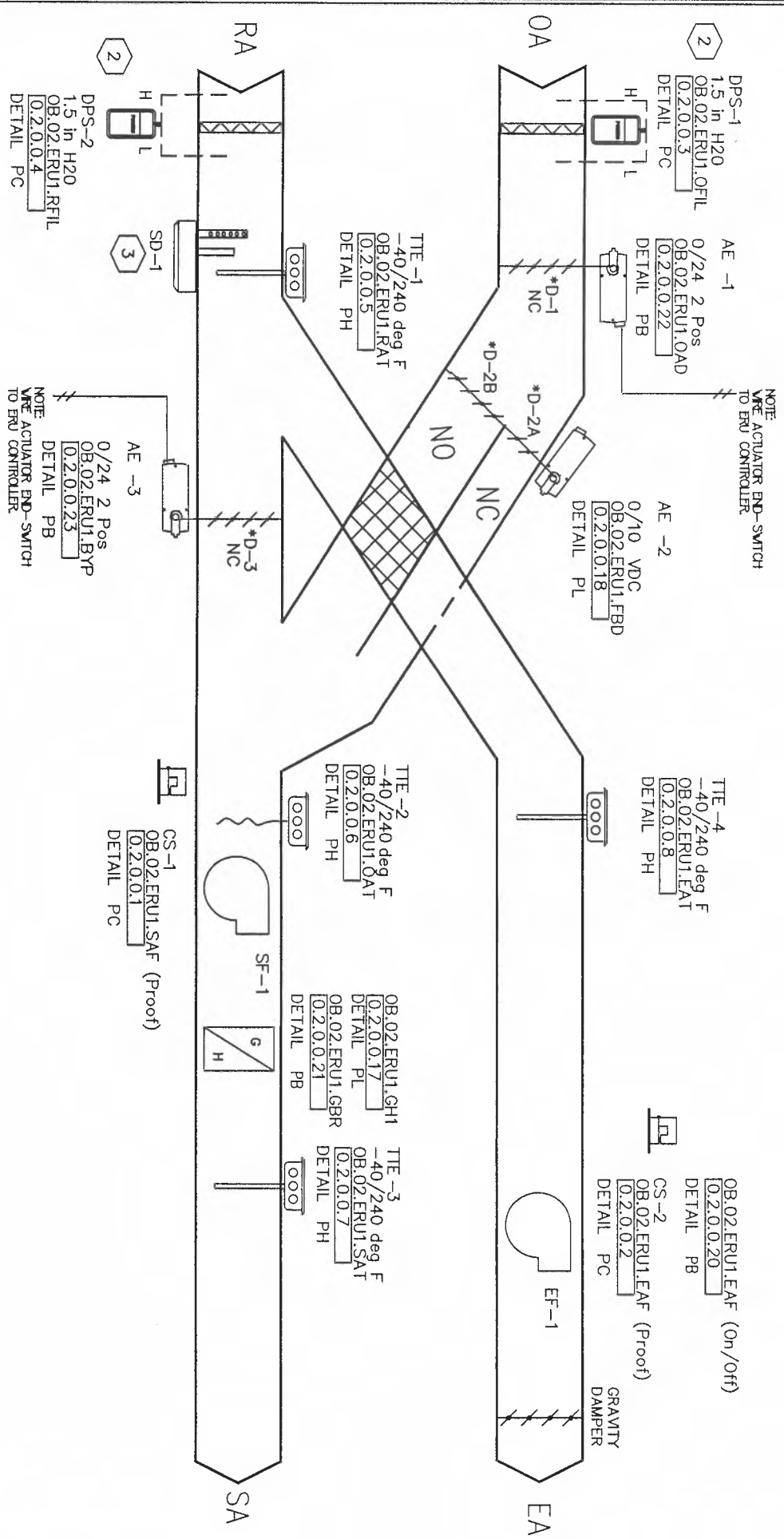
#### ERU 1-1 CONTROL DIAGRAM

440P-702374

100

1-17A

- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.

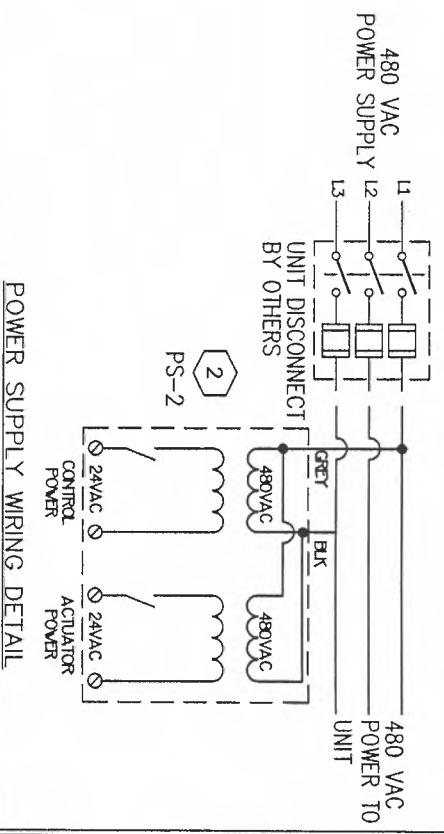
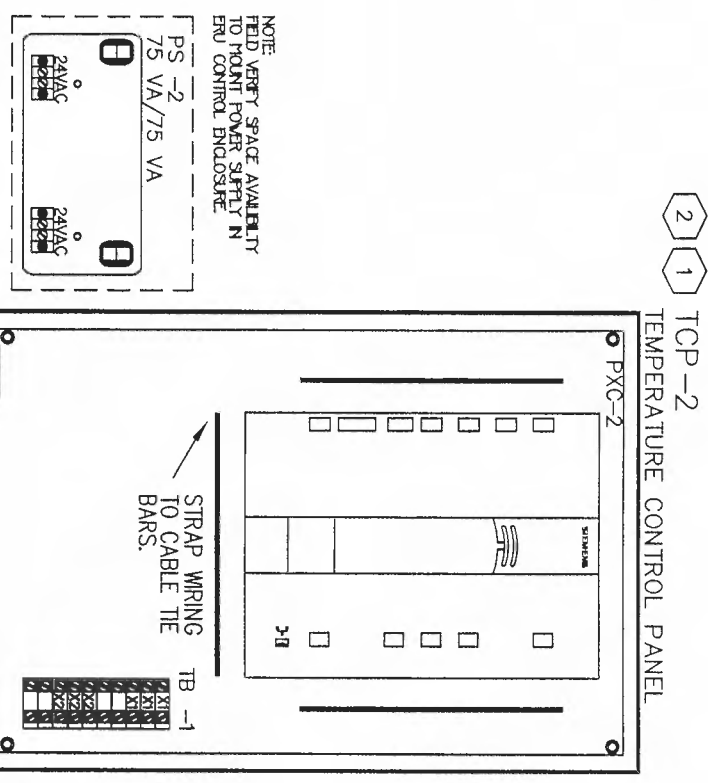


**1-17** ERU 1-1 CONTROL DIAGRAM  
 LOCATION: OPERATIONS BUILDING ROOF  
 SERVES: BALL DIAMOND, PLUMBING/ELEC, SIGN SHOPS

**TTE-5**  
 55/95 deg F  
 OB.02.ERU1.RMT  
 [0.2.0.0.11]  
 DETAIL PH

**SPACE SENSOR**  
 48" AF" (TOP OF DECK)  
 OB.02.ERU1.RMS  
 [0.2.0.0.10]  
 DETAIL PH

**SPACE**  
 LOCATION: CARD/SIGN SHOP  
 OB.02.ERU1.OVD  
 [0.2.0.0.9]  
 DETAIL PC



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-456-3800  
 FAX: 866-815-0749

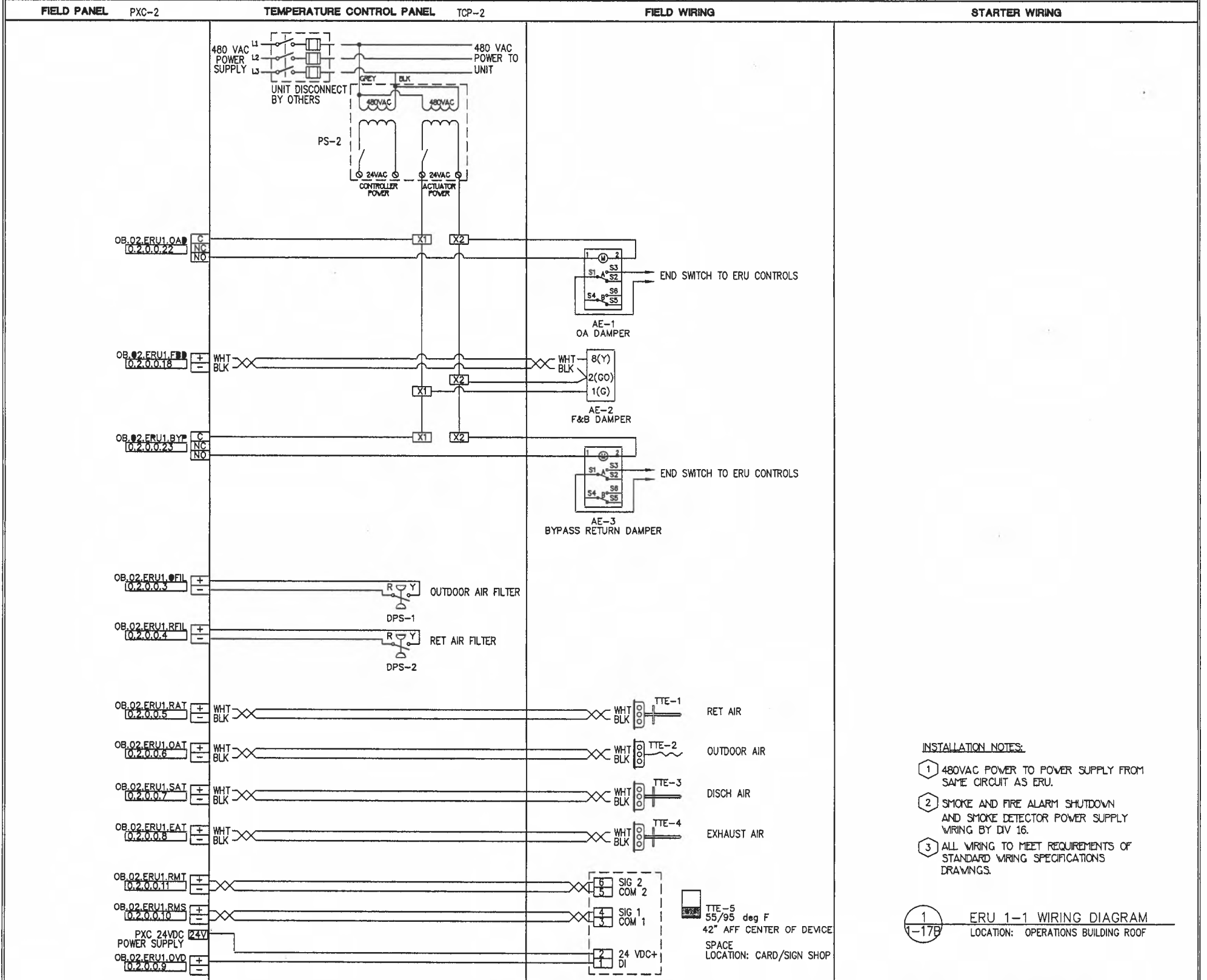
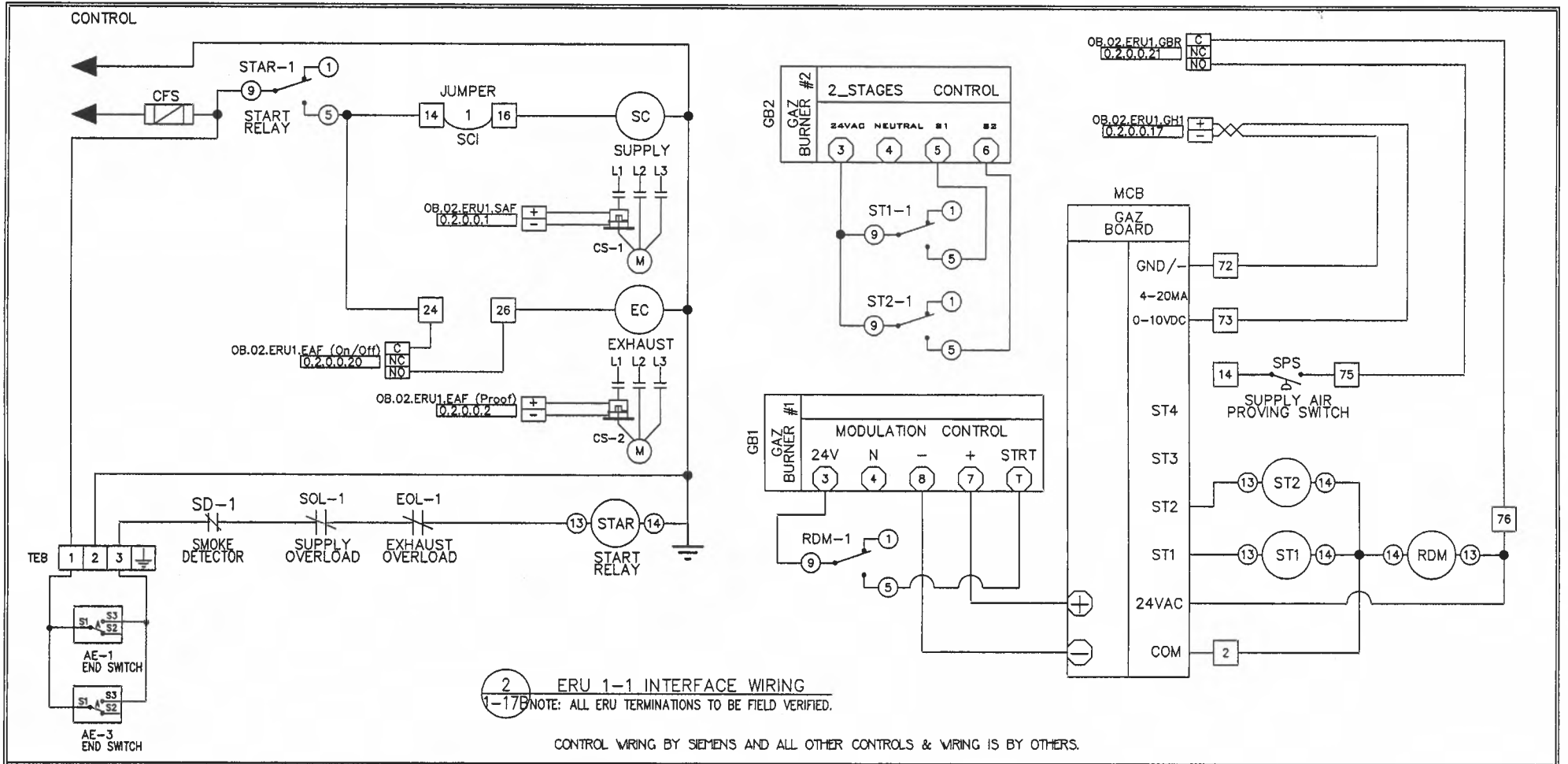
**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE DATE	LAST EDIT DATE
SFM	SFM	WJA	10/27/06	11/28/07

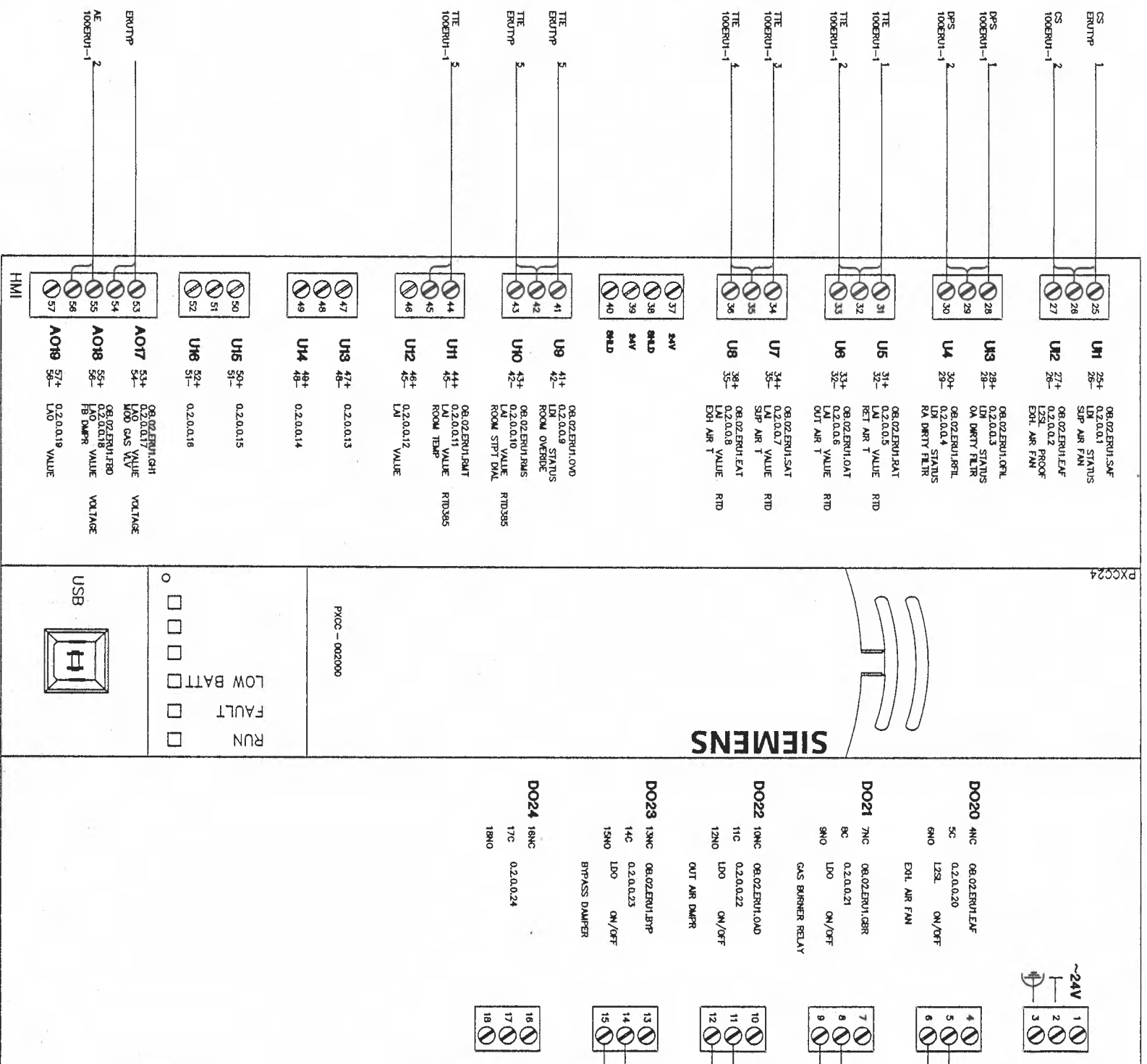
440P-702374  
 100

**1-17**



- INSTALLATION NOTES:**
- 1 480VAC POWER TO POWER SUPPLY FROM SAME CIRCUIT AS ERU.
  - 2 SMOKE AND FIRE ALARM SHUTDOWN AND SMOKE DETECTOR POWER SUPPLY WIRING BY DIV 16.
  - 3 ALL WIRING TO MEET REQUIREMENTS OF STANDARD WIRING SPECIFICATIONS DRAWINGS.

<b>REVISION HISTORY</b>		<b>SIEMENS</b>	45470 Commerce Ctr. Dr. Plymouth Twp. MI. 48170 USA Phone: 734-458-3800 Fax: 866-815-0749	<b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI		440P-702374 100
1	11/28/2007			KJ	AS-BUILT DRAWING	ENGINEER: SFM DRAFTER: SFM CHECKED BY: WLU INITIAL RELEASE: 10/27/08 LAST EDIT DATE: 11/30/07

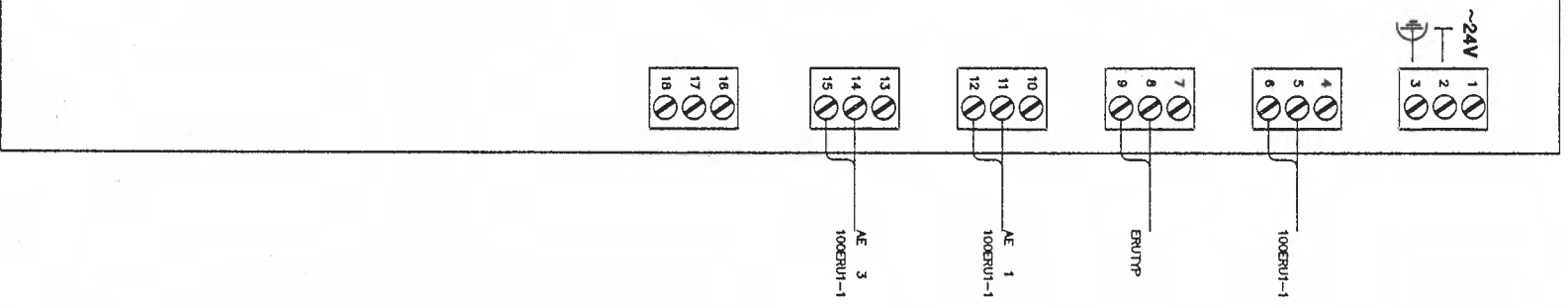


**SIEMENS**

PICC - 002000

RUN  
 FAULT  
 LOW BATT

USB



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-458-3800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	12/14	10/27/06	11/28/07

**ERU 1-1 CONTROLLER**

440P-702374  
100

**1-18**



Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 2	1	GCA161.1P	SIEMENS	154001	MOD(V) SR,24V, MED. PLNM
AE 3	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
CS 1-2	2	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SEIPT W/LED
DPS 1-2	2	141-0518	SIEMENS	155 052	SWITCH,AIR FLOW,1.0/12 WG
SD 1	1	FBO	N/A	N/A	FURNISHED BY OTHERS
TCP 3	1	A-20H16ALPP	HOFMAN	N/A	20"X16"X16" NEMA 4 ENCLOSURES
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR,18" PRB,RTD -40/240F
TTE 5	1	544-780FA	SIEMENS	149168	RM SNSR W/STPT,IND,OVERD,BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOD MOUNTING PLATE KIT
Panel Mounted Devices					
PS 3	1	PSH75A75AN	FUNCTIONAL DEVICES	1208cut145	DUAL PMRSPLY 75A/75A MLT-TAP
PXC 3	1	PXC24-PR A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP
TB 1	1	TS1.5/10WP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj.).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### Occupied

The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face

position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

#### Unoccupied

The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

#### Night Heating

Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

#### Safety

Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/28/07

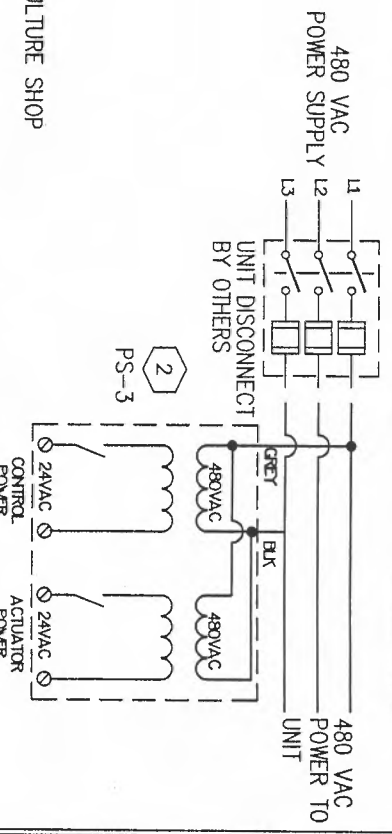
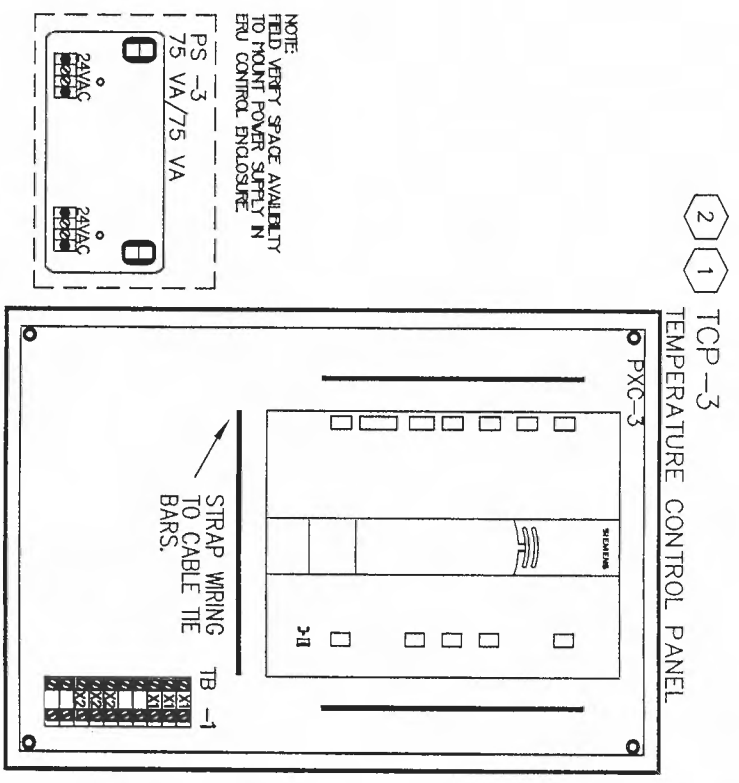
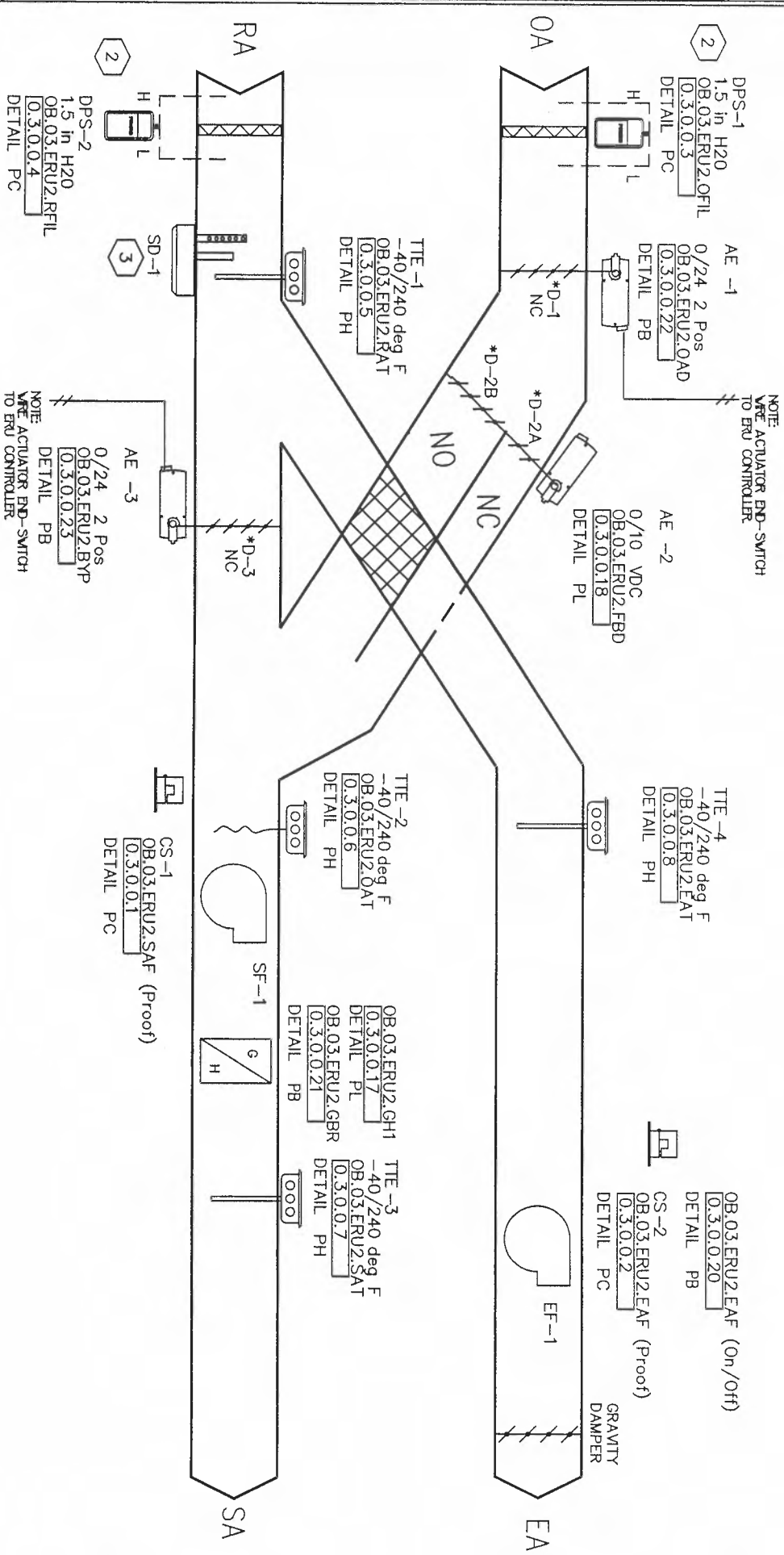
#### ERU 1-2 CONTROL DIAGRAM

440P-702374

100

1-19A

- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.



1 ERU 1-2 CONTROL DIAGRAM  
 LOCATION: OPERATIONS BUILDING ROOF  
 SERVES: FORESTRY/HORTICULTURE SHOP

TTE-5 55/95 deg F  
 0B.03.ERU2.RMT  
 0.3.0.0.11  
 DETAIL PH

0B.03.ERU2.RMS SPACE SENSOR  
 0.3.0.0.10 48" AFF (TOP OF DEVICE)  
 0B.03.ERU2.OVD SPACE  
 0.3.0.0.9 LOCATION: FORESTRY/HORTICULTURE SHOP  
 DETAIL PC

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-456-9800  
 Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

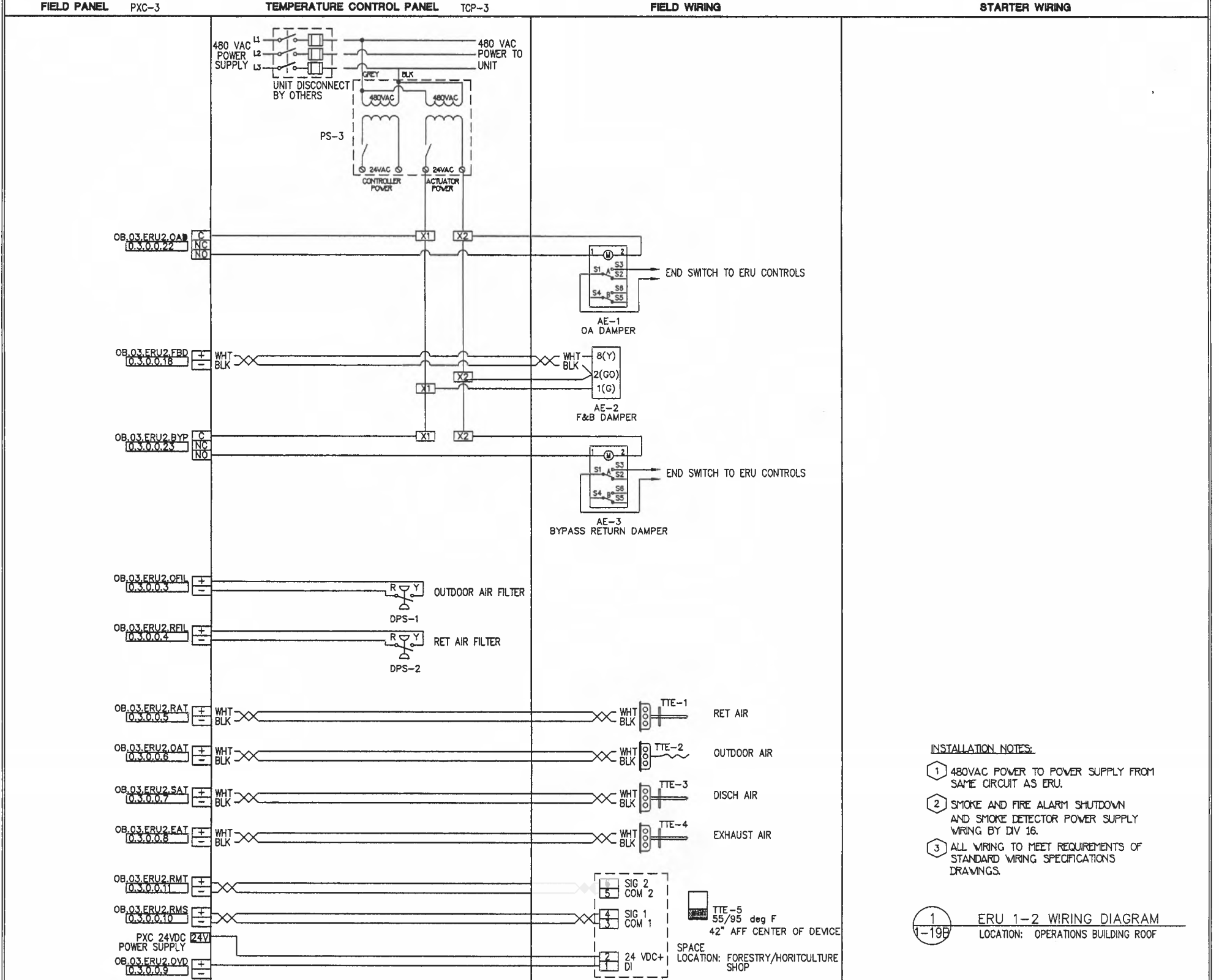
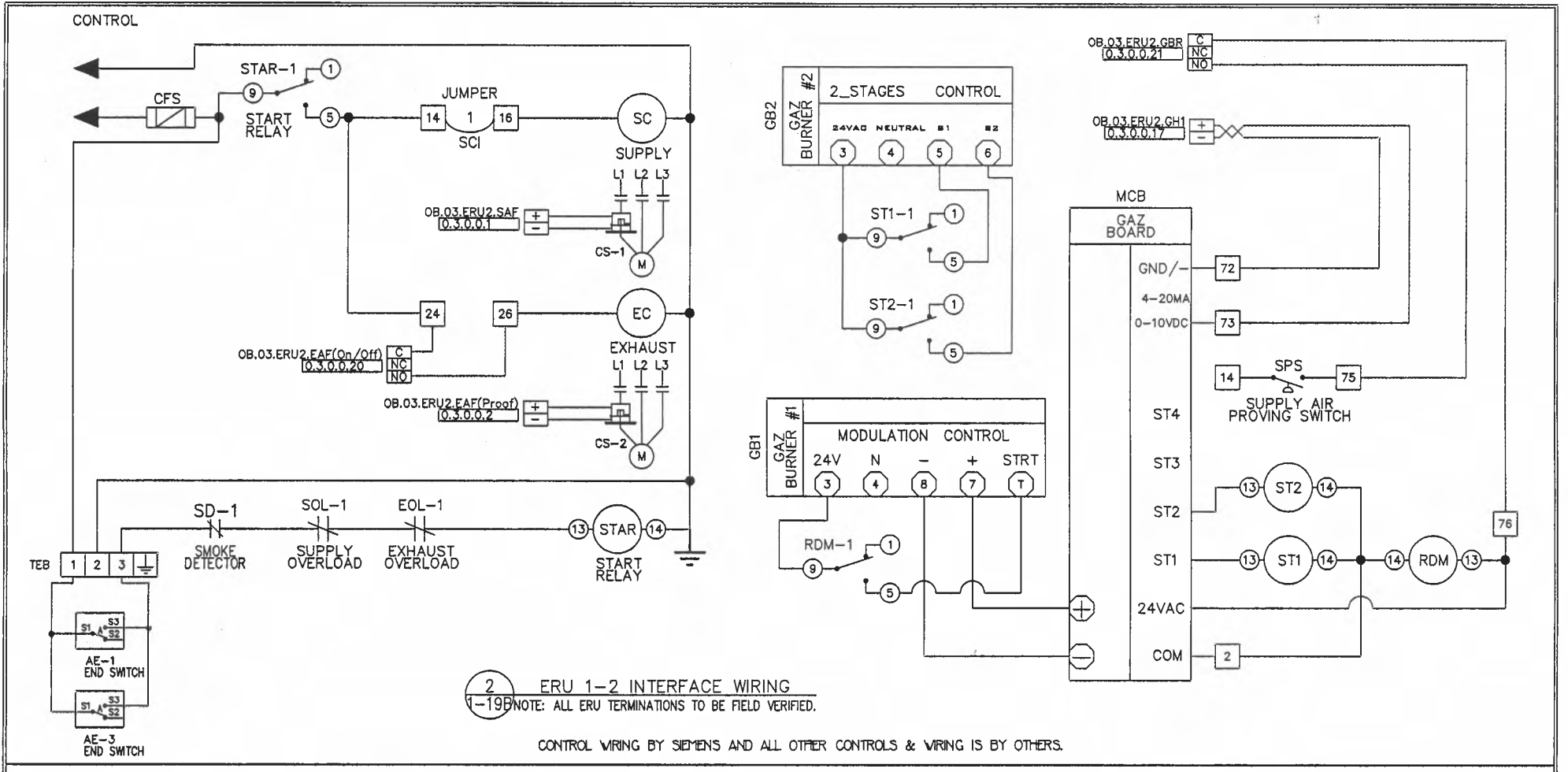
ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM			10/27/08
				11/28/07

**ERU 1-2 CONTROL DIAGRAM**

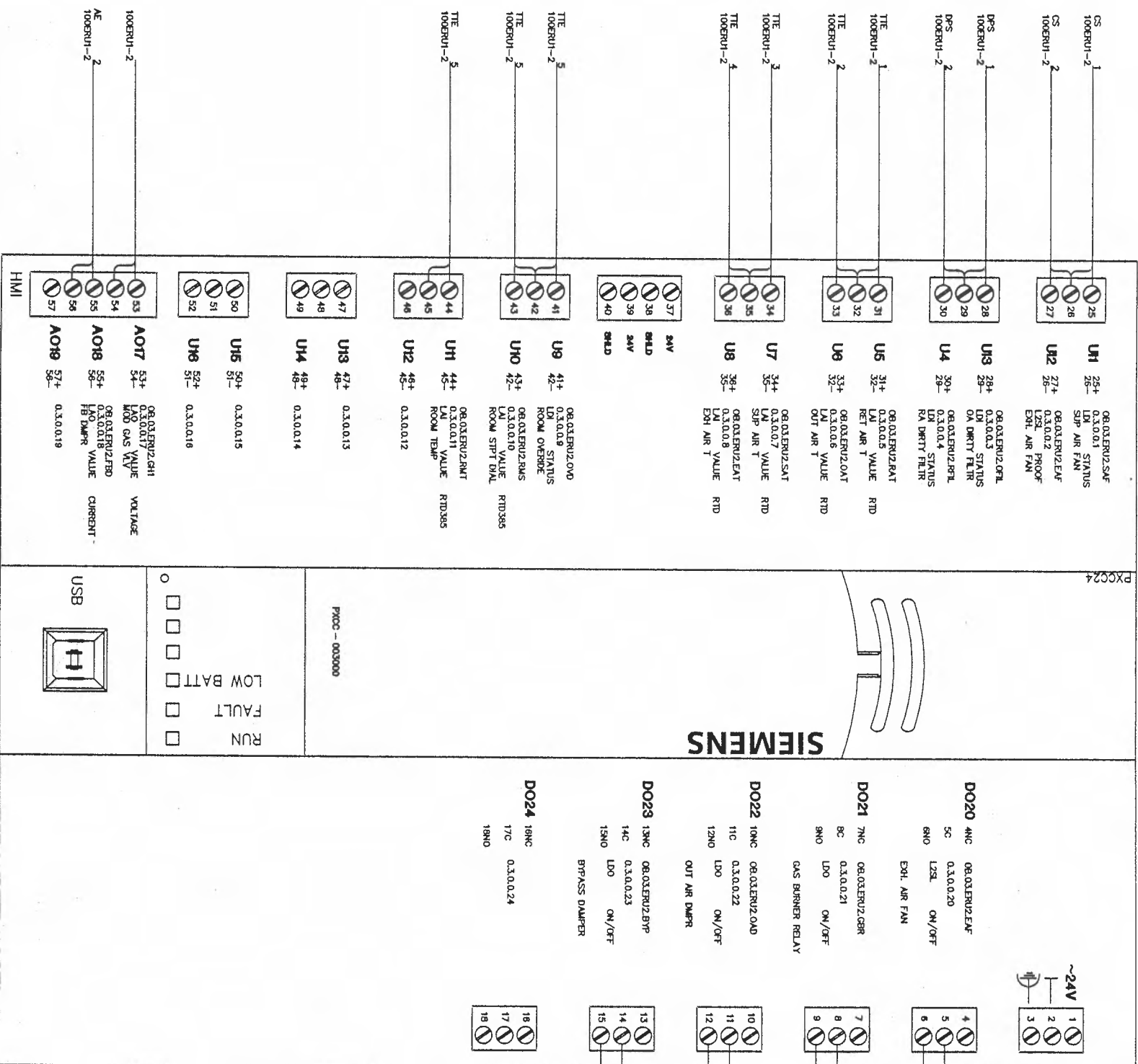
440P-702374  
 100

**1-19**



- INSTALLATION NOTES:**
- 1 480VAC POWER TO POWER SUPPLY FROM SAME CIRCUIT AS ERU.
  - 2 SMOKE AND FIRE ALARM SHUTDOWN AND SMOKE DETECTOR POWER SUPPLY WIRING BY DIV 16.
  - 3 ALL WIRING TO MEET REQUIREMENTS OF STANDARD WIRING SPECIFICATIONS DRAWINGS.

<b>REVISION HISTORY</b> 1   11/28/2007   KJ   AS-BUILT DRAWING		<b>SIEMENS</b> Siemens Building Technologies BAU		45470 Commerce Ctr. Dr. Plymouth Twp. MI. 48170 USA Phone: 734-456-3800 Fax: 866-815-0749		ANN ARBOR MAINTENANCE FACILITY ANN ARBOR, MI ENGINEER: SFM   DRAFTER: SFM   CHECKED BY: WJH   INITIAL RELEASE: 10/27/06   LAST EDIT DATE: 12/03/07		440P-702374 100 <b>1-19B</b>	
<b>ERU 1-2 WIRING DIAGRAM</b>									



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Cir. Dr.  
Plymouth Twp.  
M. 48170 USA  
Phone- 734-456-3800  
Fax: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WY</i>	10/27/06	11/28/07

440P-702374  
100  
**1-20**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V/MED/S/PLNM.
AE 2	1	GCA161.1P	SIEMENS	154001	MOD(V) SR,24V, MED. PLNM
AE 3	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V/MED/S/PLNM.
CS 1-2	2	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SETPT W/LED
DPS 1-2	2	141-0518	SIEMENS	155 052	SWITCH,AIR FLOW,1.0/12 WG
SD 1	1	FB0	N/A	N/A	FURNISHED BY OTHERS
TOP 5	1	A-20H16ALPP	HOFFMAN	N/A	20"X16"X16" NEMA 4 ENCLOSURES
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR,18",PRB,RTD -40/240F
TTE 5	1	544-780FA	SIEMENS	149168	RM SNSR W/STPT,IND,OVRO,BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOD MOUNTING PLATE KIT
Panel Mounted Devices					
PS 5	1	PSH75A75AN	FUNCTIONAL DEVICES	1208cut145	DUAL PWRSPLY 75A/75A MLT-TAP
PXC 5	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP
TB 1	1	TS1.5/10WP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj.).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### Occupied

The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face

position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

#### Unoccupied

The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

#### Night Heating

Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

#### Safety

Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

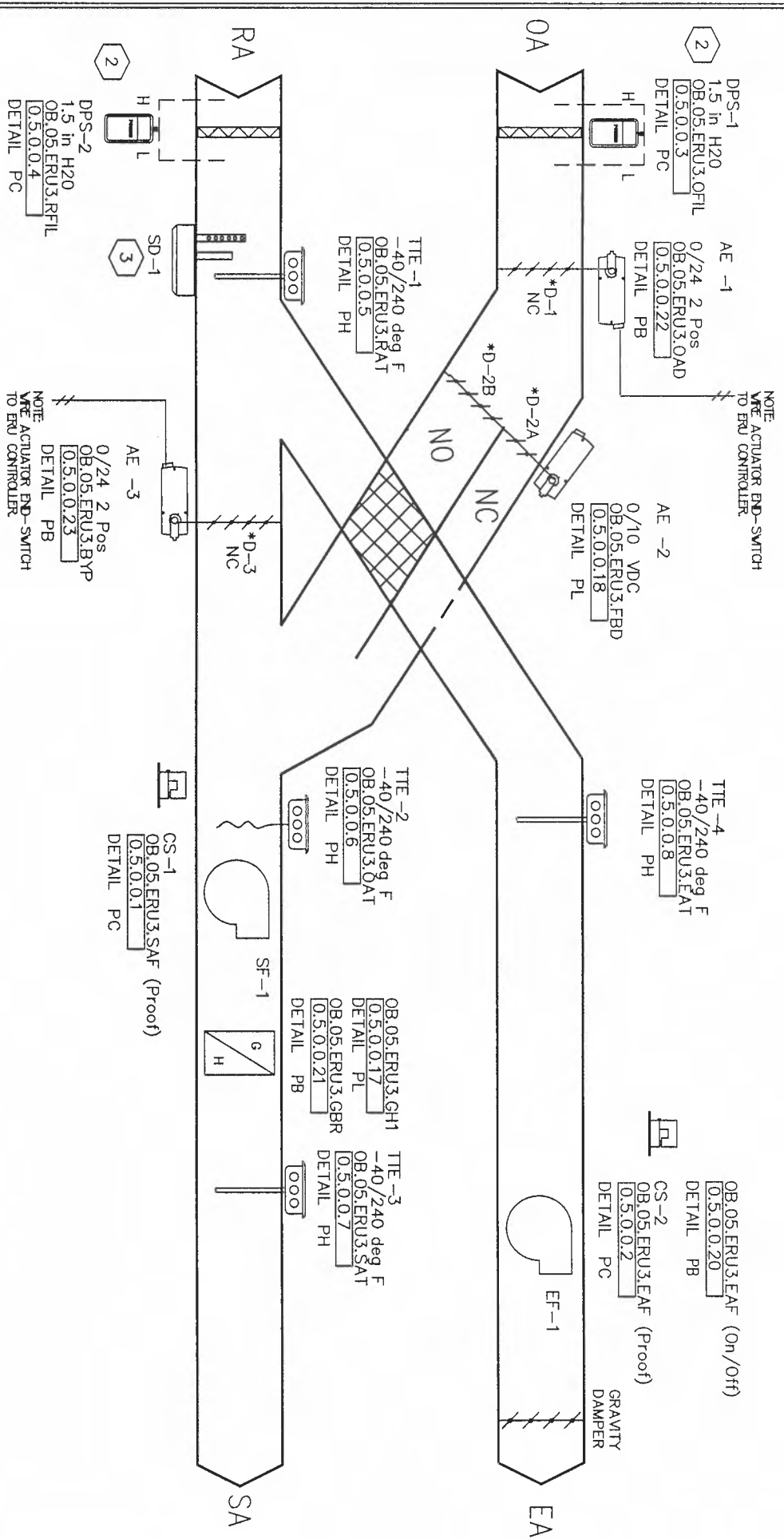
ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>[Signature]</i>	10/27/06	11/16/07

#### ERU 1-3 CONTROL DIAGRAM

440P-702374  
100

1-21A

- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.



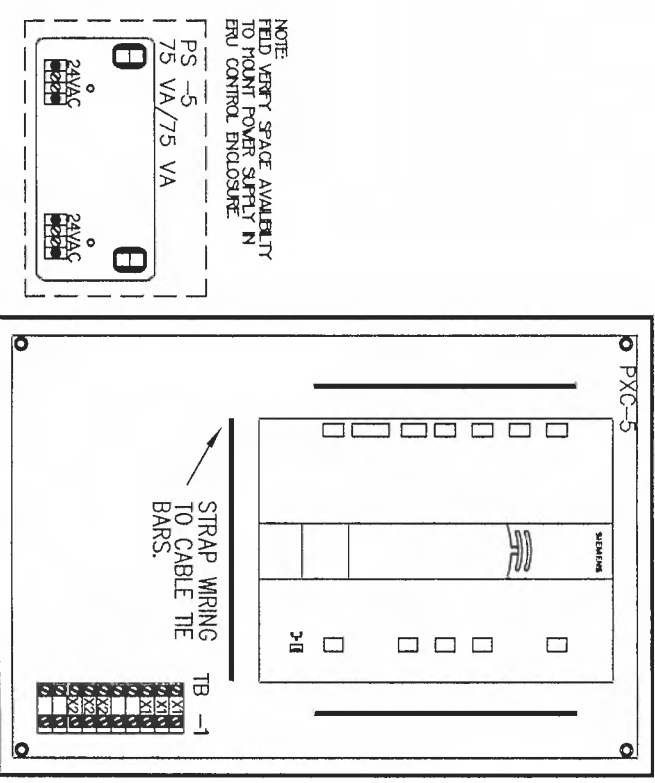
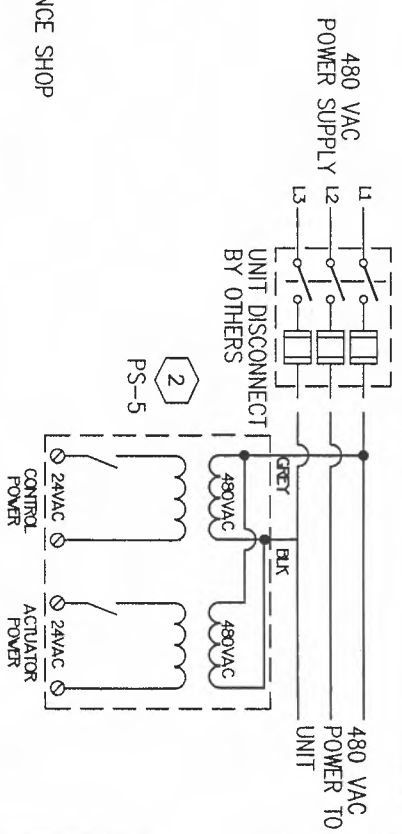
1-21 ERU 1-3 CONTROL DIAGRAM  
 LOCATION: OPERATIONS BUILDING ROOF  
 SERVES: MOWER MAINTENANCE SHOP

TTE-5  
 55/95 deg F  
 08.05.ERU3.RMT  
 0.5.0.0.11  
 DETAIL PH

08.05.ERU3.RMS  
 0.5.0.0.10  
 DETAIL PH

08.05.ERU3.OVD SPACE  
 0.5.0.0.9 LOCATION: MOWER MAINTENANCE SHOP  
 DETAIL PC

**POWER SUPPLY WIRING DETAIL**



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
 BAU

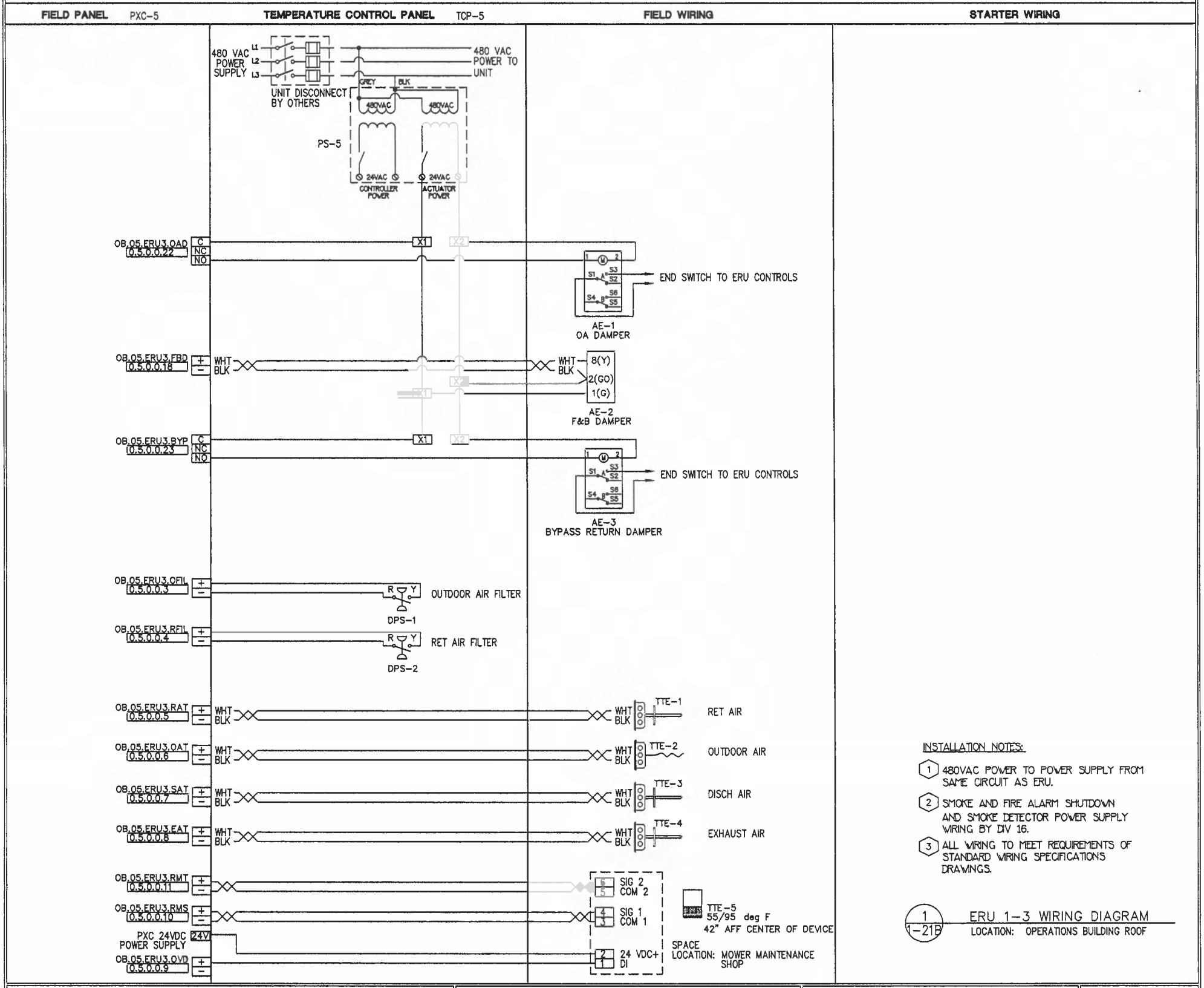
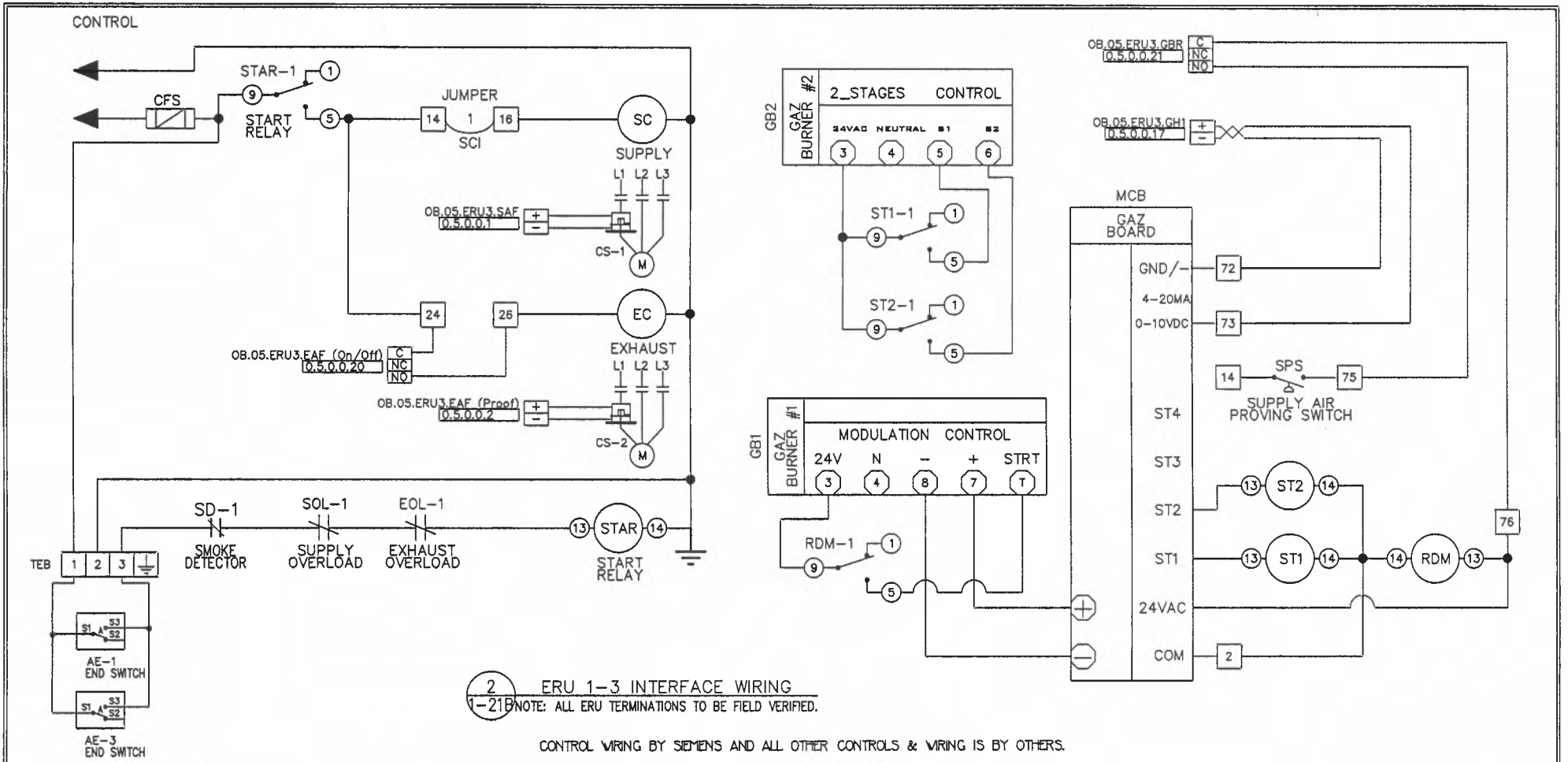
31623 Industrial Road  
 Livonia, MI 48150  
 Phone: 734-286-1488  
 Fax: 734-286-1437

**ANN ARBOR MAINTENANCE FACILITY**

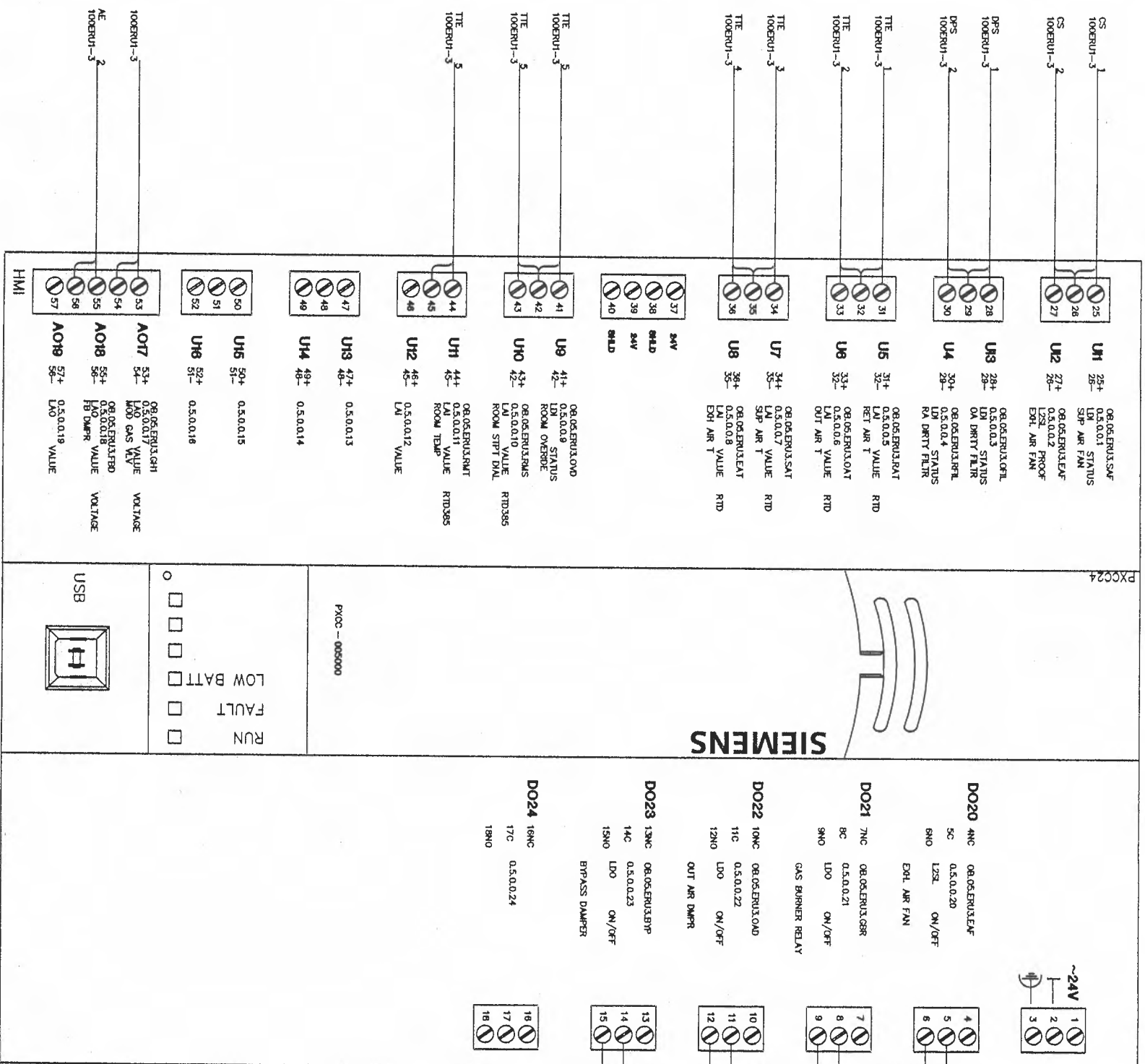
ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/28/07

233-E -4185-00  
 100  
**1-21**



<b>REVISION HISTORY</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">1</td> <td style="width: 15%;">11/28/2007</td> <td style="width: 10%;">KJ</td> <td style="width: 70%;">AS-BUILT DRAWING</td> </tr> </table>	1	11/28/2007	KJ	AS-BUILT DRAWING	<b>SIEMENS</b> 45470 Commerce Ctr. Dr. Plymouth Twp. MI. 48170 USA Phone: 734-458-3800 Fax: 888-815-0749 Siemens Building Technologies BAU	<b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">ENGINEER</td> <td style="width: 15%;">DRAWN</td> <td style="width: 15%;">CHECKED BY</td> <td style="width: 15%;">INITIAL RELEASE</td> <td style="width: 40%;">LAST EDIT DATE</td> </tr> <tr> <td>SFM</td> <td>SFM</td> <td><i>[Signature]</i></td> <td>10/27/08</td> <td>11/30/07</td> </tr> </table>	ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE	SFM	SFM	<i>[Signature]</i>	10/27/08	11/30/07	440P-702374 100 <b>1-21B</b>
1	11/28/2007	KJ	AS-BUILT DRAWING														
ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE													
SFM	SFM	<i>[Signature]</i>	10/27/08	11/30/07													

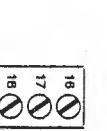
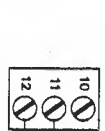
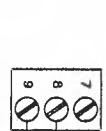
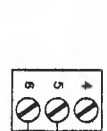
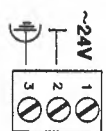


PXC24

SIEMENS

PXC - 005000

RUN  
 FAULT  
 LOW BATT



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ct. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-456-3800  
Fax: 866-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>lsp/c</i>	10/27/06	11/28/07

44OP-702974  
100  
1-22



Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 2	1	GCA161.1P	SIEMENS	154001	MOD(V) SR,24V, MED. PLNM
AE 3	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
CS 1-2	2	H608	VERIS	1006cul016	CUR SW SPLITCOR-ADJ SEPT W/LED
DPS 1-2	2	141-0518	SIEMENS	155 052	SWITCH,AIR FLOW,1.0/12 WG
SD 1	1	FBO	N/A	N/A	FURNISHED BY OTHERS
TCP 8	1	A-20H16ALPP	HOFMAN	N/A	20"X16"X16" NEMA 4 ENCLOSURES
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR,18",PRB,RTD -40/240F
TTE 5	1	544-780FA	SIEMENS	149168	RM SNSR W/STPT,IND,OVWD,BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
Panel Mounted Devices					
PS 8	1	PSH75A75AN	FUNCTIONAL DEVICES	1208cul145	DUAL PWRSPPLY 75A/75A MLT-TAP
PXC 8	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP
TB 1	1	TS1.S/10WP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj.).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### Occupied

The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face

position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

#### Unoccupied

The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

#### Night Heating

Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

#### Safety

Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

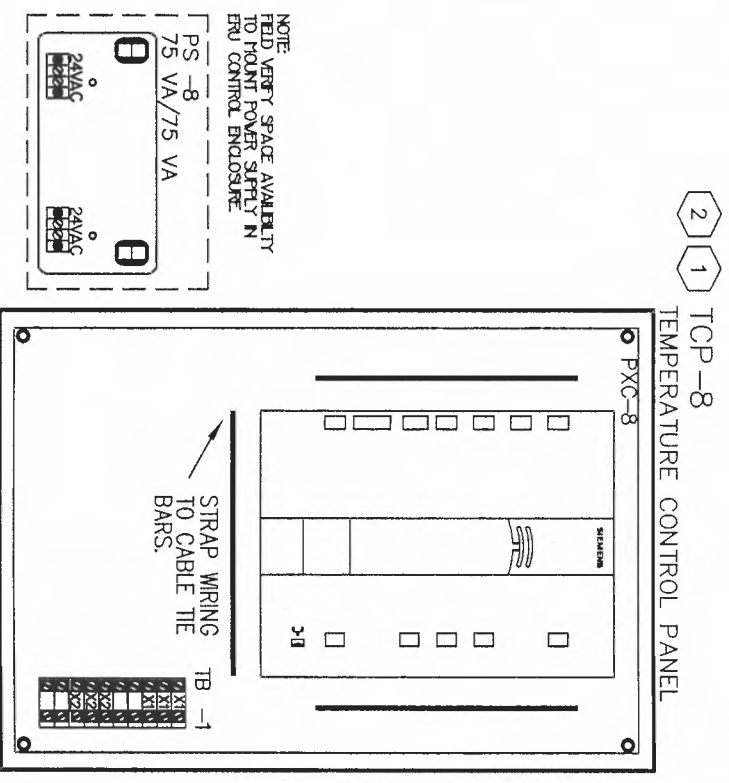
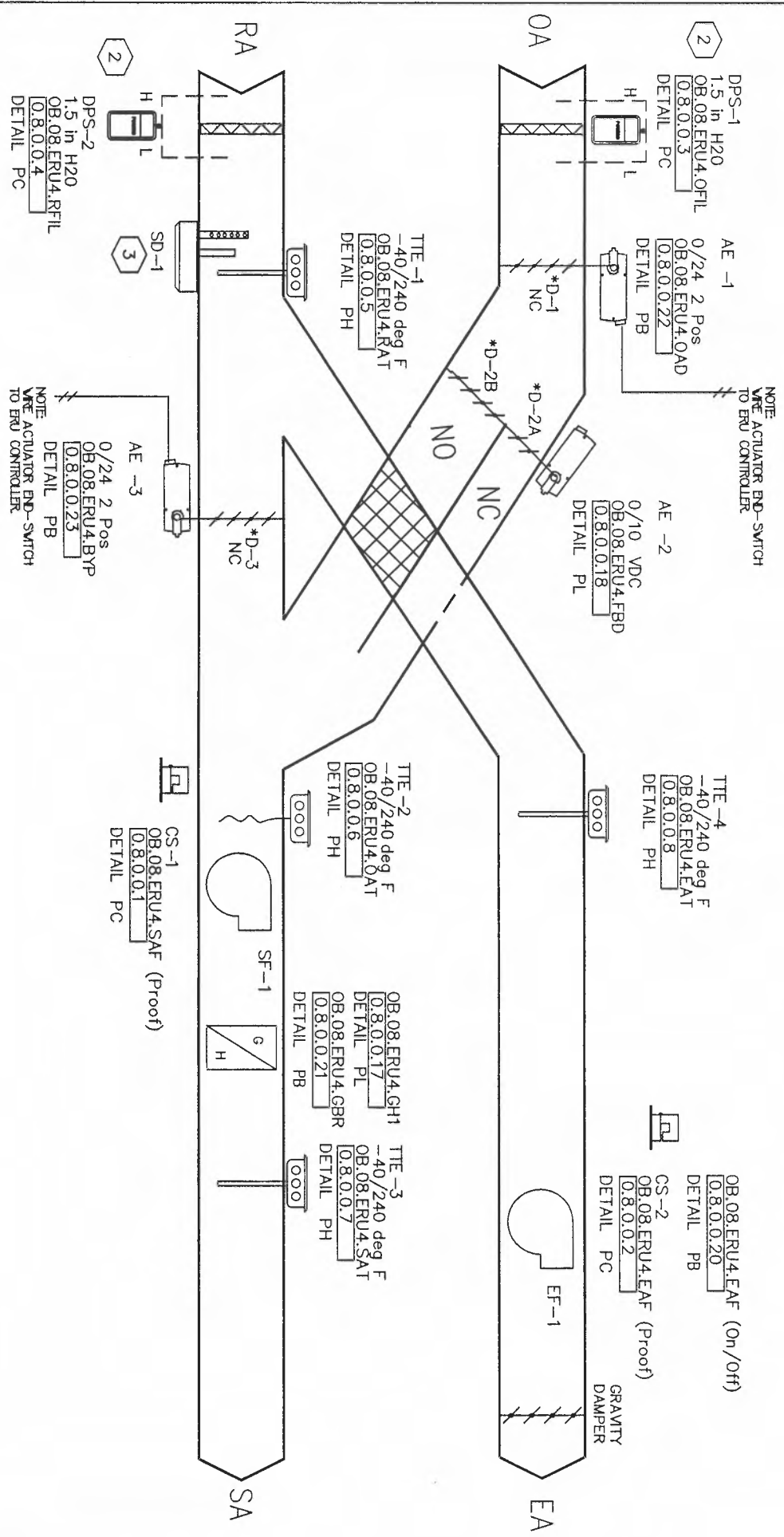
ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	cyu	10/27/06	11/18/07

#### ERU 1-4 CONTROL DIAGRAM

440P-702374  
100

1-23A

- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.



**1** ERU 1-4 CONTROL DIAGRAM  
 LOCATION: OPERATIONS BUILDING ROOF  
 SERVES: FABRICATION AREA  
 STREET LIGHT/SIGNAL CABINET SHOP  
 RADIO REPAIR BAY

**TTE-5** 55/95 deg F  
 OB.08.ERU4.RMT  
 DETAIL PH  
**OB.08.ERU4.RMS** SPACE SENSOR  
 DETAIL PH  
**OB.08.ERU4.OVD** SPACE  
 DETAIL PH  
 LOCATION: FABRICATION AREA

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MA 01870  
 USA  
 PHONE: 734-456-3800  
 FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

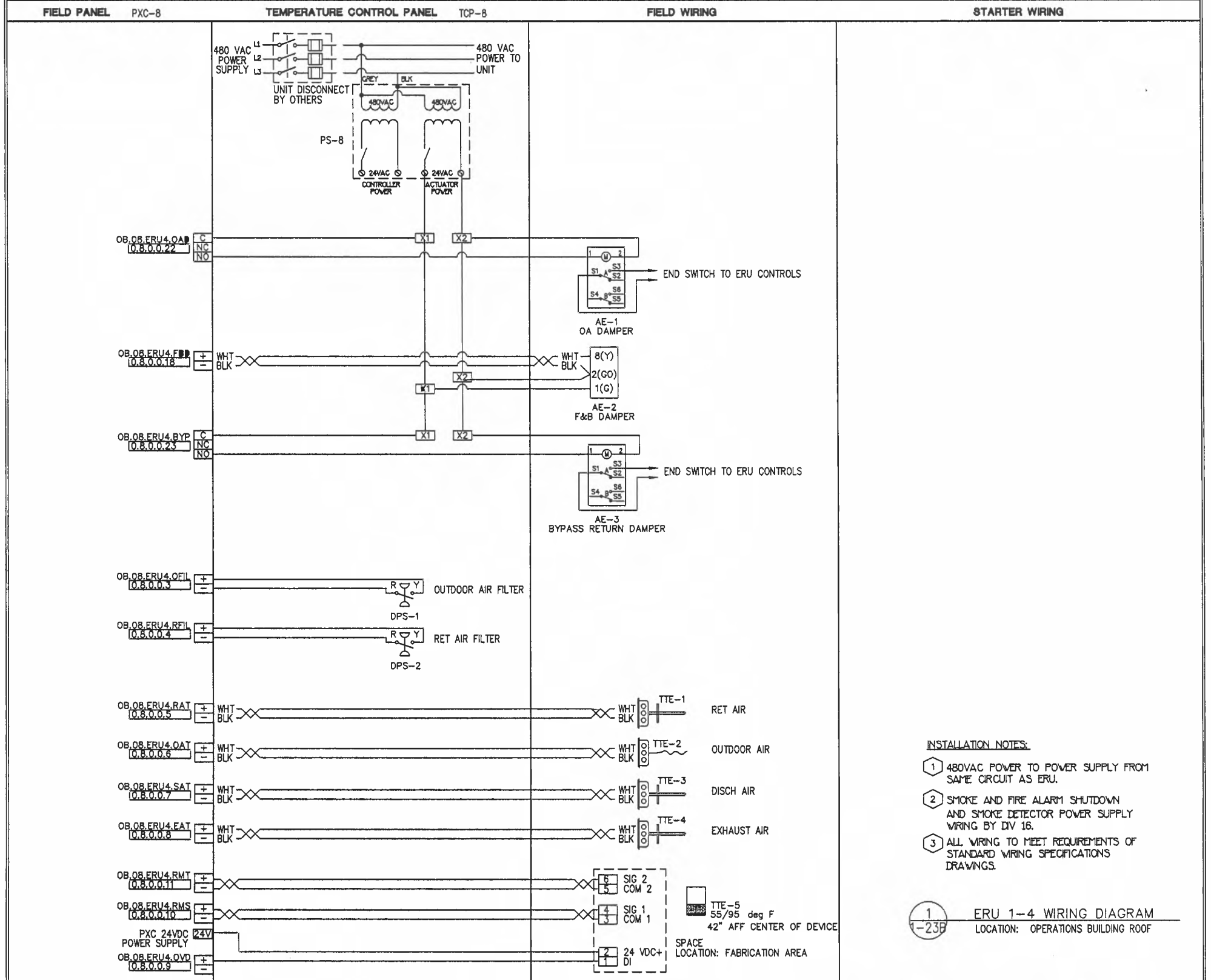
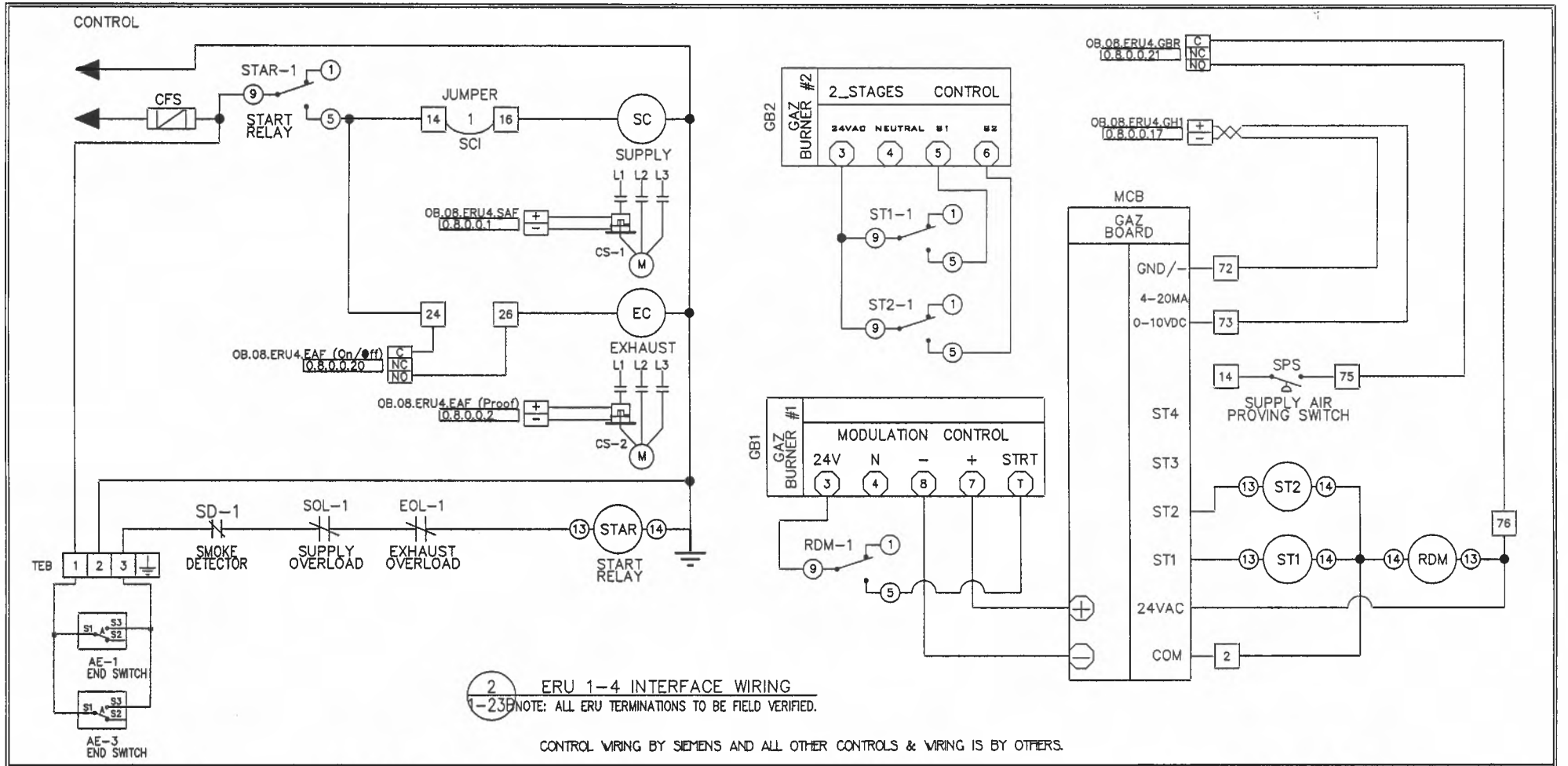
ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/08	11/28/07

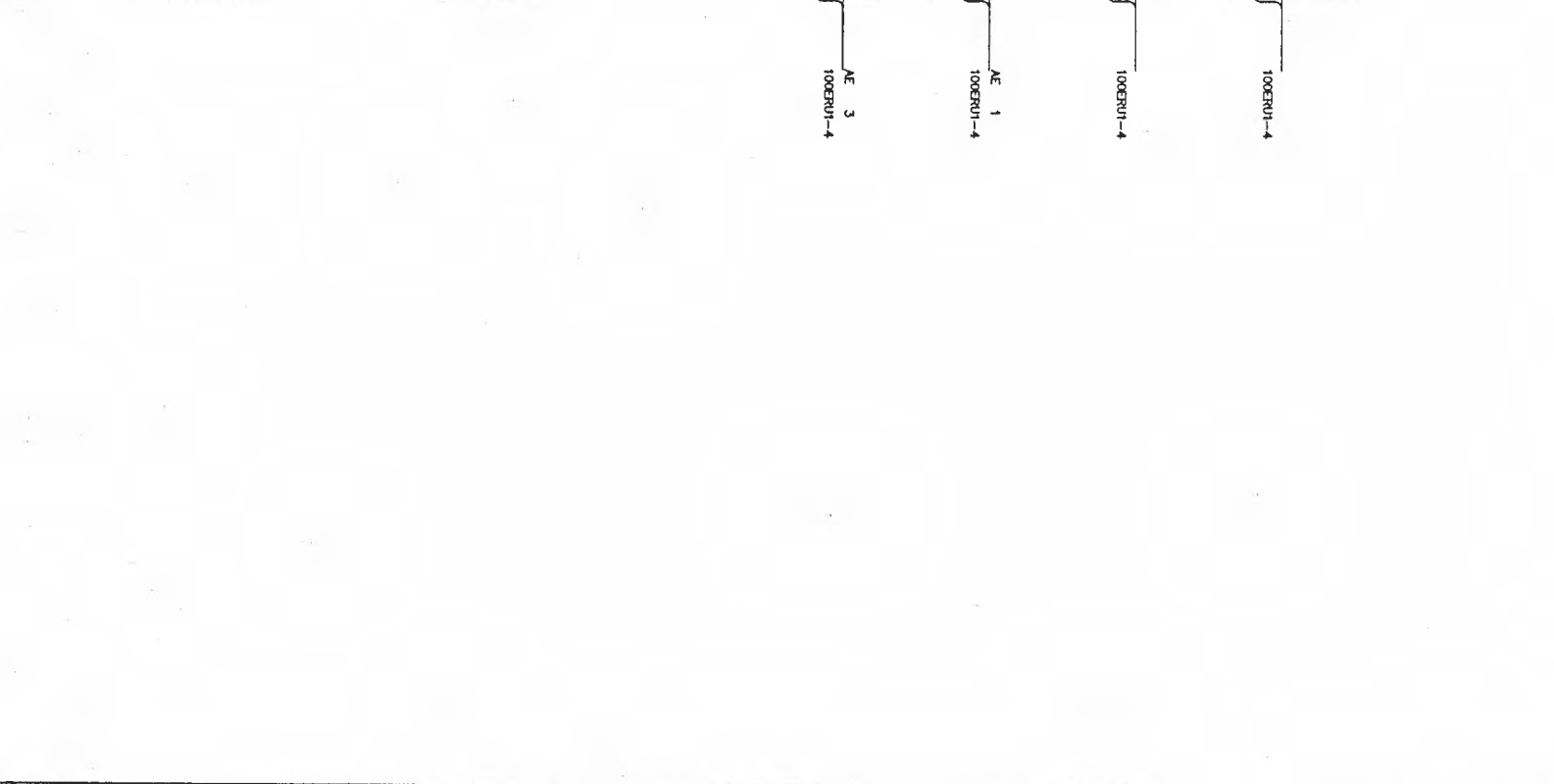
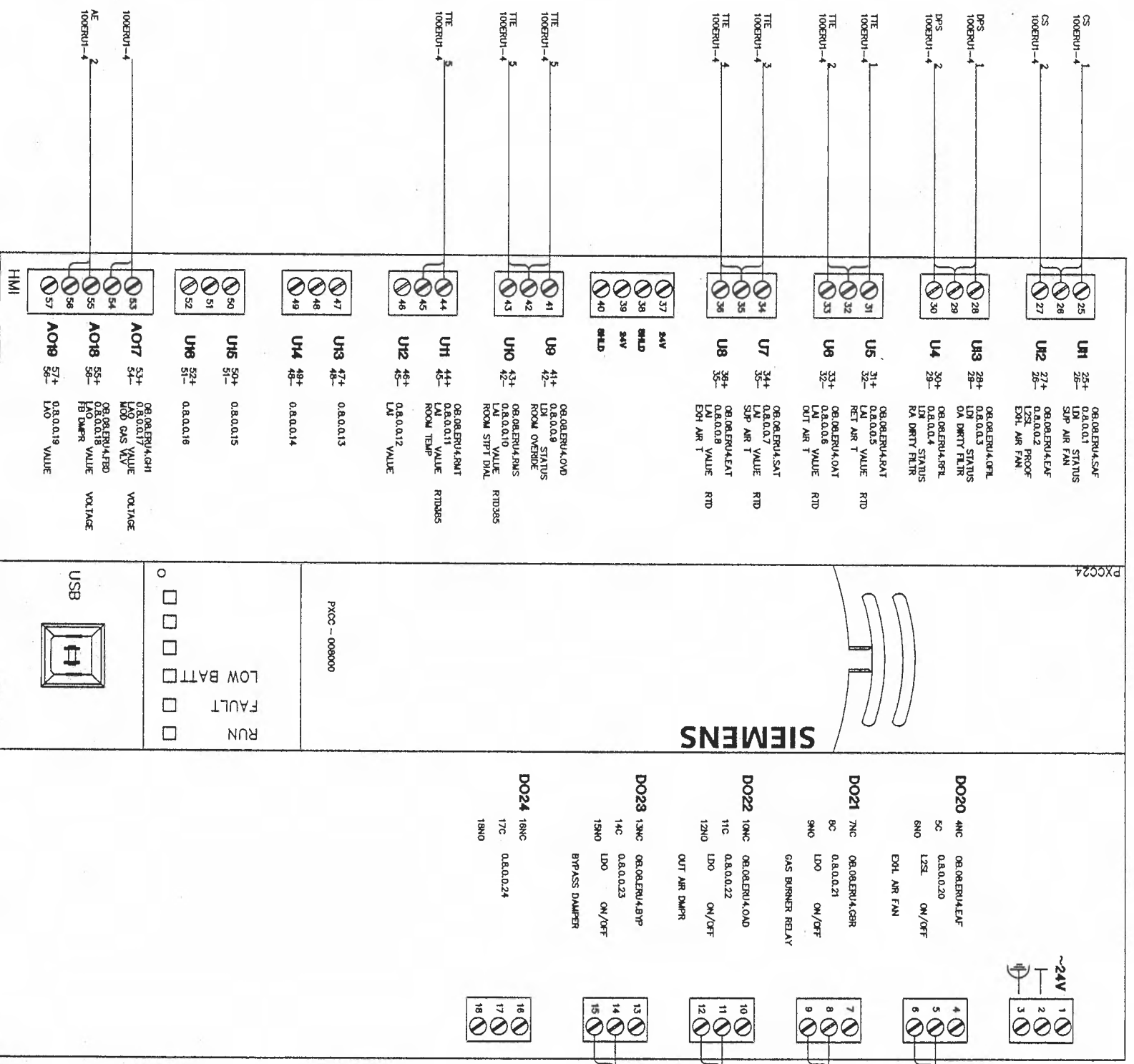
**ERU 1-4 CONTROL DIAGRAM**

440P-702374  
 100

**1-23**



<b>REVISION HISTORY</b>		<b>SIEMENS</b>	45470 Commerce Ctr. Dr. Plymouth Twp. MI 48170 USA Phone: 734-458-3800 Fax: 866-815-0749	<b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI		440P-702374 100
1	11/28/2007 KJ AS-BUILT DRAWING			Siemens Building Technologies BAU	ENGINEER: SFM DRAFTER: SFM CHECKED BY: [Signature] INITIAL RELEASE: 10/27/08 LAST EDIT DATE: 11/30/07	<b>1-23B</b>



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: *CJL*  
INITIAL RELEASE: 10/27/06  
LAST EDIT DATE: 11/28/07

440P-702374  
100

**1-24**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 2	1	GCA161.1P	SIEMENS	154001	MOD(V) SR,24V. MED. PLNM
AE 3	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
CS 1-2	2	H608	VERIS	1006cul016	CUR SW SPLITCOR-ADU SC1PT W/LED
DPS 1-2	2	141-0518	SIEMENS	155 052	SWITCH,AIR FLOW,1.0/12 WG
SD 1	1	FB0	N/A	N/A	FURNISHED BY OTHERS
TCP 13	1	A-20H16ALPP	HOFFMAN	N/A	20"X16"X16" NEMA 4 ENCLOSURES
TTE 1	1	544-343	SIEMENS	149 261	D/AV SNSR,18",PRB,RTD -40/240F
TTE 2	1	544-342	SIEMENS	149 261	D/AV TEMP SENSOR,RTD,-40/240F
TTE 3-4	2	544-343	SIEMENS	149 261	D/AV SNSR,18",PRB,RTD -40/240F
TTE 5	1	544-780FA	SIEMENS	149168	RM SNSR W/STPT,IND,OVDR,BERGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
Panel Mounted Devices					
PS 13	1	PSH75A75AN	FUNCTIONAL DEVICES	120Bcut45	DUAL PMRSPLY 75A/75A MLT-TAP
PXC 13	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP
TIB 1	1	TSL5/10WP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj.).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/08	11/16/07

#### ERU 1-5 CONTROL DIAGRAM

440P-702374  
100

# 1-25A

**Occupied**  
The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

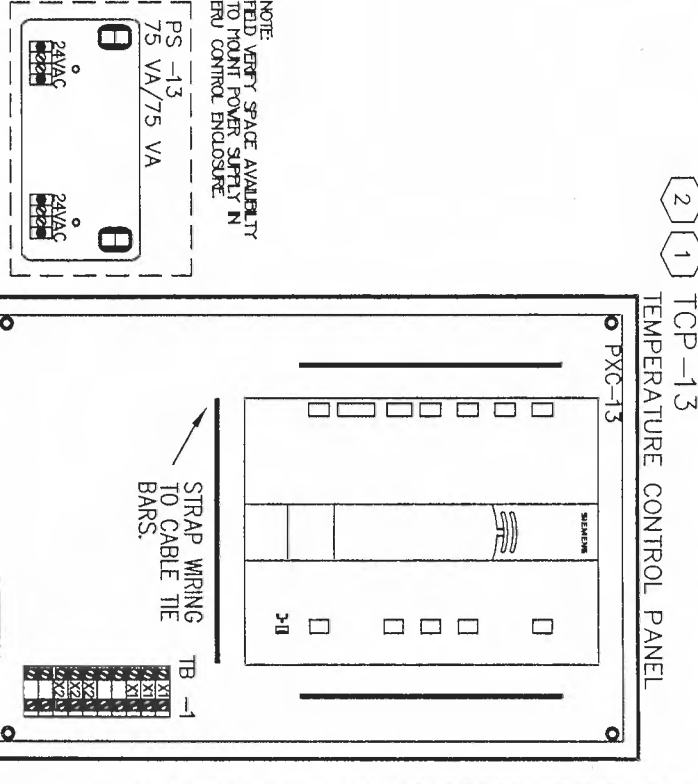
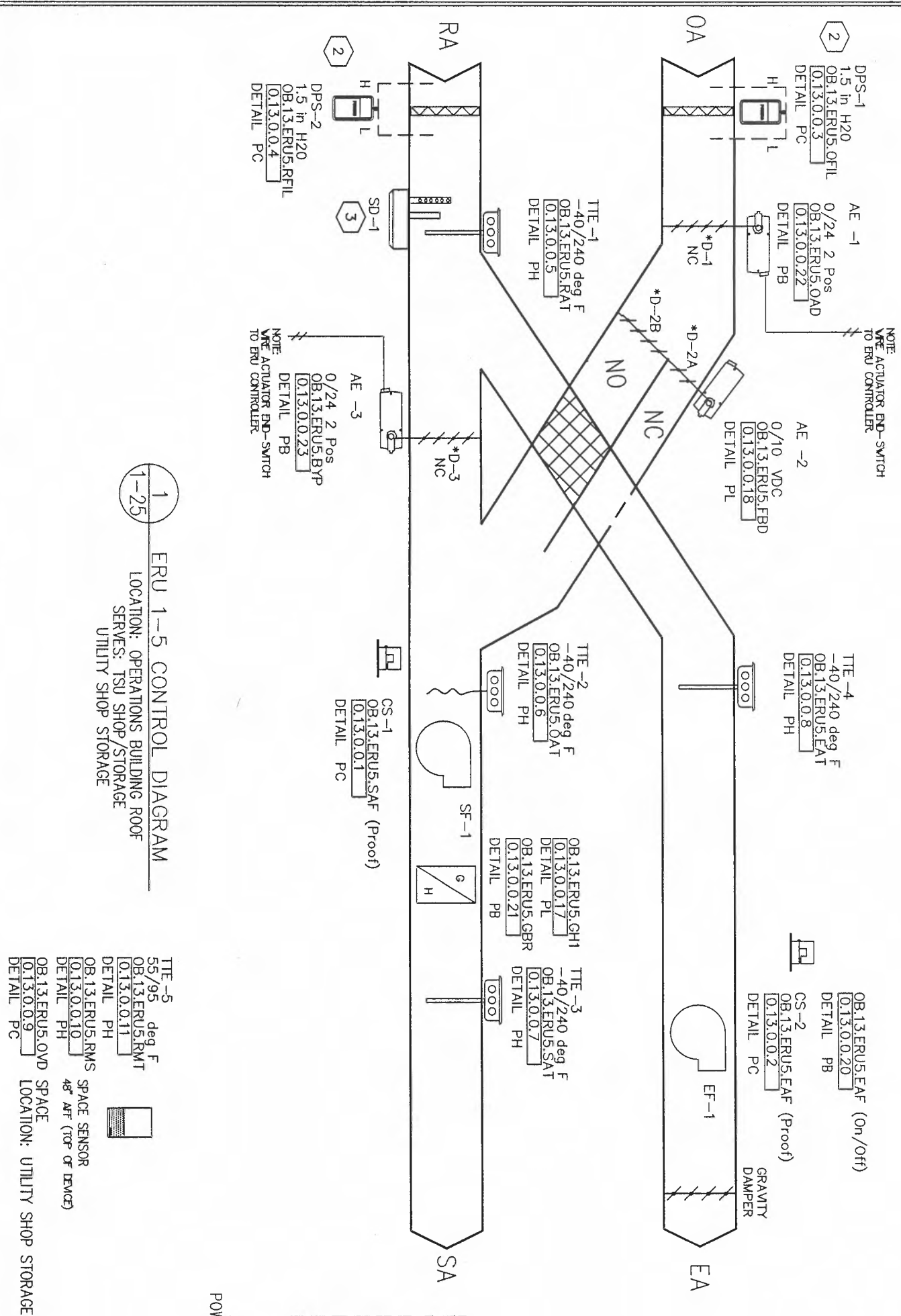
**Unoccupied**  
The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100% Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

**Night Heating**  
Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

**Safety**  
Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-458-3800  
 Fax: 888-815-0749

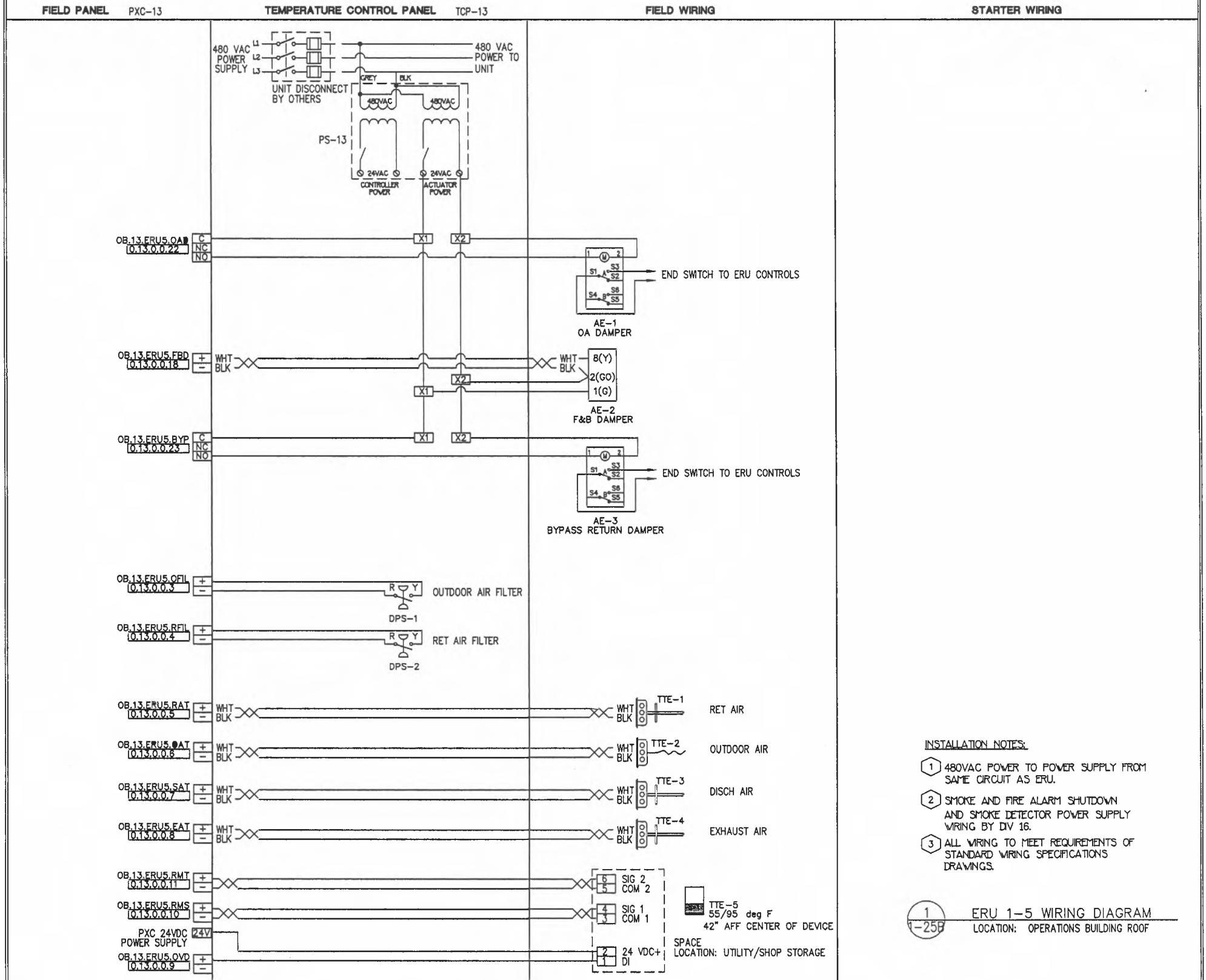
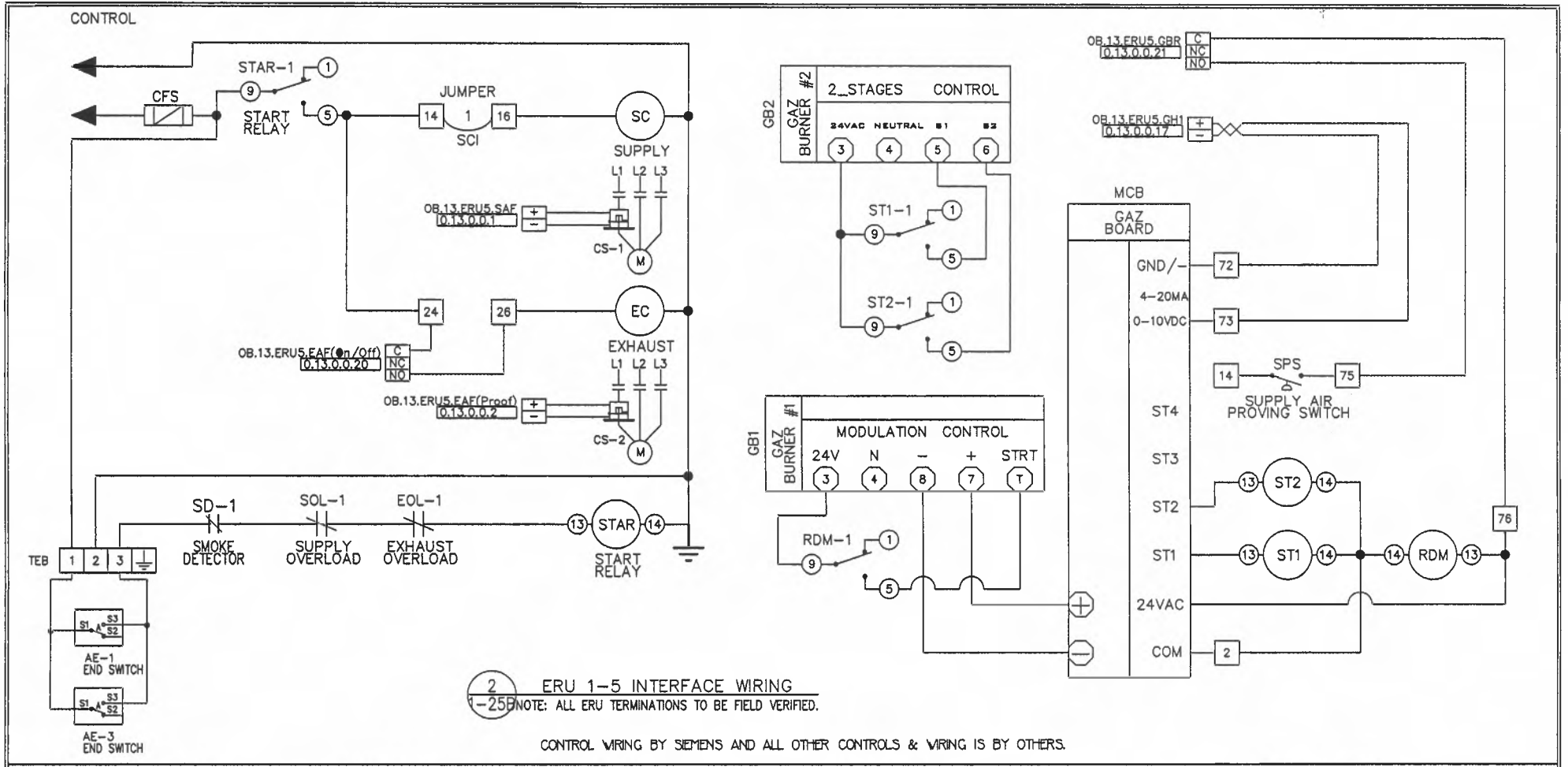
**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE DATE	LAST EDIT DATE
SFM	SFM	<i>cyz</i>	10/27/06	11/28/07

440P-702374  
 100

**1-25**



<b>REVISION HISTORY</b>		<b>SIEMENS</b>	45470 Commerce Ctr. Dr. Plymouth Twp. MI. 48170 USA Phone: 734-466-3800 Fax: 866-815-0749	<b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI	440P-702374 100
1	11/28/2007 KJ AS-BUILT DRAWING				
		Siemens Building Technologies BAU	ENGINEER: SFM DRAFTER: SFM CHECKED BY: WJK INITIAL RELEASE: 10/27/08 LAST EDIT DATE: 11/30/07	<b>1-25B</b>	

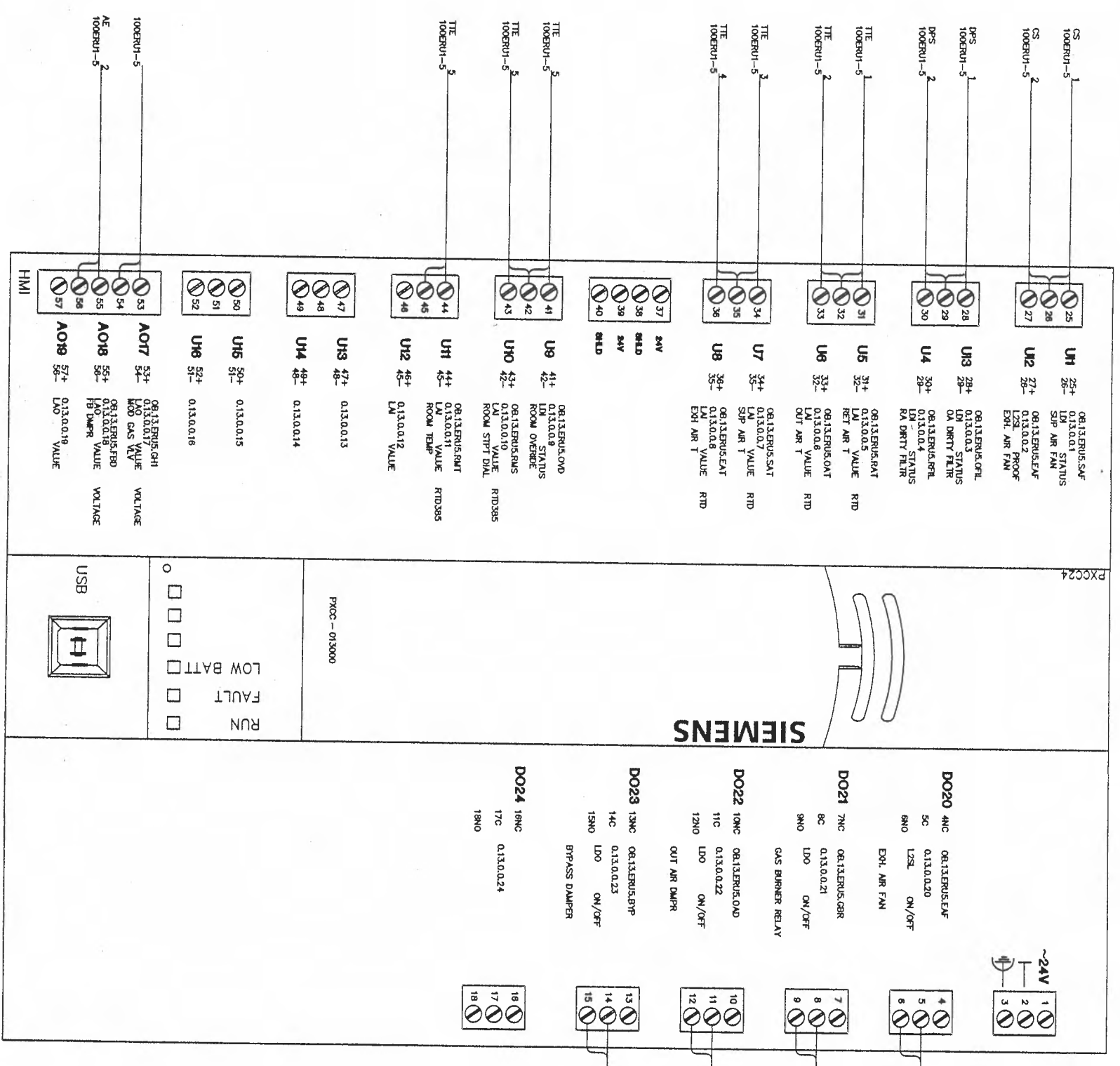
**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**ANN ARBOR MAINTENANCE FACILITY**  
ANN ARBOR, MI

440P-702374  
100  
**1-26**



45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-456-3800  
Fax: 866-815-0749

ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: *WYA*  
INITIAL RELEASE: 10/27/06  
LAST EDIT DATE: 11/28/07



**Standby Generator Monitoring**

DDC system shall interface with the Standby Generator System through the Generator Remote Annunciator Panel located in the Operations Building. The DDC system will monitor the Standby Generators at the Operations Building, Maintenance Building and Vehicle Building. The Standby Generators shall be networked to Operations Building by others.

Each Generator shall be monitored for the points as shown in the Modlon Register Mapping Information Tables. Final points coordinated with generator vendor.

Load Shedding upon overload signal from the generator/generator meter.

- a. Prevent Roof Tops Units and Air Handling Units, Split Systems, ETC supplied by the generator from operating their respective air conditioning compressors.

**Automatic Transfer Switch Monitoring (ATS-1)**

DDC system shall monitor the transfer switch for normal position.  
DDC system shall monitor the transfer switch for emergency position.

**Load Shedding**

**Operations Building**

- a. RTU 1-6A and RTU 1-6B to be interlocked through Building Management System to run only one at a time.
- b. RTU 1-1 to be interlocked through Building Management System to operate only in the heat/exhaust mode when powered by the generator.
- c. RTU 1-6A, HWP-1 and HWP-2 to be controlled through Building Management System not to operate until 5 minutes after generator is running.
- d. RTU 1-1 to be controlled through Building Management system not to operate until 5 minutes after generator is running.

**Maintenance Building**

- a. ERU 2-1 and RTU 2-3 to be controlled through Building Management System not to operate until 2 minutes after generator are running.
- b. 50 horse power compressor to be controlled through Building Management System not to operate until 5 minutes after generator is running.

**Vehicle/Equipment Storage Building:**

**Load Shed Sequence:**

- a. Upon notification of a generator overload, secure exhaust fans EF 3-2, EF 3-3, EF 3-4 and make-up air units MUAU 3-2, MUAU 3-3 and MUAU 3-4. Sequence of operation of each exhaust fan and make-up air unit noted above every 15 minutes until commercial power is restored.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILD DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

440P-702374

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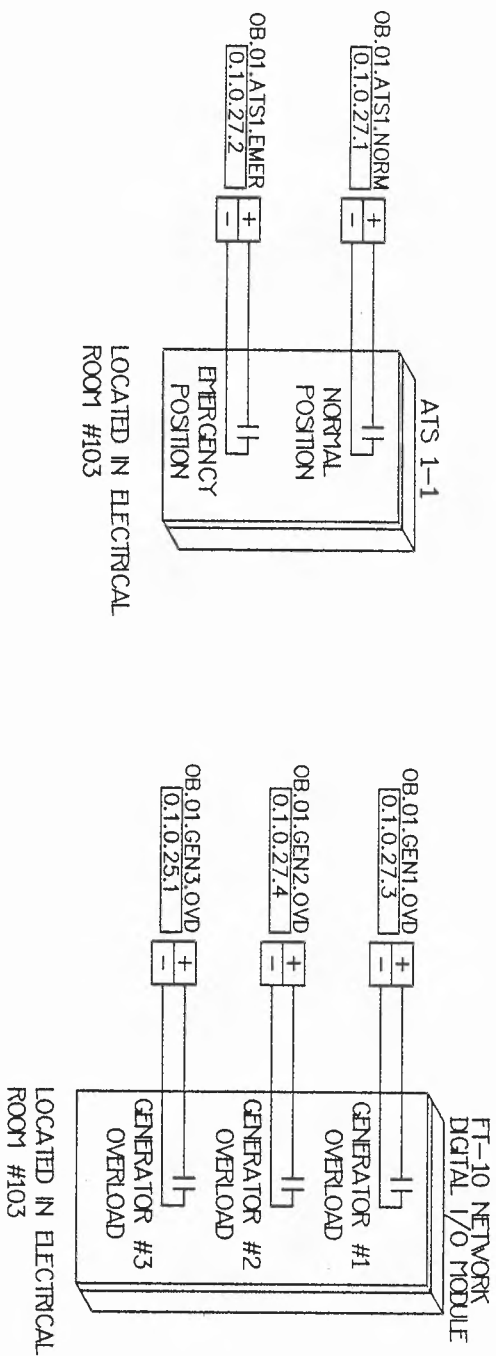
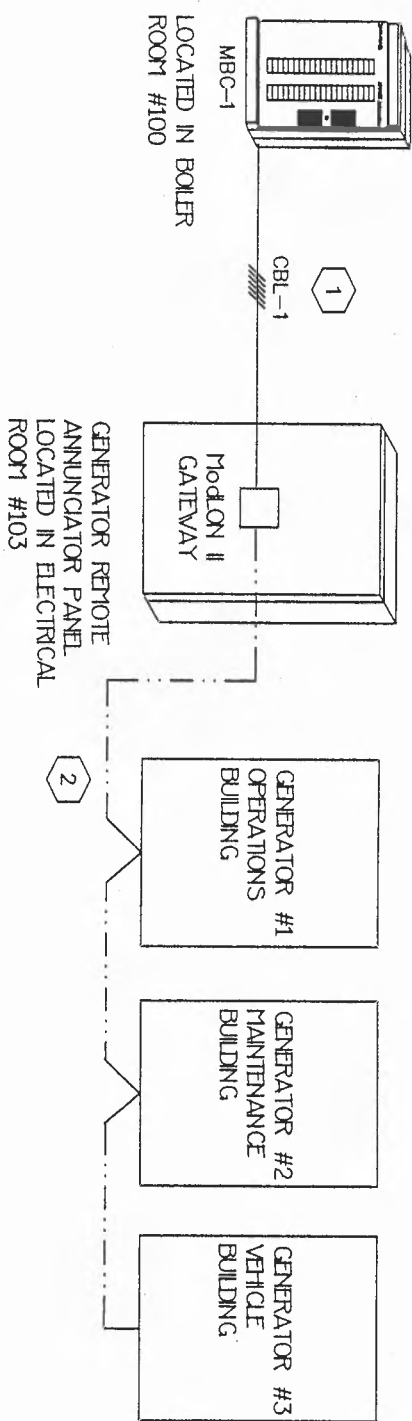
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/08	11/28/07

**GENERATOR SYSTEM INTERFACE**

1-27A

INSTALLATION NOTES:

- 1 SIEMENS TO COMMUNICATE VIA MODBUS USING RS-485 COMMUNICATIONS. REFERENCE CUPRIN'S INSTALLATION OF MODCON II GATEWAY FOR CABLE CONFIGURATION.
- 2 GENERATORS TO BE NETWORKED TOGETHER BY OTHERS.
- 3 FT-10 NETWORK DIGITAL I/O MODULE PROVIDED BY OTHERS.



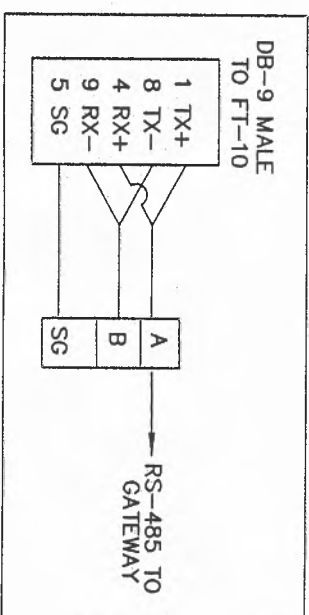
MODCON REGISTER MAPPING INFORMATION

Structure	Data Point	Modbus Registers		
		GEN[0]	GEN[1]	GEN[2]
nwoGenACDData	Frequency	40018	40118	40218
	Total pf	40019	40119	40219
	Total kva	40020	40120	40220
	Total kW	40021	40121	40221
	Volts db	40023	40123	40223
	Volts bc	40024	40124	40224
	Volts ca	40025	40125	40225
	Volts d	40026	40126	40226
	Volts b	40027	40127	40227
	Volts c	40028	40128	40228
Amps a	40029	40129	40229	
Amps b	40030	40130	40230	
Amps c	40031	40131	40231	

NFP110	
Description	Bit
Low Coolant Temperature	8
Pre-High Engine Temperature	9
High Engine Temperature	10
Pre-Low Oil Pressure	11
Low Oil Pressure	12
Low Coolant Level	14

EXTENDED	
Description	Bit
Overload	5

1 GENERATOR SYSTEM INTERFACE  
 LOCATION: ELECTRICAL ROOM #103  
 SERVES: CAMPUS EMERGENCY POWER



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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 Plymouth Twp.  
 M. 48170 USA  
 Phone: 734-456-3800  
 Fax: 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJK</i>	10/27/06	11/28/07

440P-702374  
 100  
 1-27

**Vehicle Building Lighting Sequence of Operations**

BMS shall communicate to Vehicle Building lighting panels via BACnet TC/IP protocol. BMS shall turn on/off interior and exterior lighting according to a time a day schedule.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-9800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

**ANN ARBOR, MI**

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJK	10/27/06	11/28/07

**LIGHTING SYSTEM INTERFACE**

440P-702874  
100

**1-28A**

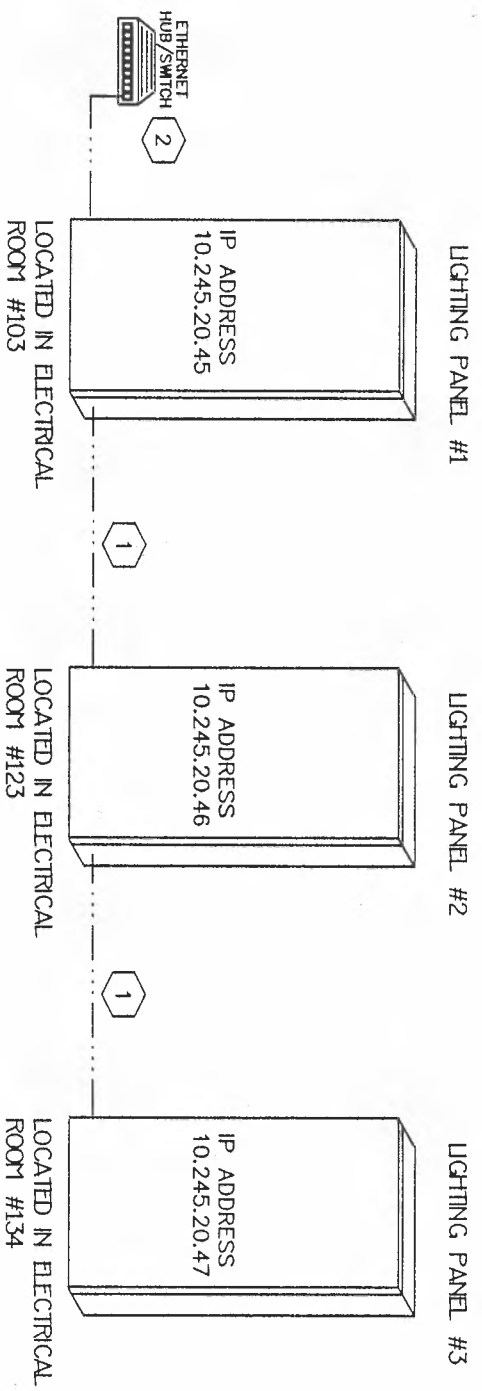
**INSTALLATION NOTES:**

1 LIGHTING PANELS TO NETWORKED TOGETHER BY OTHERS.

2 ETHERNET DROP TO BE PROVIDED BY OTHERS.

**LIGHTING INTEGRATION POINTS**

NOTE: LIGHTING INTEGRATION POINTS TO BE CORRELATED WITH LIGHTING VENDOR



1-28 PART "B" LIGHTING CONTROL

LOCATION: OPERATIONS BUILDING  
SERVES: OPERATIONS BUILDING PART B  
INTERIOR/EXTERIOR LIGHTS

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
Phone: 734-458-3800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	SFM	10/27/06	11/28/07

**LIGHTING SYSTEM INTERFACE**

440P-702374  
100

**1-28**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
CBL 1	15	588-1008	SIEMENS	N/A	6-WIRE 2-RJ11 RS CABLE 50'PLMN
TEC 1	15	550-065	SIEMENS	149 424	TEC VAV ACTUATOR PACKAGE
TTE 1	15	540-680FA	SIEMENS	149 312	TEC RM SNSR-W/STPT,IND,OVDR,BG
TTE 2	15	540-659P50	SIEMENS	149905	THERMISTOR SCREW TEC DUCT SENSOR -50
V					SEE VALVE SUBMITTAL

The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. The space served by the VAV terminal unit is controlled in Occupied and Unoccupied modes as follows:

**Occupied**

The VAV terminal unit is controlled within user defined maximum and minimum supply air volume settings. The controller monitors the room temperature sensor and air velocity sensor and modulates the supply air damper in sequence with the reheat valve to maintain the room temperature at set point. Supply air volume remains at minimum when HW reheat valve is modulated.

**Unoccupied**

The terminal unit is controlled using the night set point. The controller may reset to the Occupied mode for a predetermined time period upon a signal from the control system or manually at the room sensor.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3900  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

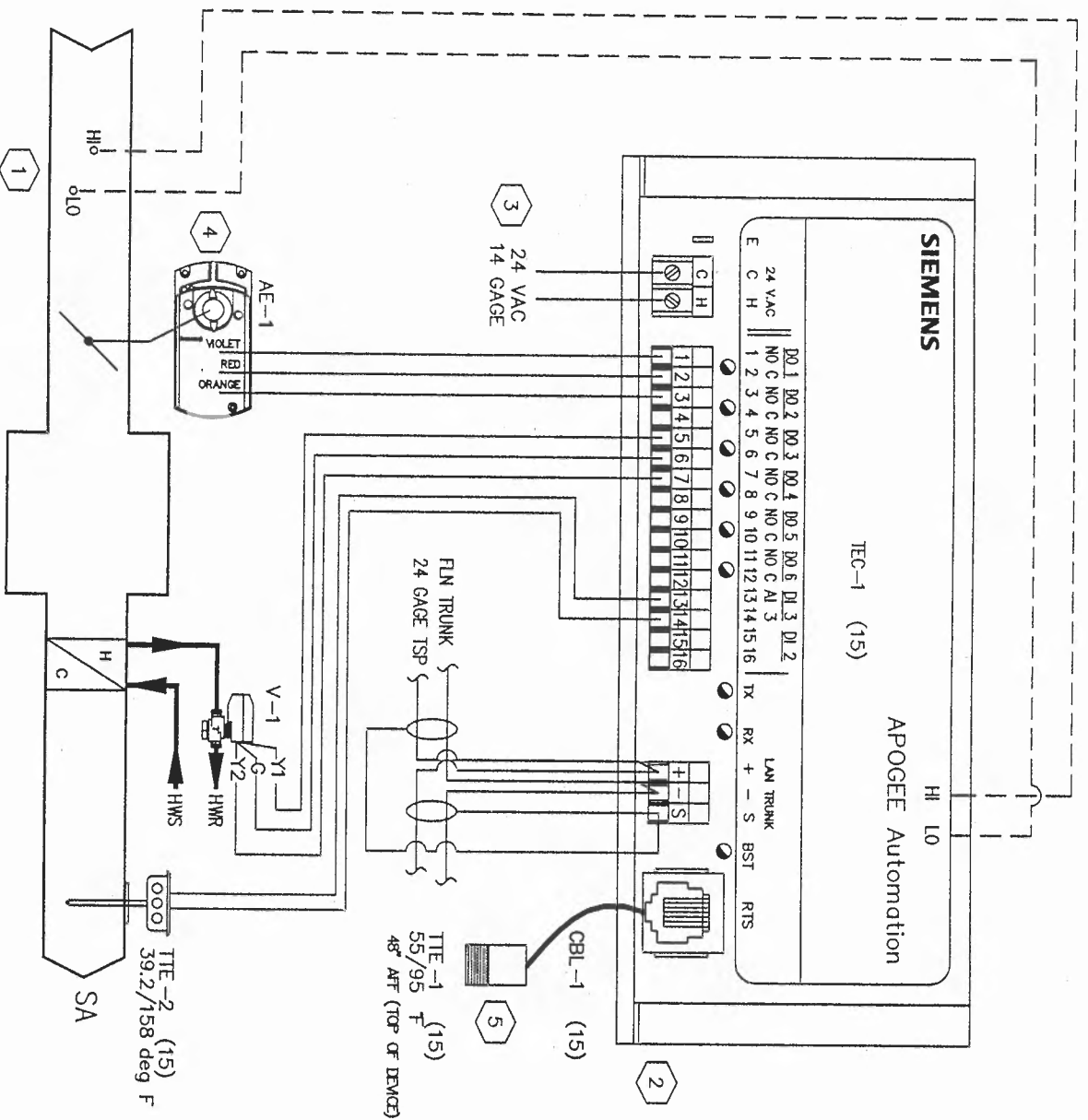
ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>CSM</i>	10/27/06	11/16/07

VAV w/HW REHEAT

440P-702374

100

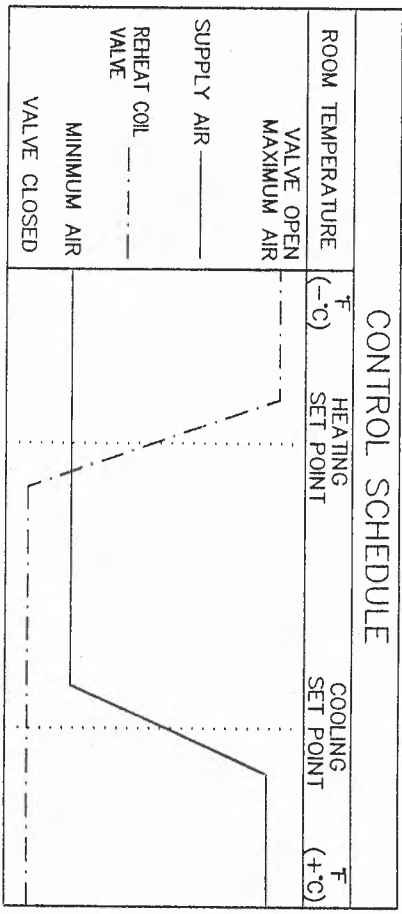
**1-29A**



1 VAV WITH REHEAT COIL (#2023)  
 LOCATION: OPERATIONS BUILDING  
 SERVICES: SEE TERMINAL EQUIPMENT SCHEDULE

**INSTALLATION NOTES:**

- 1 VAV BOX INSTALLED BY MECHANICAL CONTRACTOR WITH 3 TO 5 STRAIGHT DUCT DAMPERS UPSTREAM OF BOX TO PROVIDE PROPER FLOW SENSING
- 2 TEC-1 TO BE MOUNTED IN MANUFACTURER SUPPLIED CONTROLLER ENCLOSURE
- 3 REFER TO BUILDING POWER TRUNK DRAWING FOR 24 VAC POWER
- 4 MOUNT ACTUATOR WITH DAMPER IN FULL OPEN POSITION. VERIFY TEC-1 AND ACTUATOR REQUIREMENT WITH THE BOX MANUFACTURER
- 5 LOCATE AS SHOWN ON FLOOR PLANS/CONTRACT DOCUMENTS



DEVICE	SIEMENS		MANUFACTURER	DIVISION 16	DIVISION 15
	FILTER	ELEC.			
TTE-1		M,W			
AE-1			M,W		
TEC-1			M,W,P		
V-1					M
LAN TRUNK					
POWER (24VAC)					

M-MOUNTED  
 W-WIRED  
 P-PIPED

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-456-3800  
 Fax: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI  
 ENGINEER: SFM  
 DRAFTER: SFM  
 CHECKED BY: [Signature]  
 INITIAL RELEASE: 10/27/06  
 LAST EDIT DATE: 11/28/07

440P-702374  
 100  
**1-29**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
CEL 1	3	588-1008	SIEMENS	N/A	6-WIRE 2-RJ11 RS CABLE 50'PLMN
TEC 1	3	550-065	SIEMENS	149 424	TEC VAV ACTUATOR PACKAGE
TTE 1	3	540-680FA	SIEMENS	149 312	TEC RM SNSR-W/STPT,IND,OMRD,BG
	3	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
TTE 2	3	540-659P50	SIEMENS	149905	THERMISTOR SCREW TEC DUCT SENSOR -50
V					SEE VALVE SUBMITTAL

The variable volume (VAV) terminal unit is controlled independent of system pressure fluctuations by an application specific DDC controller using electric actuation. The space served by the VAV terminal unit is controlled in Occupied and Unoccupied modes as follows:

**Occupied**

The VAV terminal unit is controlled within user defined maximum and minimum supply air volume settings. The controller monitors the room temperature sensor and air velocity sensor and modulates the supply air damper in sequence with the reheat and radiation valves to maintain the room temperature at set point. Supply air volume remains at minimum when HW reheat and radiation is modulated.

**Unoccupied**

The terminal unit is controlled using the night set point. The controller may reset to the Occupied mode for a predetermined time period upon a signal from the control system or manually at the room sensor.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>copy</i>	10/27/06	11/16/07

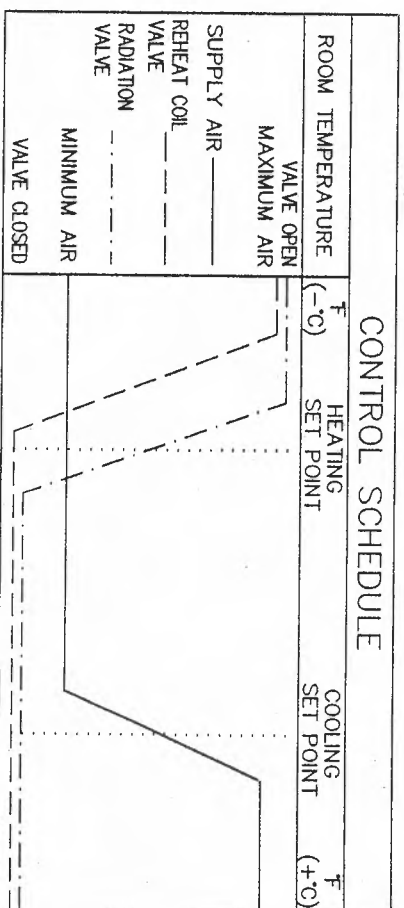
**VAV/HW REHEAT & FTR**

440P-702374

100

**1-30A**

- INSTALLATION NOTES:**
- VAV BOX INSTALLED BY MECHANICAL CONTRACTOR WITH 3 TO 5 STRAIGHT DUCT DAMPERS UPSTREAM OF BOX TO PROVIDE PROPER FLOW SENSING
  - TEC-1 TO BE MOUNTED IN MANUFACTURER SUPPLIED CONTROLLER ENCLOSURE
  - REFER TO BUILDING POWER TRUNK DRAWING FOR 24 VAC POWER
  - MOUNT ACTUATOR WITH DAMPER IN FULL OPEN POSITION. VERIFY TEC-1 AND ACTUATOR REQUIREMENT WITH THE BOX MANUFACTURER
  - LOCATE AS SHOWN ON FLOOR PLANS/CONTRACT DOCUMENTS

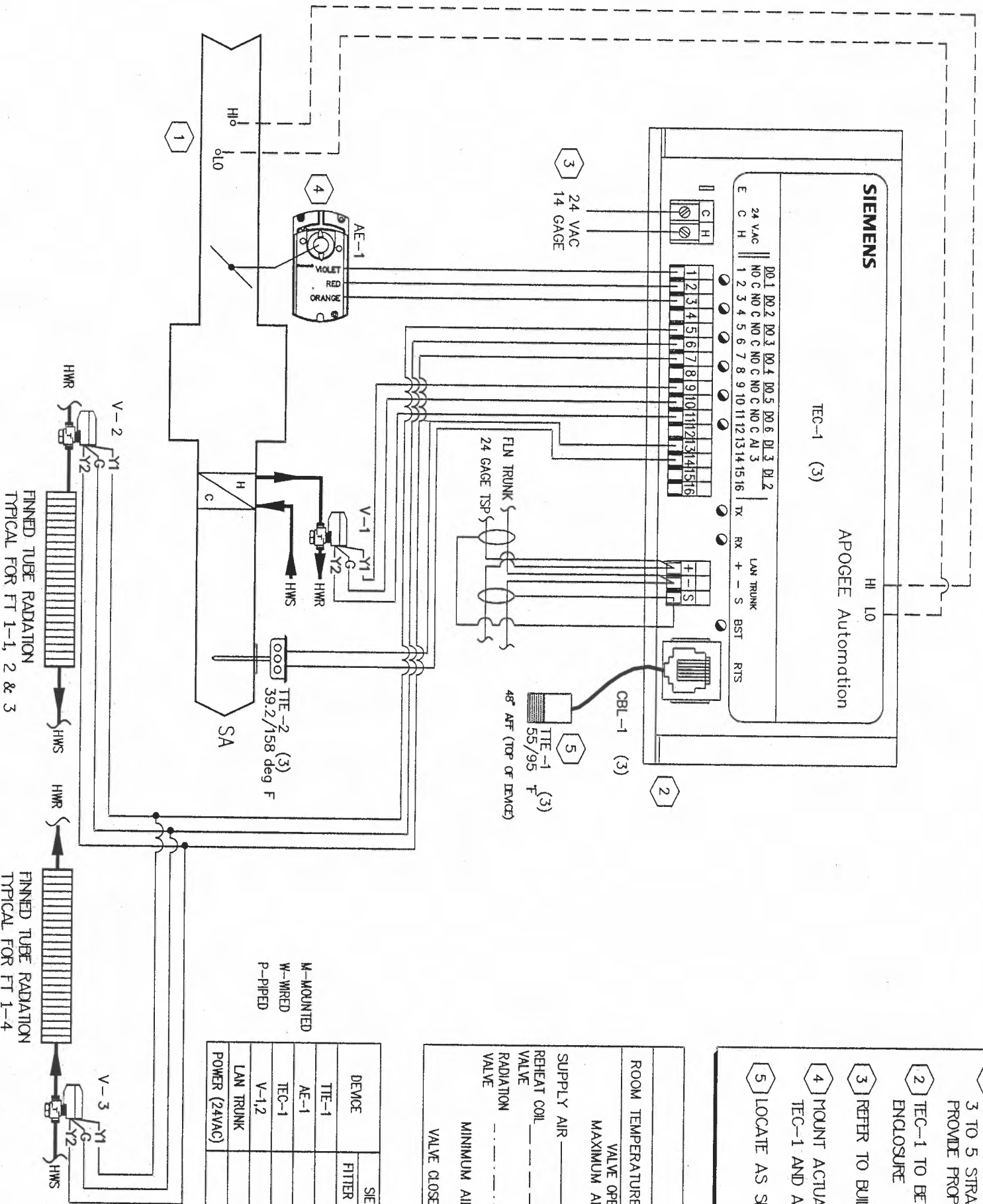


DEVICE	SIEMENS FITTER	ELEC.	MANUFACTURER	DIVISION 16	DIVISION 15
TTE-1		M,W			
AE-1		M,W			
TEC-1		M,W,P			
V-1,2		W			M
LAN TRUNK		W			
POWER (24VAC)		W			

**FINNED TUBE RADIATION SCHEDULE**

BOX ID	CONTROLLER #	FTR ID	SERVES
VB 1-5	VB 1-5	FT 1-2	ROOM #142
VB 1-6	VB 1-6	FT 1-1	ROOM #141
VB 1-12	VB 1-12	FT 1-3	ROOM #150
VB 1-12	VB 1-12	FT 1-4	ROOM #150

1 VAV, RHT, & RADIATION (#2023)  
 1-30 LOCATION: OPERATIONS BUILDING  
 SERVES: SEE TERMINAL EQUIPMENT SCHEDULE



FINNED TUBE RADIATION TYPICAL FOR FT 1-1, 2 & 3

FINNED TUBE RADIATION TYPICAL FOR FT 1-4

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-458-9800  
 Fax: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER: SFM  
 DRAFTER: SFM  
 CHECKED BY: INITIAL RELEASE  
 LAST EDIT DATE: 10/27/06

**VAV/HW REHEAT & FTR**

440P-702374  
 100  
**1-30**



Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1-2	2	GCA221.1U	SIEMENS	154001	2 PT SR.115V,MED
TE 1-4	4	134-1084	SIEMENS	155 017	TSTAT/H/C/LINE VOLT CON/EXP

**Exhaust Fan EF 1-1, 1-2, 1-4 Sequence of Operations**  
The power roof vent exhaust fan runs constantly (Not shown on control drawings).

**Exhaust Fan EF 1-3, 1-4 Sequence of Operations**  
The space thermostat cycles the power roof vent exhaust fan to maintain the space temperature at set point. The intake air damper on the Intake Hood opens when the fan is started.

**Exhaust Fan EF 1-5, 1-8 Sequence of Operations**  
The space thermostat cycles the power roof vent exhaust fan to maintain the space temperature at set point.

**Exhaust Fan EF 1-6, 1-7 Sequence of Operations**  
The power roof vent exhaust fan cycles from local light switch (Not shown on control drawings and wired by others).

### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

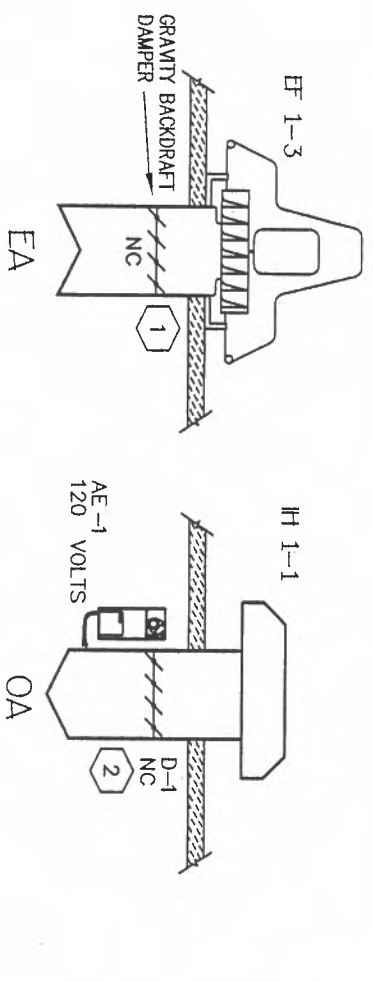
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJL</i>	10/27/06	11/16/07

### EXHAUST FAN CONTROL

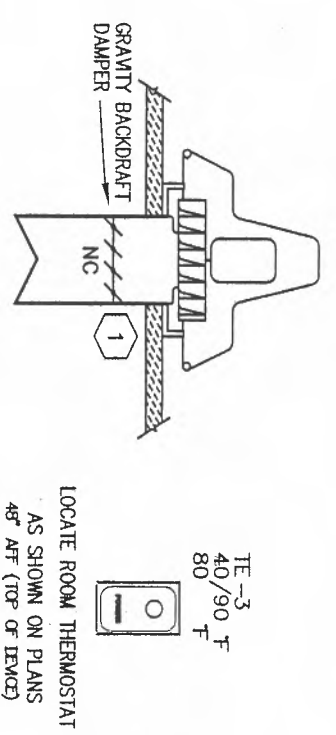
440P-702374  
100

# 1-31A

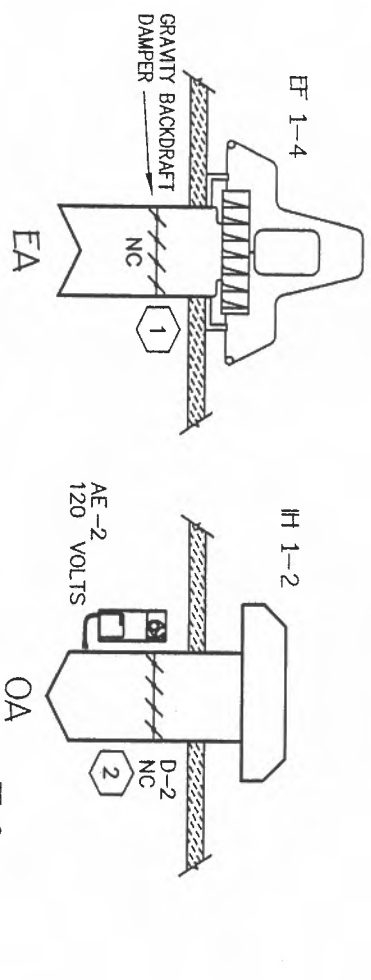
- INSTALLATION NOTES:
- 1 GRAVITY DAMPER PROVIDED BY OTHERS.
  - 2 MOTORIZED DAMPER PROVIDED BY OTHERS.



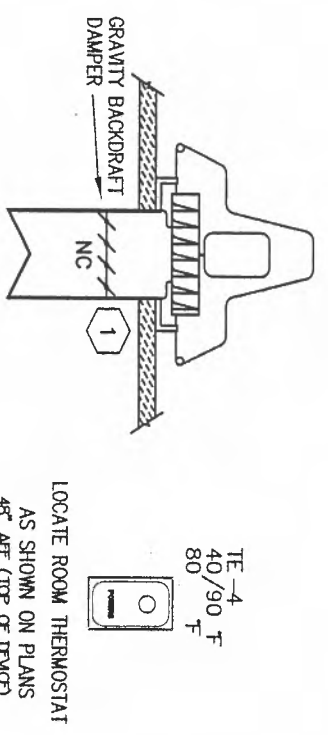
1-31 EXHAUST FAN EF1-3 CONTROL  
 LOCATION: OPERATION BUILDING ROOF  
 SERVES: ELECTRIC ROOM #103



1-31 EXHAUST FAN EF1-5 CONTROL  
 LOCATION: OPERATION BUILDING ROOF  
 SERVES: COMPRESSOR ROOM #130



1-31 EXHAUST FAN EF1-4 CONTROL  
 LOCATION: OPERATION BUILDING ROOF  
 SERVES: ELECTRIC ROOM #123



1-31 EXHAUST FAN EF1-8 CONTROL  
 LOCATION: OPERATION BUILDING ROOF  
 SERVES: ELECTRIC ROOM #134

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MA 01870  
 USA  
 PHONE: 794-458-3800  
 FAX: 866-815-0749

ANN ARBOR MAINTENANCE FACILITY

ENGINEER	ANN ARBOR, MI
DRAFTER	SFM
CHECKED BY	WJL
INITIAL RELEASE	10/27/06
LAST EDIT DATE	11/28/07

440P-702374  
 100  
 1-31

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
TE 1-3	3	FBO	N/A	N/A	FURNISHED BY OTHERS

**Unit Heater Sequence of Operations**

A unit mounted electric thermostat cycles the unit heater fan to maintain the space temperature at set point.

**Gas Unit Heater Sequence of Operations**

A unit mounted electric thermostat cycles the unit heater fan and gas heat to maintain the space temperature at set point.

**Cabinet Unit Heater Sequence of Operations**

A wall mounted electric thermostat cycles the unit heater fan to maintain the space temperature at set point.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

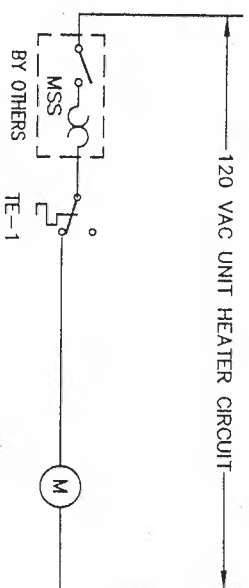
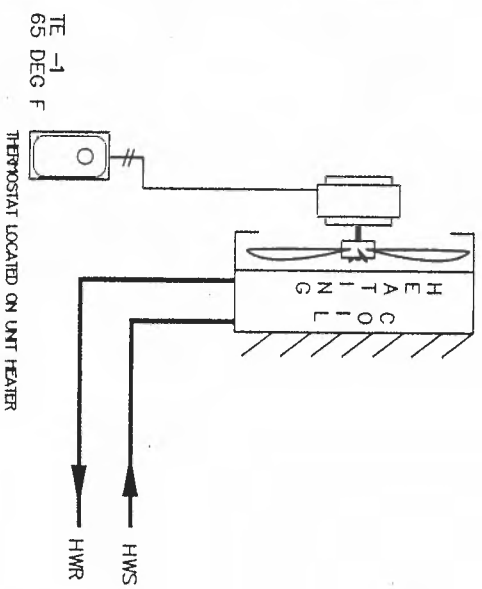
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	LJ/L	10/27/06	11/16/07

**UNIT HEATER CONTROL**

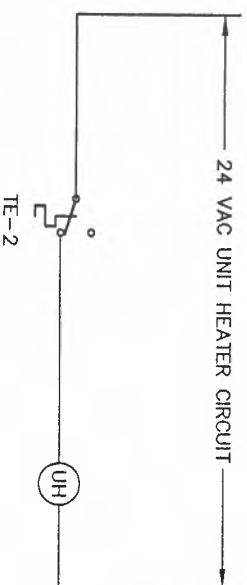
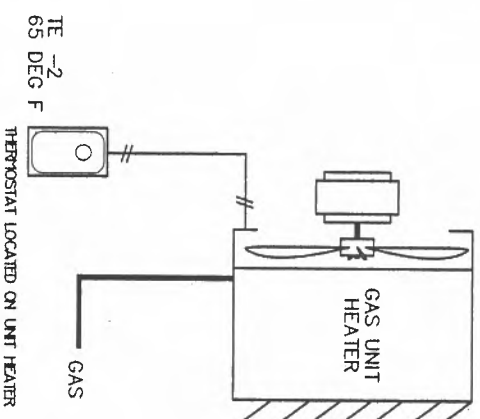
440P-702374

100

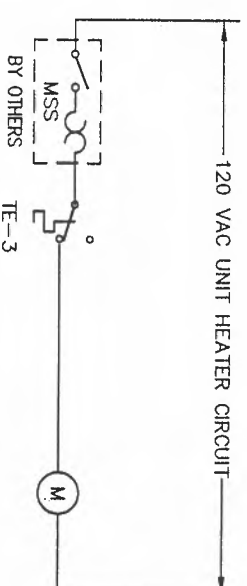
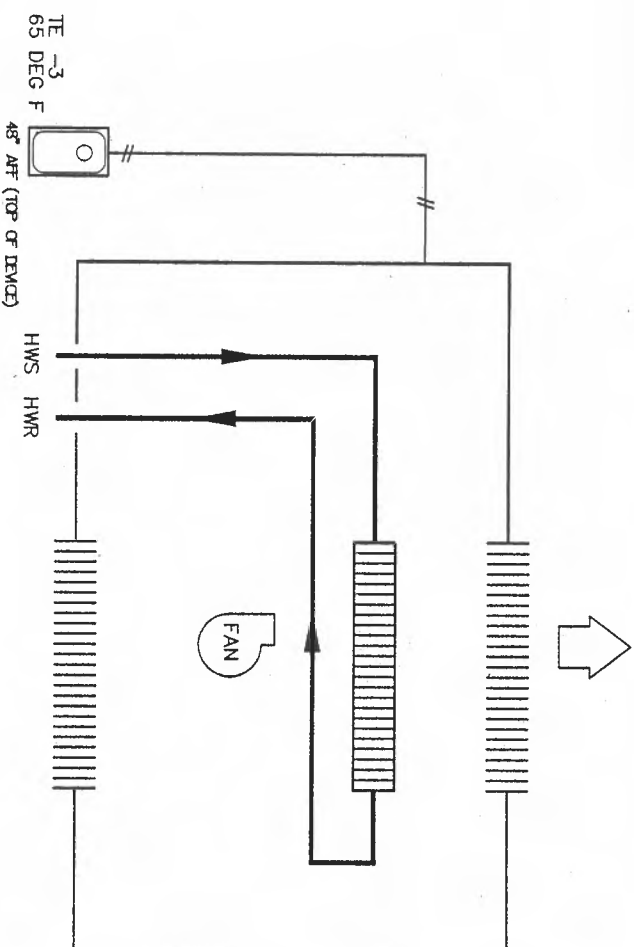
**1-32A**



1  
1-32 UNIT HEATER CONTROL  
LOCATION: OPERATIONS BUILDING  
TYPICAL OF NINE



2  
1-32 GAS UNIT HEATER CONTROL  
LOCATION: OPERATIONS BUILDING  
SERVES: BOILER ROOM #100



3  
1-32 CABINET UNIT HEATER CONTROL  
LOCATION: OPERATIONS BUILDING  
TYPICAL OF FOUR

UNIT HEATER SCHEDULE

UNIT HEATER	SERVES
UH 1-1	ROOM #114 FORESTRY/HORTICULTURE SHOP
UH 1-2	ROOM #114 FORESTRY/HORTICULTURE SHOP
UH 1-3	ROOM #113 MOWER MAINTENANCE SHOP
UH 1-4	ROOM #116 FABRICATION AREA
UH 1-5	ROOM #132 RADIO REPAIR BAY
UH 1-6	ROOM #126 UTILITY/SHOP STORAGE
UH 1-7	ROOM #124 TSU SHOP/SHOP STORAGE
UH 1-8	ROOM #124 TSU SHOP/SHOP STORAGE
UH 1-9	ROOM #127 SIGN STORAGE

CABINET UNIT HEATER SCHEDULE

UNIT HEATER	SERVES
CUH 1-1	CORRIDOR #110 ENTRY
CUH 1-2	CORRIDOR #111 ENTRY
CUH 1-3	CORRIDOR #125 ENTRY
CUH 1-4	CORRIDOR #125 ENTRY

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRATER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	w/y	10/27/06	11/30/07

UNIT HEATER CONTROL

440P-702374  
100

1-32

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Panel Mounted Devices					
MBC 001000	1	545-142	SIEMENS	149 251	MBC-40ENC ASSY W/STPLD DR 115V
	1	562-001	SIEMENS	N/A	OPEN PROCESSOR 64MB
MBC 026000	1	986-90392A	SIEMENS	1270729	P2 OP MODBUS
	1	PTM6.2Y420	SIEMENS	149 251	2 A0, 4-20 MA
	3	PTM6.4D20	SIEMENS	149 251	4 D1, DRY CONTACT
	3	PTM6.2P1K	SIEMENS	149 251	2 A1, 1K PLATINUM RTD
	1	545-825	SIEMENS	149 251	ADDRESS KEYS 01-16
	1	545-826	SIEMENS	149 251	ADDRESS KEYS,17-32
	1	545-827	SIEMENS	149 251	ADDRESS KEYS,33-48
	1	545-714	SIEMENS	149 251	M-BUS POWER MODUAL
	2	PTM6.20250-M	SIEMENS	149 251	2 DO,CONTACT W/MANUAL OVERRIDE

**REVISION HISTORY**

1 11/28/2007 KU AS-BUILT DRAWING

**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WPK</i>	10/27/06	11/28/07

OB.01.BLRROOM.100 LAYOUT

440P-702974  
0

**1-33A**

1 11/28/2007 KJ AS-BUILT DRAWING

REVISION HISTORY

COM (PT1)	8	08.01.BLR.1BS BOILER 1 ST	08.01.BLR.2BS BOILER 2 ST	2p1k 001
SIG (PT1)	7	0.1.0.1.2 100BOILER	0.1.0.1.1 100BOILER	
COM (PT2)	6	TTE 4	TTE 3	
SIG (PT2)	5			
COM (PT1)	8	08.01.BLR.HWS BOILER HWS	08.01.BLR.HWR BOILER HWR	2p1k 003
SIG (PT1)	7	0.1.0.3.2 100BOILER	0.1.0.3.1 100BOILER	
COM (PT2)	6	TTE 2	TTE 1	
SIG (PT2)	5			
COM (PT1)	8		08.01.OAT OA TEMP	2p1k 005
SIG (PT1)	7	0.1.0.5.2	0.1.0.5.1 100BOILER	
COM (PT2)	6		TTE 5	
SIG (PT2)	5			

- (PT1)	8		08.01.BLR.STPT STPT RESET	2p420 002
+ (PT1)	7	0.1.0.2.2	0.1.0.2.1 100BOILER	
- (PT2)	6			
+ (PT2)	5			

- 1A
- 2A
- 3A
- 4A
- 5A
- 6A
- 7A
- 8A
- 9A
- 10A
- 11A
- 12A
- 13A
- 14A
- 15A
- 16A
- 17A
- 18A
- 19A
- 20A

A (PT3)	8	0.1.0.25.1 100GENERATOR	08.01.GEN3.OVD GENERATOR 3 OVD	4d20 025
B (PT3)	7	0.1.0.25.2		
A (PT4)	6	0.1.0.25.3		
B (PT4)	5	0.1.0.25.4		
A (PT3)	8	0.1.0.27.1 100GENERATOR	08.01.ATSI.NORM NORMAL POSITION	4d20 027
B (PT3)	7	0.1.0.27.2 100GENERATOR	08.01.ATSI.EMER EMER POSITION	
A (PT4)	6	0.1.0.27.3 100GENERATOR	08.01.GEN1.OVD GENERATOR 1 OVD	
B (PT4)	5	0.1.0.27.4 100GENERATOR	08.01.GEN2.OVD GENERATOR 2 OVD	
A (PT3)	8	0.1.0.28.1 100BOILER	08.01.BLR.1AL BOILER 1 AL	4d20 029
B (PT3)	7	0.1.0.28.2 100BOILER	08.01.BLR.2AL BOILER 2 AL	
A (PT4)	6	0.1.0.28.3 100BOILER	08.01.HWP.1SS HWP 1 SS	
B (PT4)	5	0.1.0.28.4 100BOILER	08.01.HWP.2SS HWP 2 SS	

NC (PT1)	8		08.01.HWP.2SS HWP 2 SS	2q250M 028
COM (PT1)	7	0.1.0.28.2	0.1.0.28.1 100BOILER	
NC (PT2)	6		RE 2	
COM (PT2)	5			
NC (PT1)	8		08.01.HWP.1SS HWP 1 SS	2q250M 030
COM (PT1)	7	0.1.0.30.2	08.01.BLR.ENG BOILER ENABLE	
NC (PT2)	6		0.1.0.30.1 100BOILER	
COM (PT2)	5		RE 1	
			RE 3	

- 1B
- 2B
- 3B
- 4B
- 5B
- 6B
- 7B
- 8B
- 9B
- 10B
- 11B
- 12B
- 13B
- 14B
- 15B
- 16B
- 17B
- 18B
- 19B
- 20B

MODBUS OP POWER OPEN PROCESSOR W/RS-485	18A	MBC 026 986-90392A
OPEN PROCESSOR 64 MB	19A	MBC 001 562-001
POWER MODULE	20A	545 714

**SIEMENS**  
Siemens Building Technologies  
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ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

440P-702374  
1-33

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
XFMR	1	PSH500A	FUNCTIONAL DEVICES	1208cut143	PS FIVE 100VA C2 120-24VAC ENC

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
---	------------	----	------------------

**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

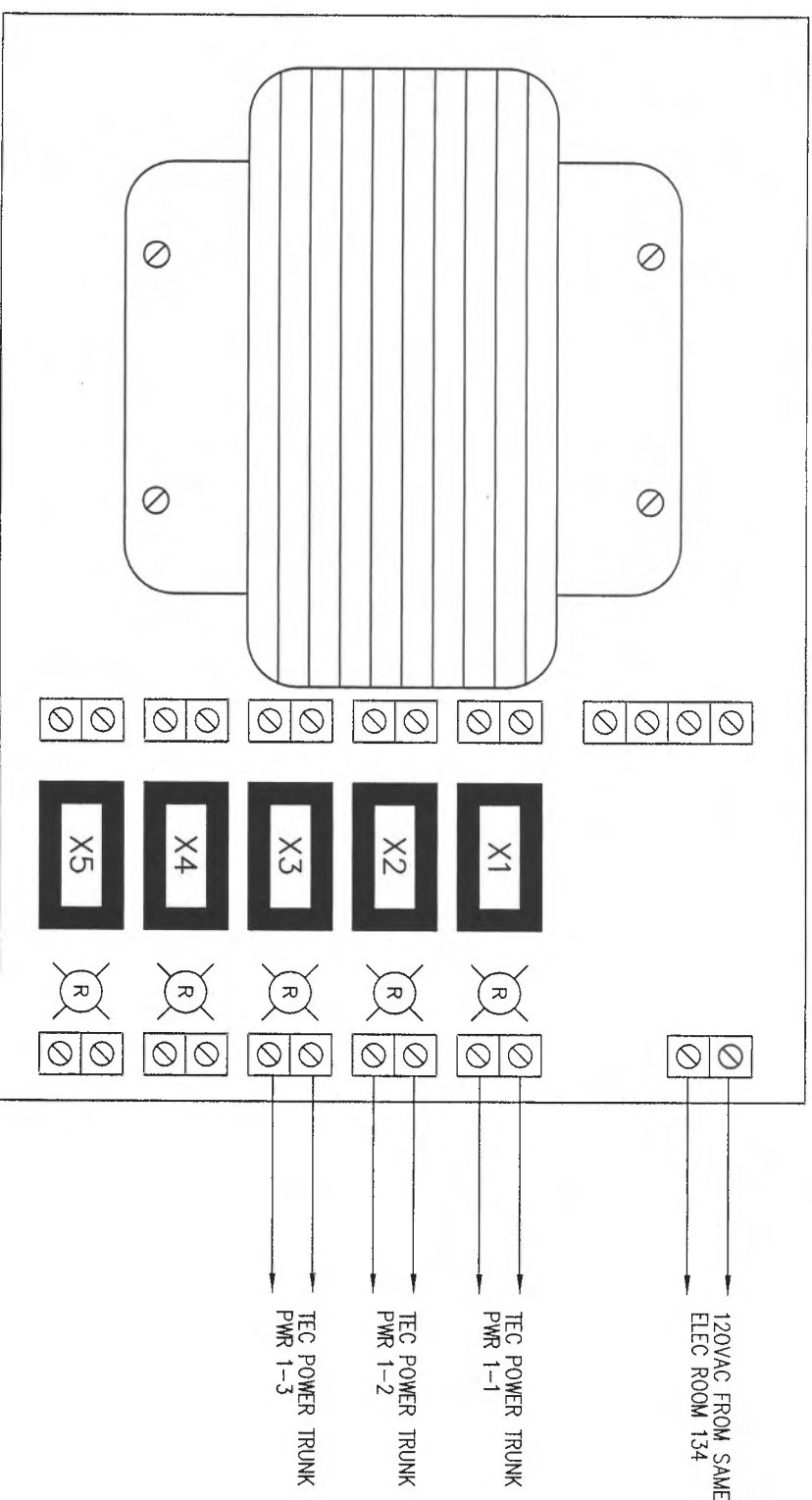
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJL</i>	10/27/06	11/16/07

**XFMR-1 PANEL LAYOUT**

440P-702374  
100

**1-34A**

XFMR-1



1  
1-34  
TRANSFORMER PANEL LAYOUT  
LOCATION: ELECTRICAL ROOM #134  
SERVES: TEC POWER TRUNKS, BOILER SYSTEM

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU  
45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-8800  
FAX: 888-815-0749

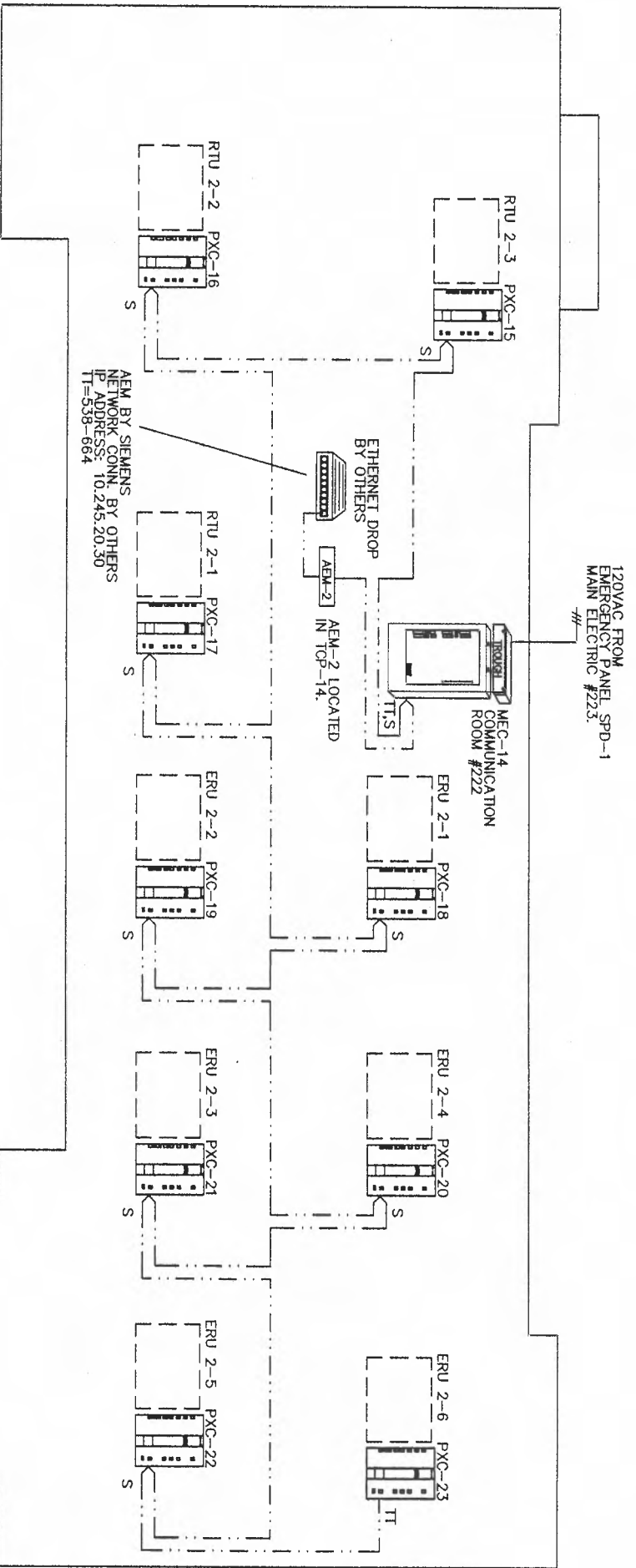
**ANN ARBOR MAINTENANCE FACILITY**

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/30/07

**XFMR-1 PANEL LAYOUT**

233-E -4185-00  
100  
**1-34**





**MAINTENANCE BUILDING**

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3900  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	TRAITER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	W/L	10/27/06	12/03/07

**MAINTENANCE BUILDING RISER**

440P-702374  
200

**2-1**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
CS 1	1	H608	VERIS	1006cut016	CUR SW SPLICOR-ADJ SETPT W/LED
SD 1-2	2	FBO	N/A	N/A	FURNISHED BY OTHERS
TOP 17	1	A-20H16ALPP	HOFMAN	N/A	20"X16"X16" NEMA 4 ENCLOSURES
TTE 1-2	2	544-339	SIEMENS	149 261	D/PT TEMP SENSOR,RTD,-40/240F
TTE 3	1	544-780FA	SIEMENS	149168	RM SNSR W/S/PT,IND,OVRO,DEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOD MOUNTING PLATE KIT
Panel Mounted Devices					
PS 17	1	PSH75AN	FUNCTIONAL DEVICES	1208cut034	PMRSPLY 75VA MLT-TAP W/O OULT
PXC 17	1	PXC24-PR-A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

**Warm-Up**  
The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

**Occupied**  
The fan starts the gas heating and DX cooling stage in sequence without overlap to maintain the room temperature setpoint. When the outside air dry bulb temperature is below the economizer changeover value the DX cooling is disabled and the fan will run for free cooling to maintain the room temperature setpoint. When the outside air dry bulb temperature is above the economizer changeover value, DX cooling is enabled to maintain the room temperature setpoint.

**Unoccupied**  
The supply fan is off, the DX cooling is off, gas heating is off.

**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space

temperature of 65 degrees F (adj). The DX cooling remains off.

**Safety**  
Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Monitoring**  
DDC system shall monitor the rooftop supply air temperature. DDC system shall monitor the rooftop return air temperature.

## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-466-3800  
FAX: 888-615-0749

## ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	LSJ	10/27/06	12/03/07

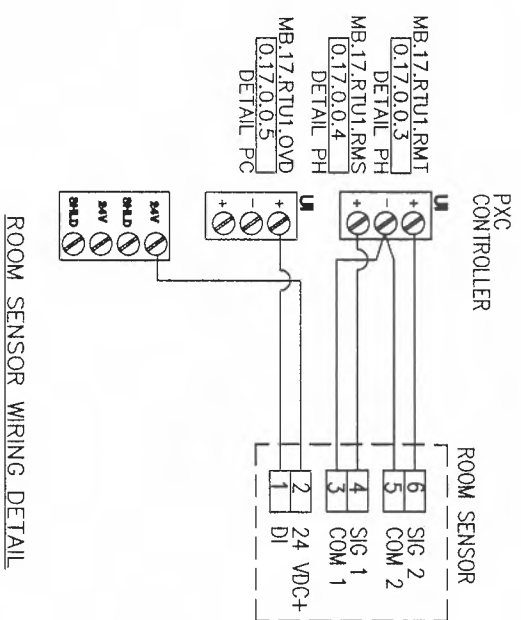
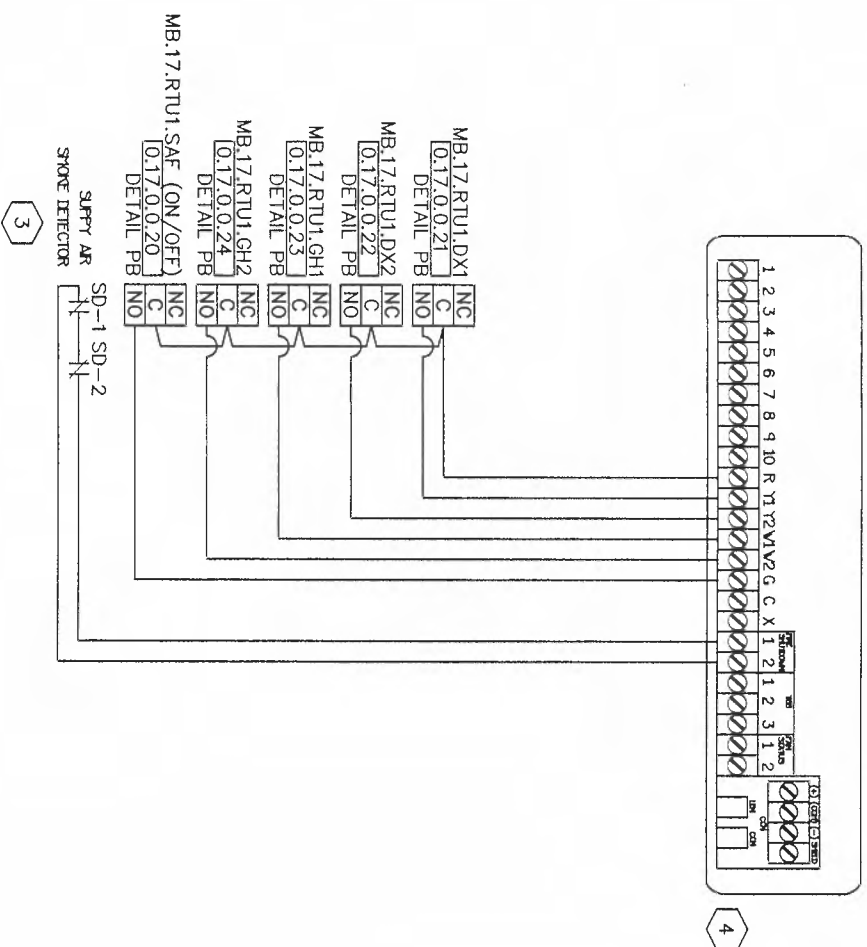
## RTU 2-1 CONTROL DIAGRAM

440P-702374

200

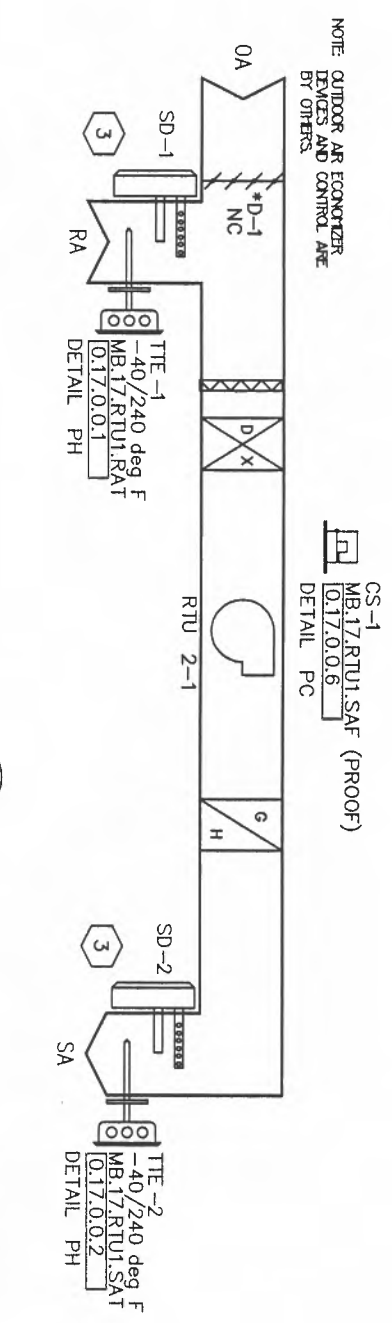
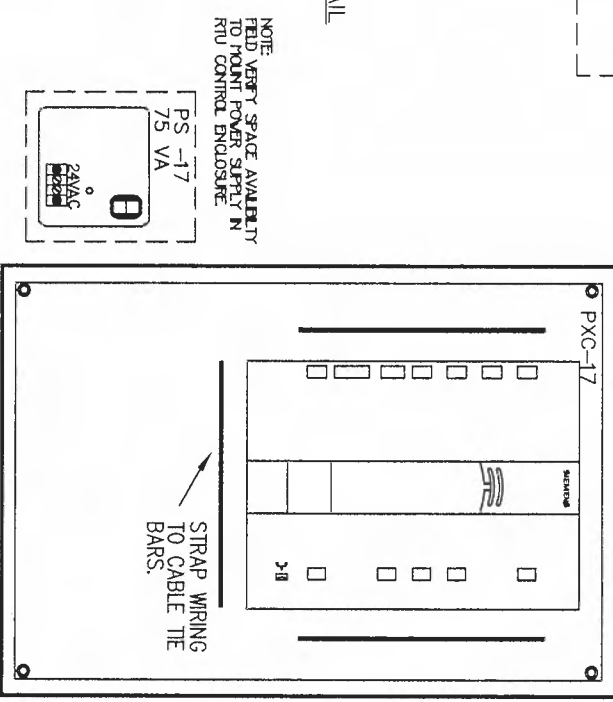
2-2A

ROOF TOP LOW VOLTAGE TERMINAL STRIP

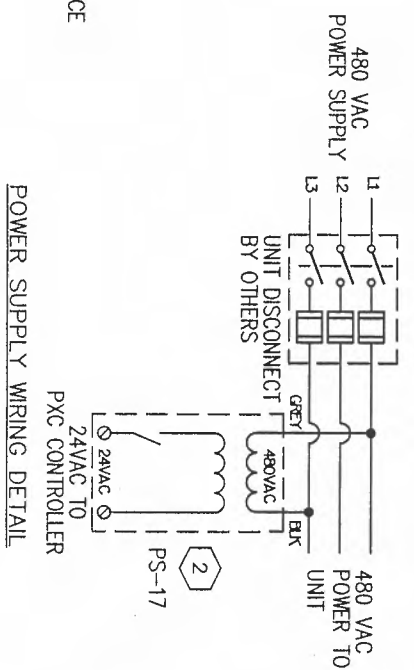


- INSTALLATION NOTES:
- TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU
  - WIRE POWER SUPPLY AFTER UNIT DISCONNECT
  - SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - FIELD VERIFY ALL RTU TERMINATIONS

1 TCP-17  
TEMPERATURE CONTROL PANEL



1 RTU 2-1 CONTROL DIAGRAM  
2-2 LOCATION: MAINTENANCE BUILDING ROOF SERVICES: SUPERVISORS OFFICES, WAITING ROOM



POWER SUPPLY WIRING DETAIL

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

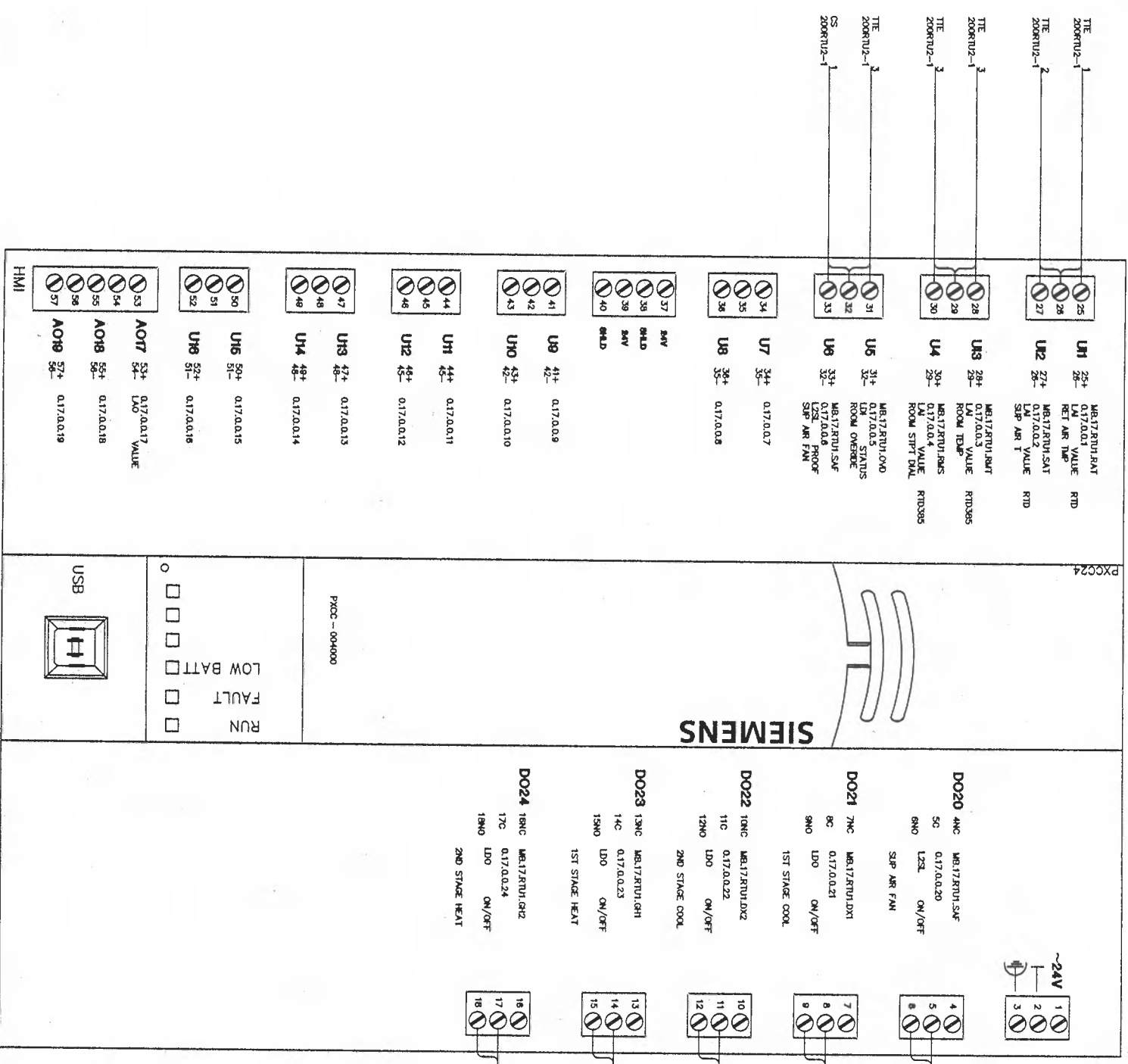
46470 Commerce Ctr. Dr.  
Plymouth Twp., MA 01870  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0149  
Siemens Building Technologies  
BAU

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI  
ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: JYU  
INITIAL RELEASE: 10/27/06  
LAST EDIT DATE: 12/03/07

440P-702374  
200

RTU 2-1 CONTROL DIAGRAM  
2-2



LOW BATT  
 FAULT  
 RUN

PXCC24

PXCC - 004000

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
 BAU  
 45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone- 734-458-9800  
 Fax- 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	12/03/07

440P-702374  
 200  
**2-3**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
<b>Field Mounted Devices</b>					
CS 1	1	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SEPT W/LED
SD 1-2	2	FBO	N/A	N/A	FURNISHED BY OTHERS
TOP 16	1	A-20H16ALPP	HOFFMAN	N/A	20"X16"X16" NEMA 4 ENCLOSURES
TTE 1-2	2	544-339	SIEMENS	149 261	D/P/T TEMP SENSOR,RTD,-40/240F
TTE 3	1	544-780FA	SIEMENS	149168	RM SNSR W/SPT,IND,OV,RD,BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOD MOUNTING PLATE KIT
<b>Panel Mounted Devices</b>					
PS 16	1	PSH75AN	FUNCTIONAL DEVICES	1208cut034	PNRSPLY 75VA MLT-TAP W/O OULTI
PXC 16	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

**Warm-Up**  
The supply fan starts and the DX cooling remains off. The gas heating stages to maintain the room temperature set point. The system is prevented from entering the Warm-Up mode more than once per day.

**Occupied**  
The fan starts the gas heating and DX cooling stage in sequence without overlap to maintain the room temperature setpoint. When the outside air dry bulb temperature is below the economizer changeover value the DX cooling is disabled and the fan will run for free cooling to maintain the room temperature setpoint. When the outside air dry bulb temperature is above the economizer changeover value, DX cooling is enabled to maintain the room temperature setpoint.

**Unoccupied**  
The supply fan is off, the DX cooling is off, gas heating is off.

**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space

temperature of 65 degrees F (adj). The DX cooling remains off.

**Safety**

Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Monitoring**

DDC system shall monitor the rooftop supply air temperature. DDC system shall monitor the rooftop return air temperature.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-468-8800  
FAX: 888-85-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>CS</i>	10/27/08	12/03/07

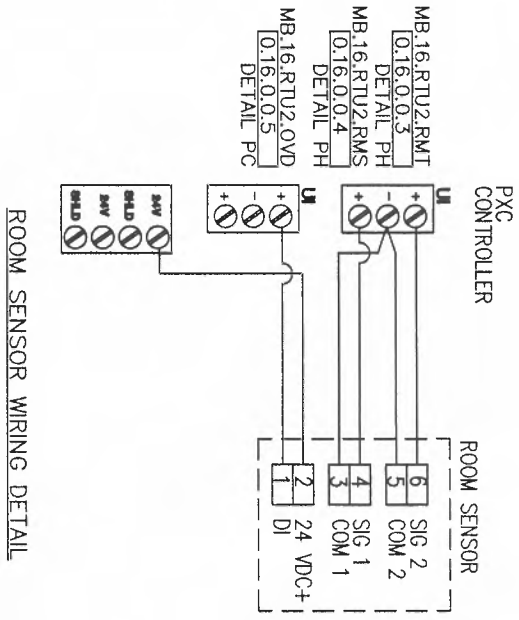
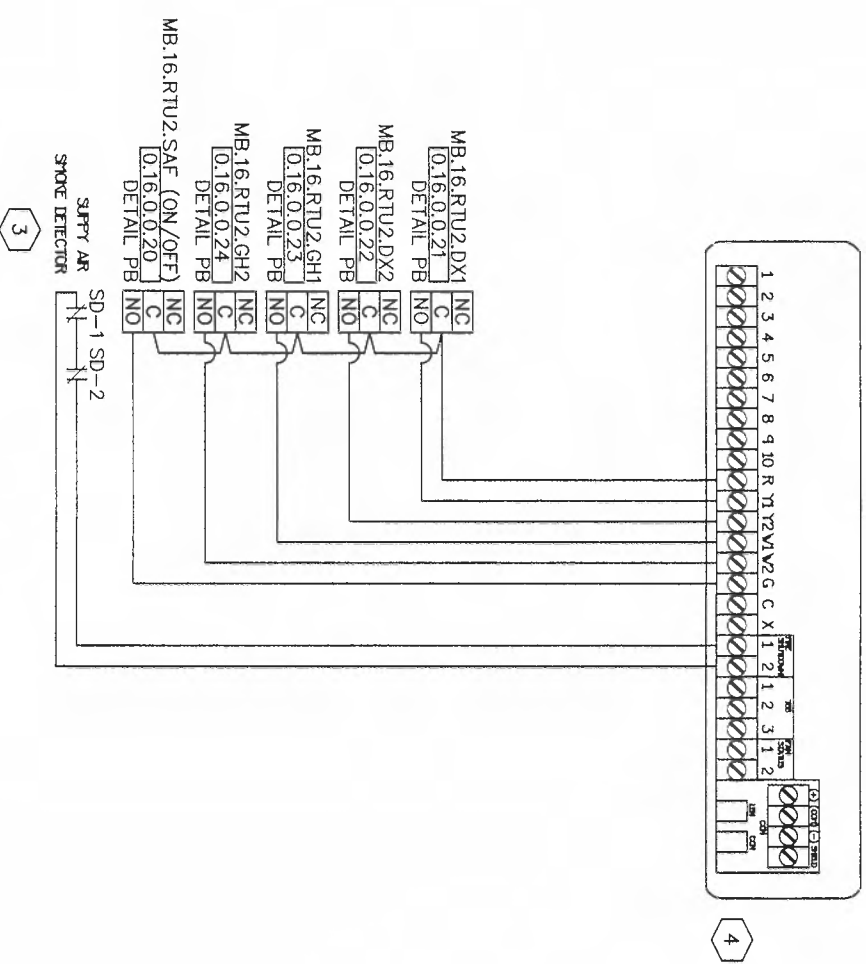
**RTU 2-2 CONTROL DIAGRAM**

440P-702374

200

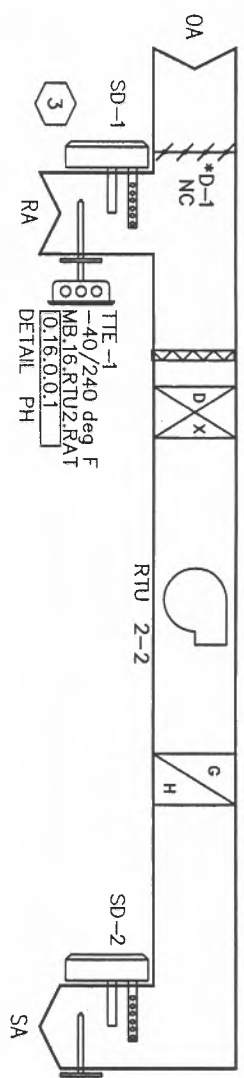
**2-4A**

ROOF TOP LOW VOLTAGE TERMINAL STRIP

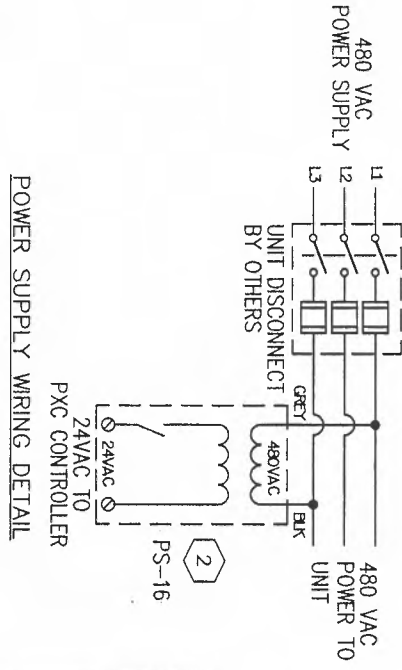
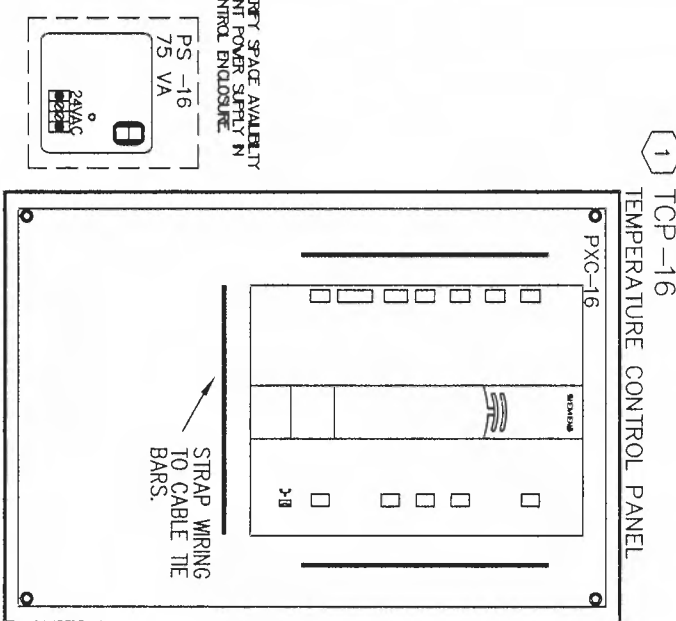


- INSTALLATION NOTES:
- TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU
  - WIRE POWER SUPPLY AFTER UNIT DISCONNECT.
  - SMOKE DETECTOR PROVIDED, MOUNTED AND WREID BY DIVISION 16.
  - FIELD VERIFY ALL RTU TERMINATIONS.

NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL ARE BY OTHERS



1 RTU 2-2 CONTROL DIAGRAM  
 2-4 LOCATION: MAINTENANCE BUILDING ROOF  
 SERVES: TOILETS, CREW ROOM



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

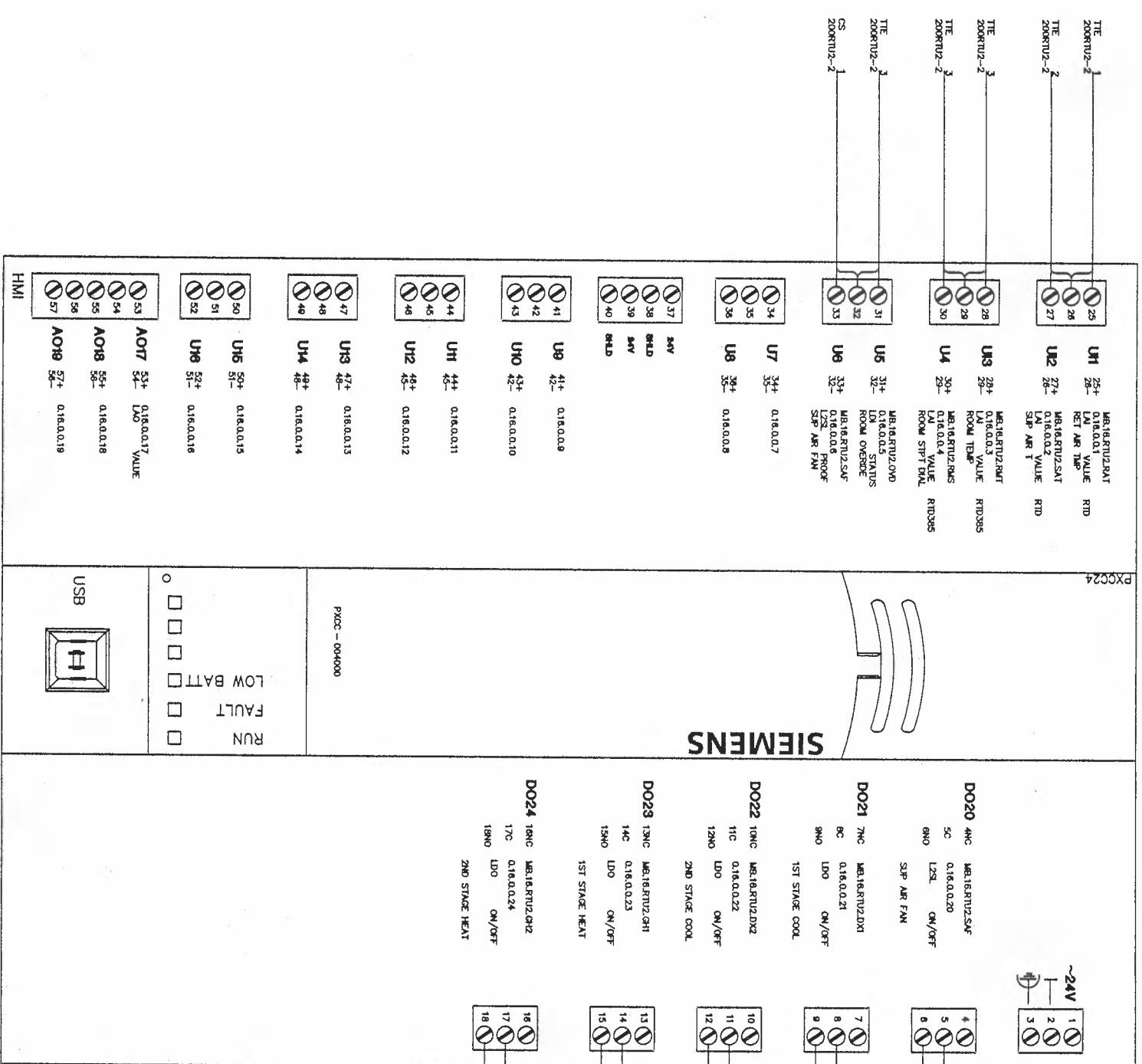
45470 Commerce Cir. Dr.  
 Plymouth Twp., NJ 08770  
 USA  
 PHONE: 734-458-3800  
 FAX: 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI  
 ENGINEER: SFM  
 CHECKED BY: SFM  
 INITIAL RELEASE: 10/27/06  
 LAST EDIT DATE: 12/03/07

440P-702374  
 200

RTU 2-2 CONTROL DIAGRAM  
 2-4



Terminal	Module	Address	Function
25	U1	25+	MA16.RTU2.BAT
26	U1	25+	016.0.0.1
27	U2	27+	RET AIR FAN
28	U2	27+	MA16.RTU2.SAT
29	U2	27+	016.0.0.2
30	U2	27+	MA16.RTU2.SAT
31	U3	29+	MA16.RTU2.BAT
32	U3	29+	016.0.0.3
33	U3	29+	MA16.RTU2.SAF
34	U3	29+	ROOM TEMP
35	U4	29+	MA16.RTU2.BMS
36	U4	29+	016.0.0.4
37	U4	29+	MA16.RTU2.BMS
38	U4	29+	ROOM STP1 VAL
39	U5	31+	MA16.RTU2.DM0
40	U5	31+	016.0.0.0
41	U5	31+	STATUS
42	U5	31+	ROOM OVERIDE
43	U6	32+	MA16.RTU2.SAF
44	U6	32+	016.0.0.6
45	U6	32+	PROOF
46	U6	32+	SFP AIR FAN
47	U7	34+	016.0.0.7
48	U8	35+	016.0.0.8
49	U9	41+	016.0.0.9
50	U9	42+	016.0.0.10
51	U10	43+	016.0.0.11
52	U10	43+	016.0.0.12
53	U11	44+	016.0.0.13
54	U11	44+	016.0.0.14
55	U12	45+	016.0.0.15
56	U12	45+	016.0.0.16
57	U13	46+	016.0.0.17
58	U13	46+	016.0.0.18
59	U14	47+	016.0.0.19
60	U14	47+	016.0.0.20

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: SFM  
INITIAL RELEASE: 10/27/06  
LAST EDIT DATE: 12/03/07

440P-702374  
200

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
CS 1	1	H608	VERIS	1006aut016	CUR SW SPLITCOR-ADJ SETPT W/LED
PS 15	1	PSH75AN	FUNCTIONAL DEVICES	1208aut034	PKMSPLY 75VA MLT-TAP W/O OULIT
PXC 15	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT P2 RS-485, ROOFTOP
SD 1-2	2	FBO	N/A	N/A	FURNISHED BY OTHERS
TOP 15	1	A-20H16ALPP	HOFFMAN	N/A	20"x16"x16" NEMA 4 ENCLOSURES
TTE 1-2	2	544-339	SIEMENS	149 261	D/P/T TEMP SENSOR,RTD,-40/240F
TTE 3	1	544 780FA	N/A	N/A	N/A

The constant volume roof top unit consists of a mixed air section with outdoor air dampers, pre-filter, DX cooling coil, gas heating section and supply fan. The unit is DDC controlled using electric actuation.

The roof top unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the system can enter the Warm-Up mode when the space temperature is below set point. The system stays in the Warm-Up until the mode set point is satisfied. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 65 degrees F (adj). The latest start time is the scheduled occupancy for the space.

The roof top unit operates in Warm-Up, Occupied, Unoccupied, Night Heating, and Safety modes as follows (All suggested set points and settings are adjustable.):

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The supply fan is off, the DX cooling is off, gas heating is off.

**Night Heating**  
The supply fan starts with the gas heating staging to maintain the room air temperature set point for a minimum space temperature of 65 degrees F (adj). The DX cooling remains off.

**Safety**  
Smoke detector in the return air stream de-energizes the supply fan upon activation.

A current switch is installed in the supply fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Monitoring**  
DDC system shall monitor the rooftop supply air temperature. DDC system shall monitor the rooftop return air temperature.

**Emergency Power**  
Rooftop RTU 2-3 to be controlled through the Building Management System not to operate until 2 minutes after generator is running.

## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ct. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

## ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJA</i>	10/27/06	12/03/07

## RTU 2-3 CONTROL DIAGRAM

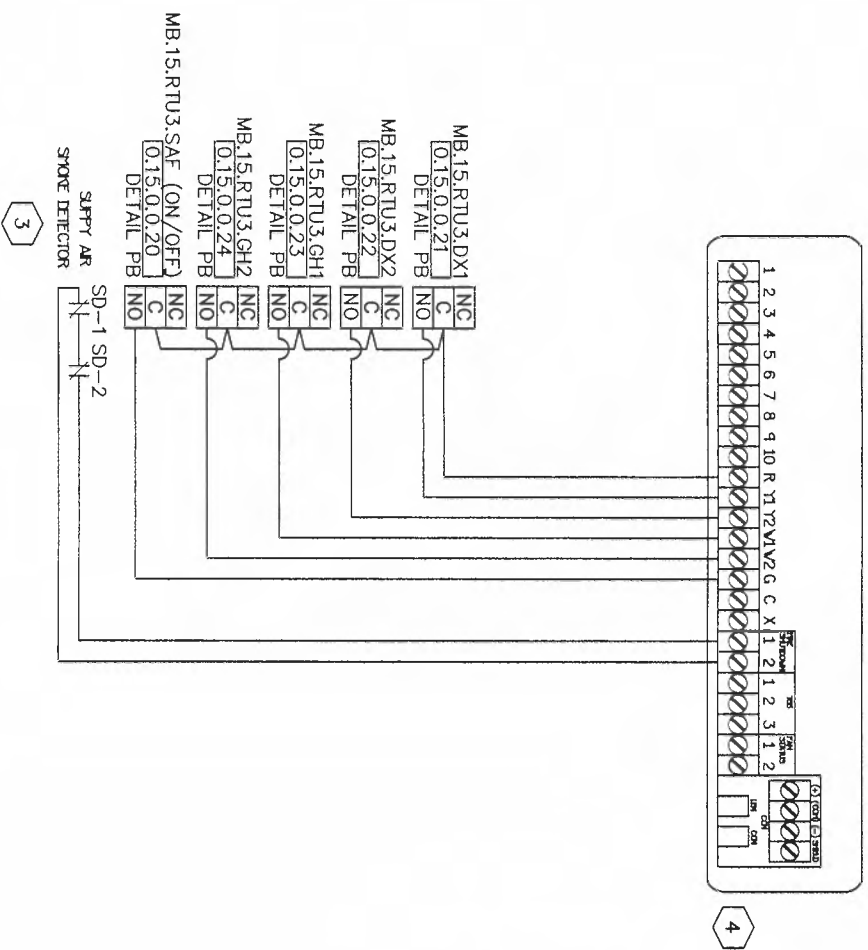
440P-702374

200

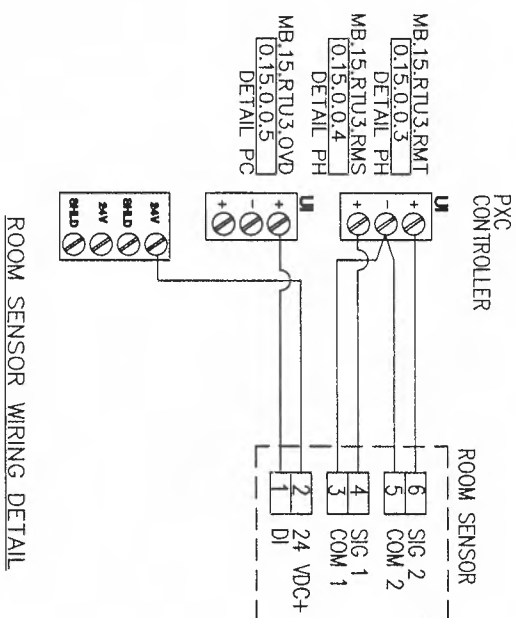
# 2-6A



ROOF TOP LOW VOLTAGE TERMINAL STRIP

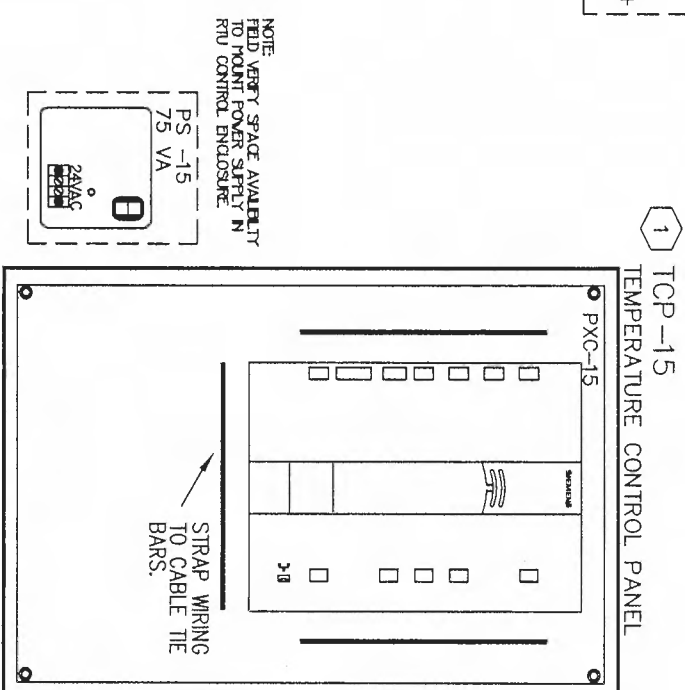


4



ROOM SENSOR WIRING DETAIL

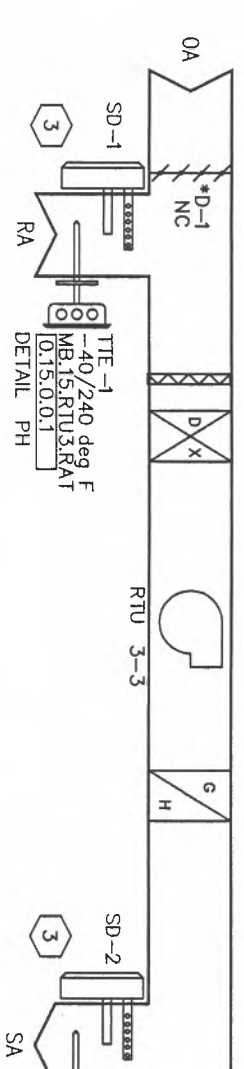
- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF RTU.
  - 2 WIRE POWER SUPPLY AFTER UNIT DISCONNECT.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL RTU TERMINATIONS.



1 TCP-15

TEMPERATURE CONTROL PANEL

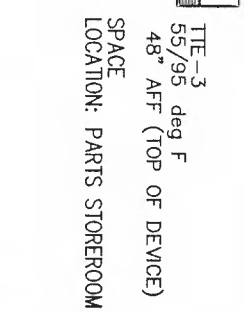
NOTE: OUTDOOR AIR ECONOMIZER DEVICES AND CONTROL ARE BY OTHERS.



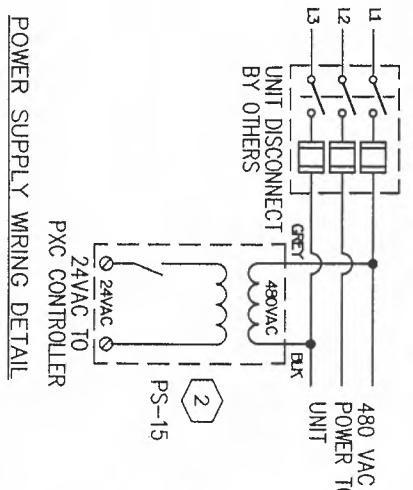
CS-1 MB.15.RTU3.SAF (PROOF) DETAIL PC

1 RTU 2-3 CONTROL DIAGRAM  
LOCATION: MAINTENANCE BUILDING ROOF  
SERVICES: PARTS STOREROOM, COMMUNICATION

2-6



SPACE LOCATION: PARTS STOREROOM



POWER SUPPLY WIRING DETAIL

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

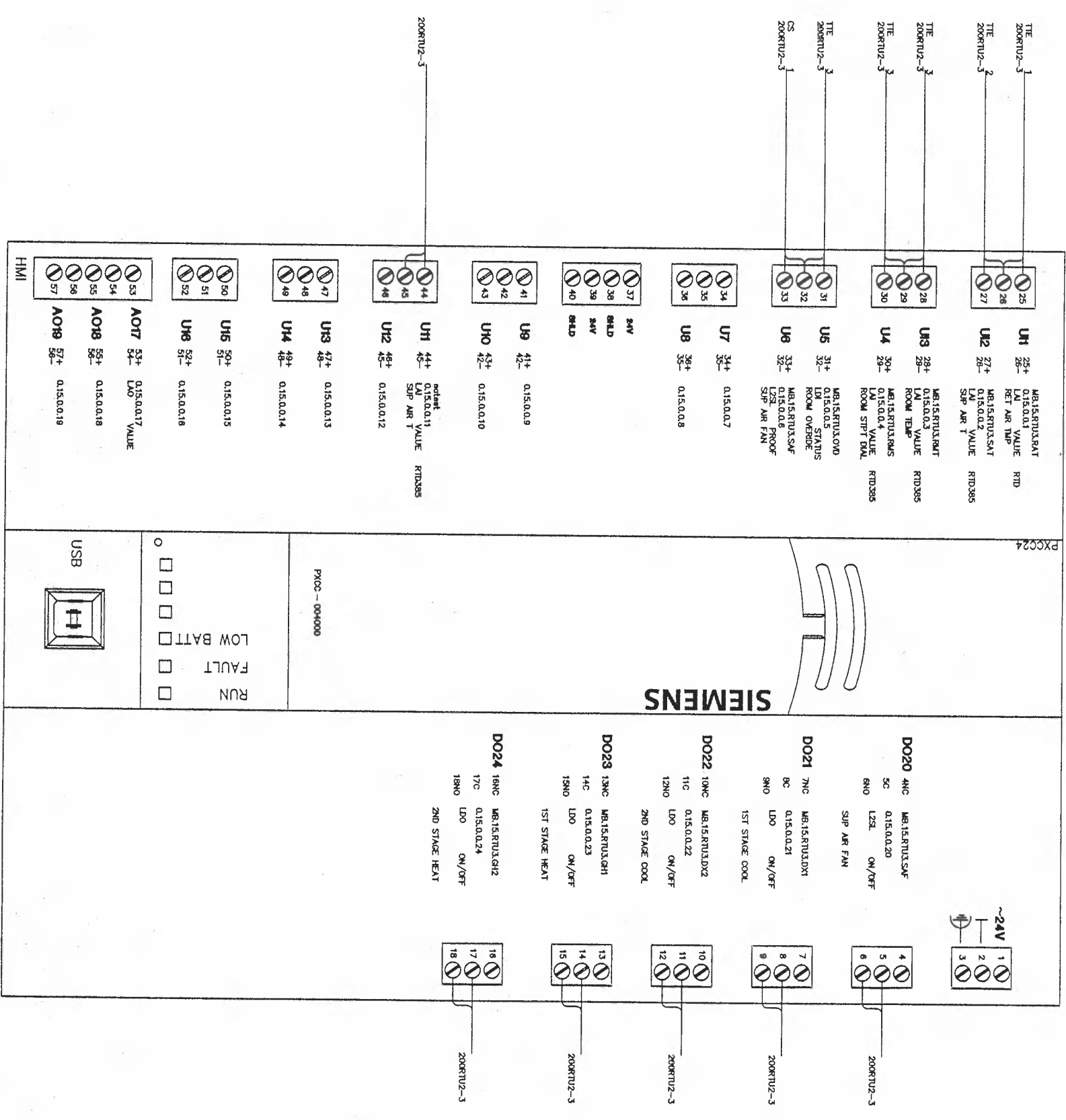
45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI  
ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: SFM  
INITIAL RELEASE: 10/27/06  
LAST EDIT DATE: 12/03/07

440P-702374  
200

2-6



**REVISION HISTORY**

1	11/28/2007	SFM	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-458-3800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRATER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/28/07

440P-702374  
200  
**2-7**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
<b>Field Mounted Devices</b>					
AE 1	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 2	1	GCA161.1P	SIEMENS	154001	MOD(V) SR,24V, MED. PLNM
AE 3	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 4	1	GCA121.1P	SIEMENS	154001	2 PT SR,24V,MED,PLNM
CS 1-2	2	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SEPT W/LED
D					SEE DAMPER SUBMITTAL
DPS 1-2	2	141-0518	SIEMENS	155 052	SMTCH, AIR FLOW, 1.0/12 WG
SD 1	1	FBO	N/A	N/A	FURNISHED BY OTHERS
TOP 18	1	A-20H16ALPP	HOFFMAN	N/A	20"x16"x16" NEMA 4 ENCLOSURES
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR, 16" PRB, RTD -40/240F
TTE 5	1	544-780FA	SIEMENS	149168	RM SNSR W/SIPL, IND, OVRD, BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
<b>Panel Mounted Devices</b>					
PS 18	1	PSH75A/75AN	FUNCTIONAL DEVICES	1208cut1145	DUAL PHRSPLY 75A/75A MLT-TAP
PXC 18	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP
TB 1	1	TSI.5/10WP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj.).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-456-8800  
FAX: 888-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM		10/27/08	12/03/07

#### ERU 2-1 CONTROL DIAGRAM

440P-702374  
200

2-8A

**Occupied**  
The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

**Unoccupied**  
The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

**Night Heating**  
Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

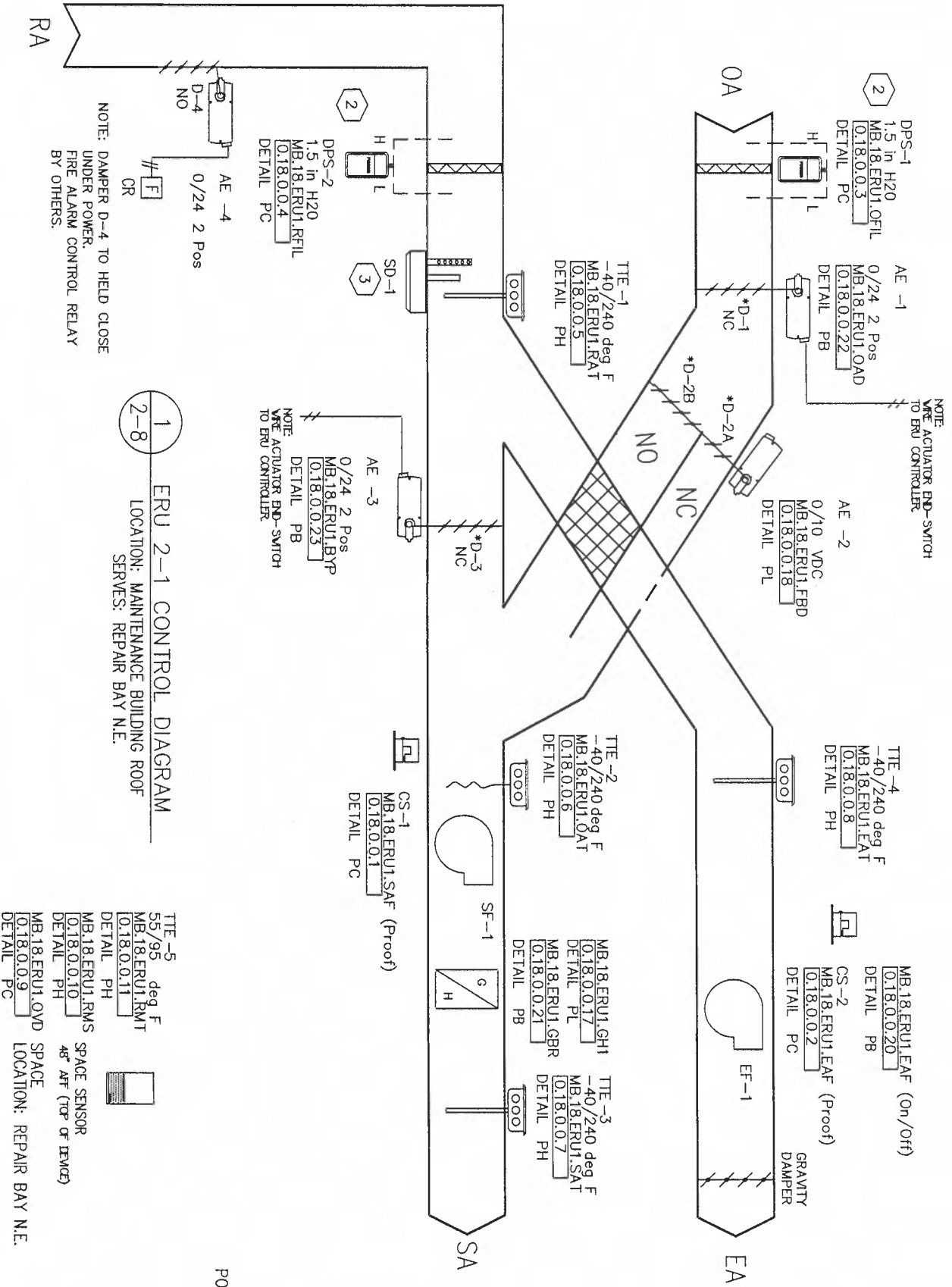
**Safety**  
Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Emergency Power**  
Rooftop ERU 2-1 to be controlled through the Building Management System not to operate until 2 minutes after generator is running.

**Gas Monitoring System**  
Damper D-4 installed on side of exhaust air riser shall be held closed under power. Upon alarm from the Gas Monitoring System, the local fire alarm control relay (By others) shall interrupt power to damper actuator opening the control damper.

- INSTALLATION NOTES:
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.



1 ERU 2-1 CONTROL DIAGRAM  
 LOCATION: MAINTENANCE BUILDING ROOF  
 SERVES: REPAIR BAY N.E.

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

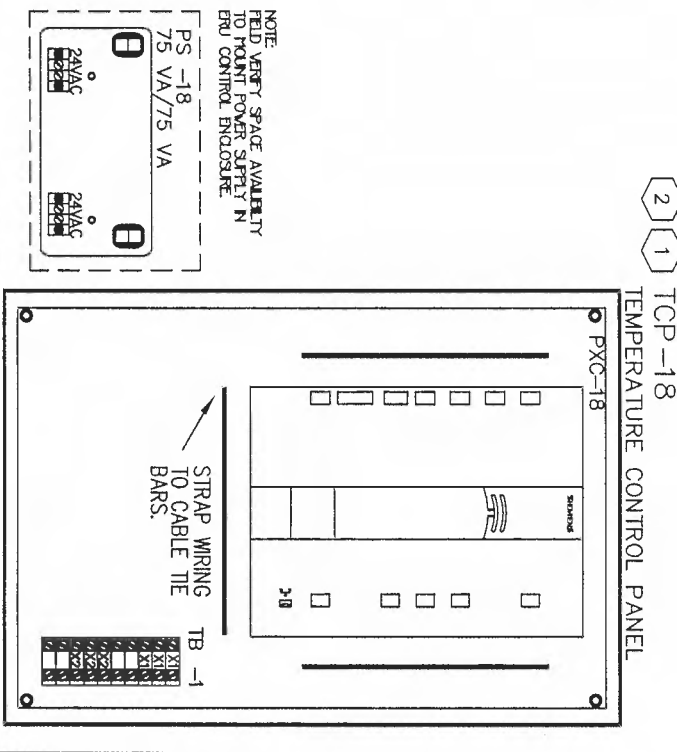
Siemens Building Technologies  
 BAU

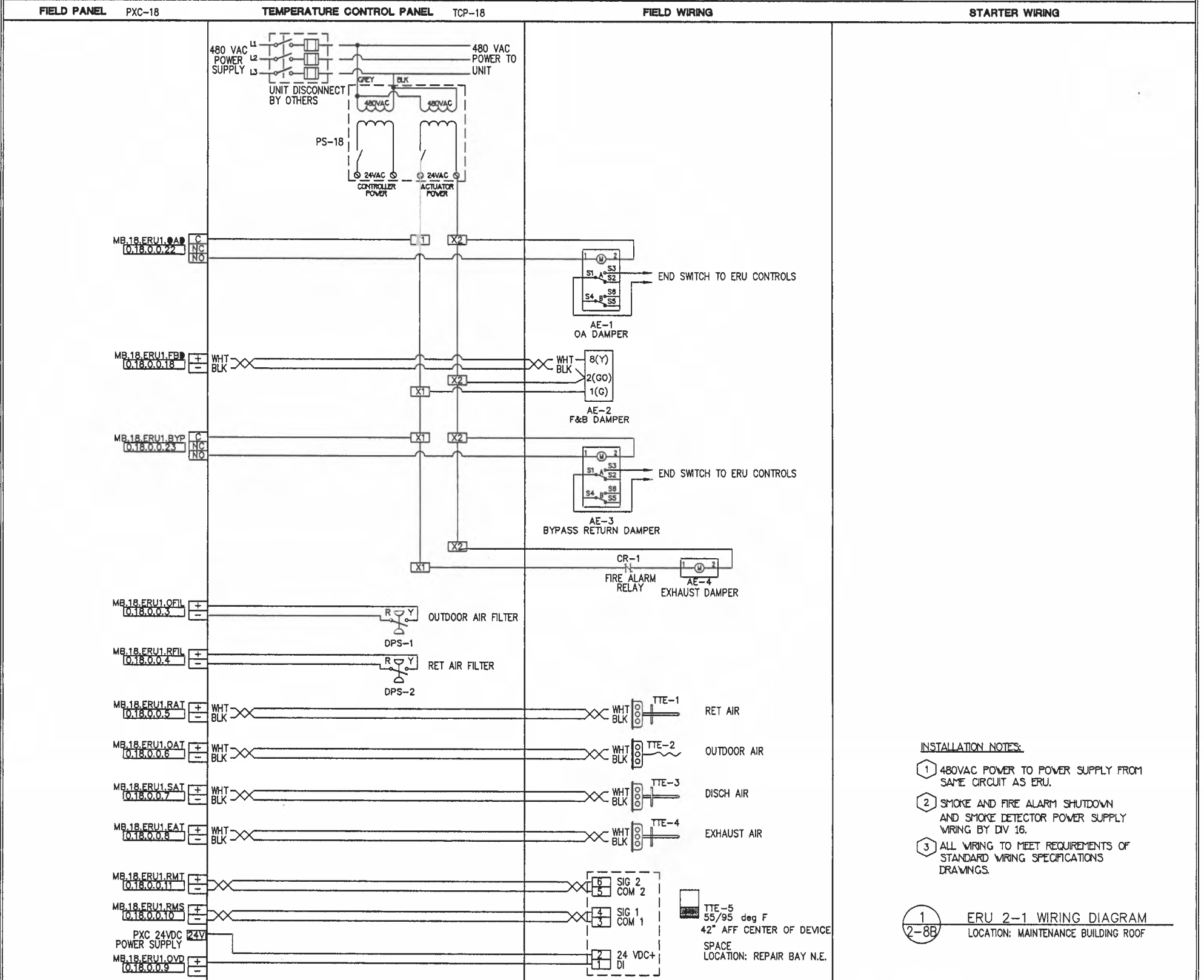
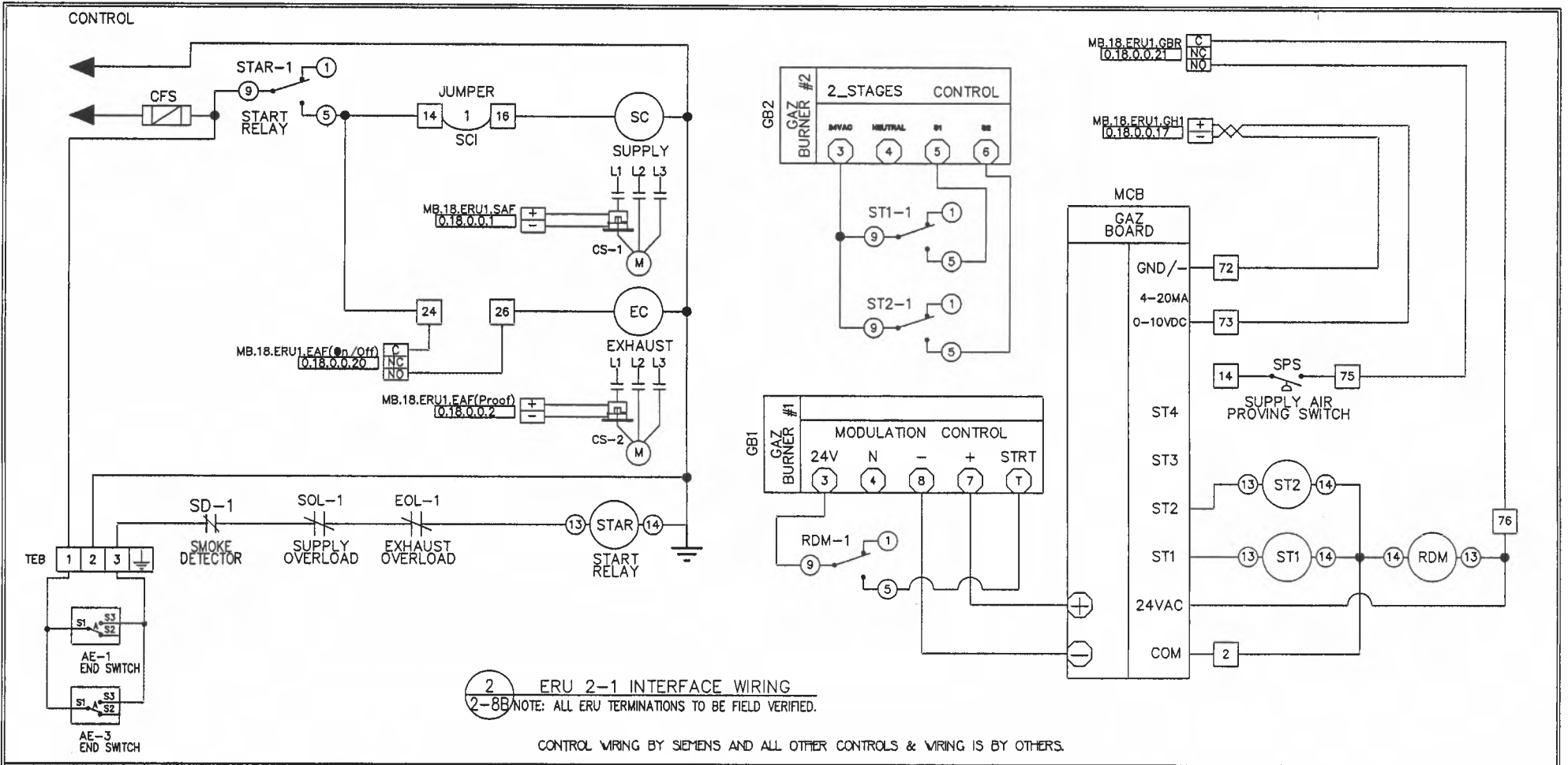
45470 Commerce Ct. Dr.  
 Plymouth Twp., MA 01870  
 USA  
 PHONE: 734-458-3800  
 FAX: 866-815-0749

ANN ARBOR MAINTENANCE FACILITY

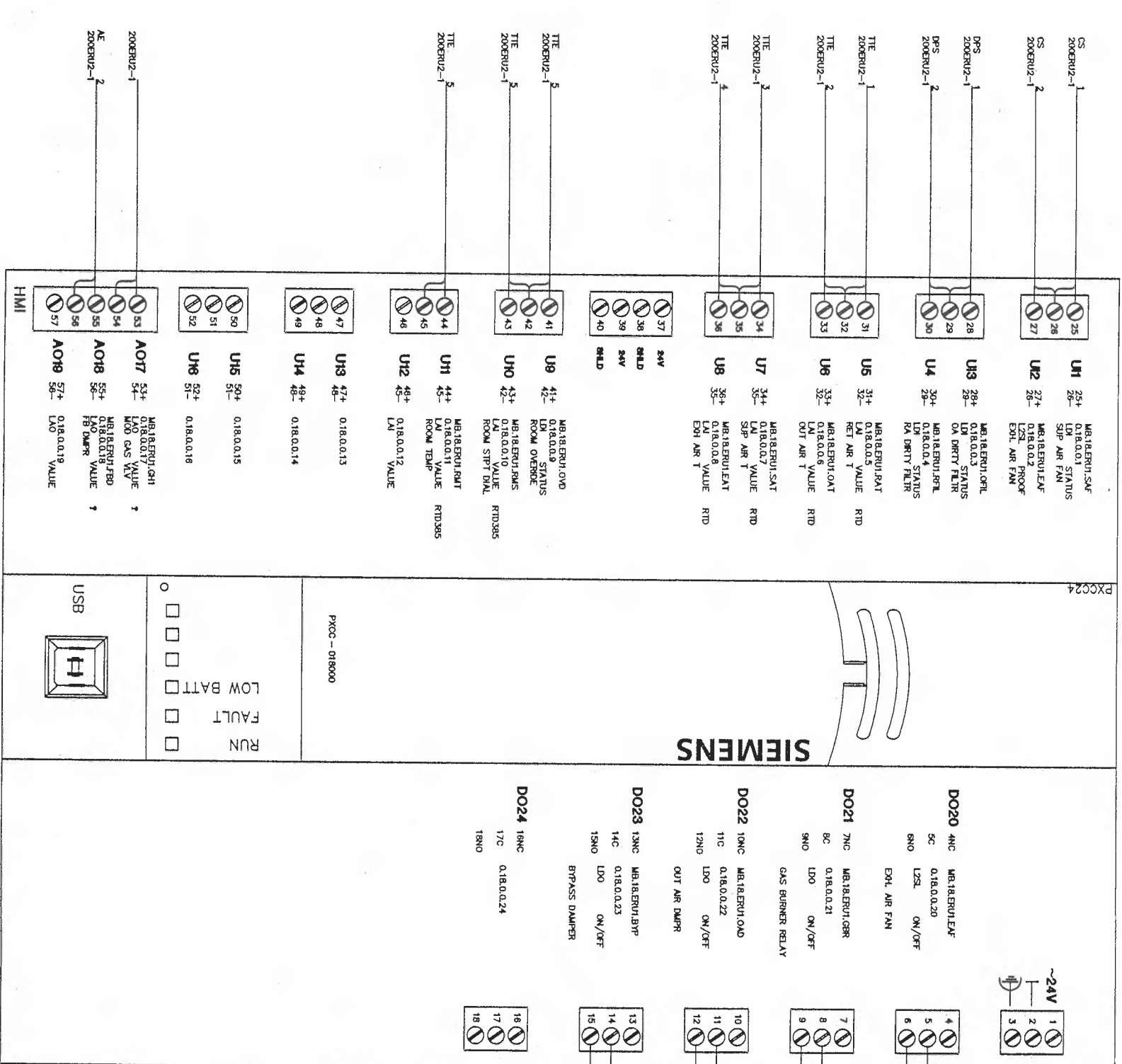
ANN ARBOR, MI	ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
	SFM	SFM	SFM	10/27/06	11/30/07

440P-702374  
 200  
**2-8**





<b>REVISION HISTORY</b>		<b>SIEMENS</b>	45470 Commerce Ctr. Dr. Plymouth Twp. MI 48170 USA Phone: 734-456-3800 Fax: 866-815-0749	<b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI		440P-702374 200
1	11/28/2007 KJ AS-BUILT DRAWING			ENGINEER SFM	DRAFTER SFM	CHECKED BY JTH



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**  
 Siemens Building Technologies  
 BAU

45470 Commerce Ct. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-456-3800  
 Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**  
 ANN ARBOR, MI  
 ENGINEER: DRAPIER  
 CHECKED BY: INITIAL RELEASE  
 SFM SFM  
 10/27/06 11/30/07

440P-702374  
 200  
**2-9**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
<b>Field Mounted Devices</b>					
AE 1	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 2	1	GCA161.1P	SIEMENS	154001	MOD(V) SR,24V, MED, PLNM
AE 3	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 4	1	GCA121.1P	SIEMENS	154001	2 PT SR,24V,MED,PLNM
CS 1-2	2	H608	VERIS	1006aut016	CUR SW SPLICOR-ADJ SETPT W/LED
D					SEE DAMPER SUBMITTAL
DPS 1-2	2	141-0518	SIEMENS	155 052	SWTCH,AIR FLOW,1.0/12 WG
SD 1	1	FBO	N/A	N/A	FURNISHED BY OTHERS
TCP 19	1	A-20H16ALPP	HOFFMAN	N/A	20"x16"x16" NEMA 4 ENCLDSURES
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR,16"PRB,RTD -40/240F
TTE 5	1	544-780FA	SIEMENS	149168	RM SNSR W/STPT,IND,OVRO,BEGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
<b>Panel Mounted Devices</b>					
PS 19	1	PSH75A/75AN	FUNCTIONAL DEVICES	1208aut145	DUAL PMSRPLY 75A/75A MLI-TAP
PXC 19	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-P.T, P2 RS-485, ROOFTOP
TB 1	1	TSI.5/10WP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj.).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILD DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	CP/L	10/27/06	11/30/07

#### ERU 2-2 CONTROL DIAGRAM

440P-702374  
200

# 2-10A

**Occupied**  
The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

**Unoccupied**  
The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

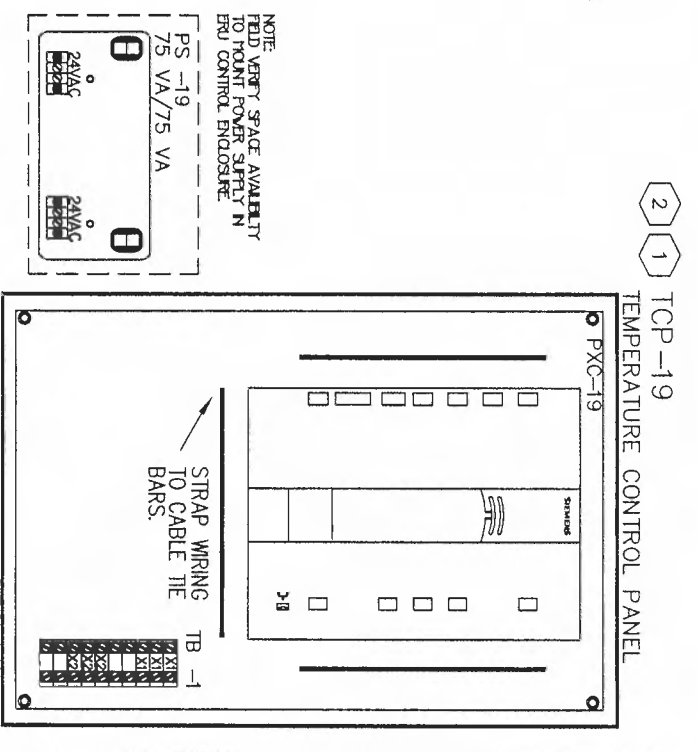
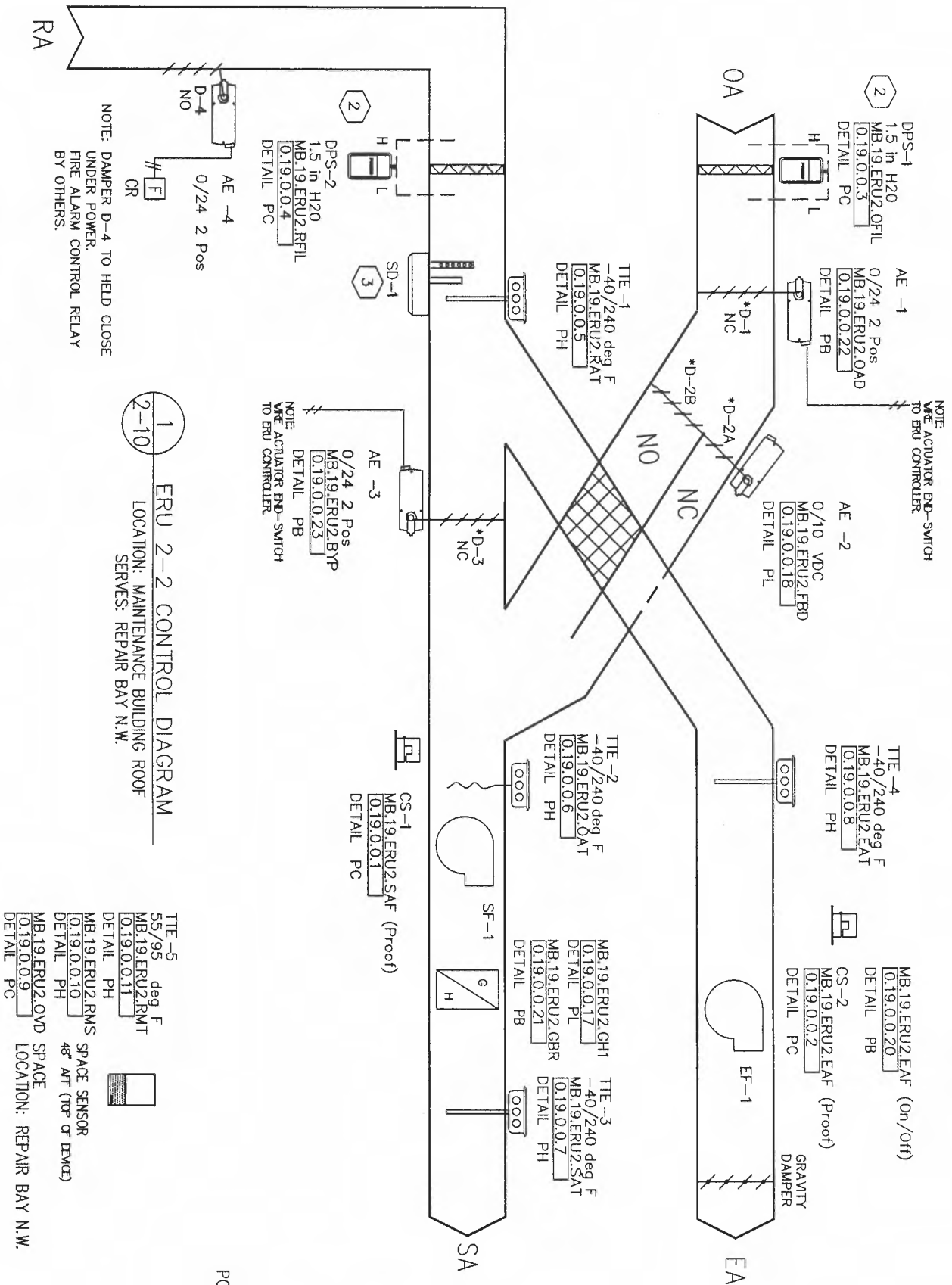
**Night Heating**  
Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

**Safety**  
Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Gas Monitoring System**  
Damper D-4 installed on side of exhaust air riser shall be held closed under power. Upon alarm from the Gas Monitoring System, the local fire alarm control relay (By others) shall interrupt power to damper actuator opening the control damper.

- INSTALLATION NOTES:
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

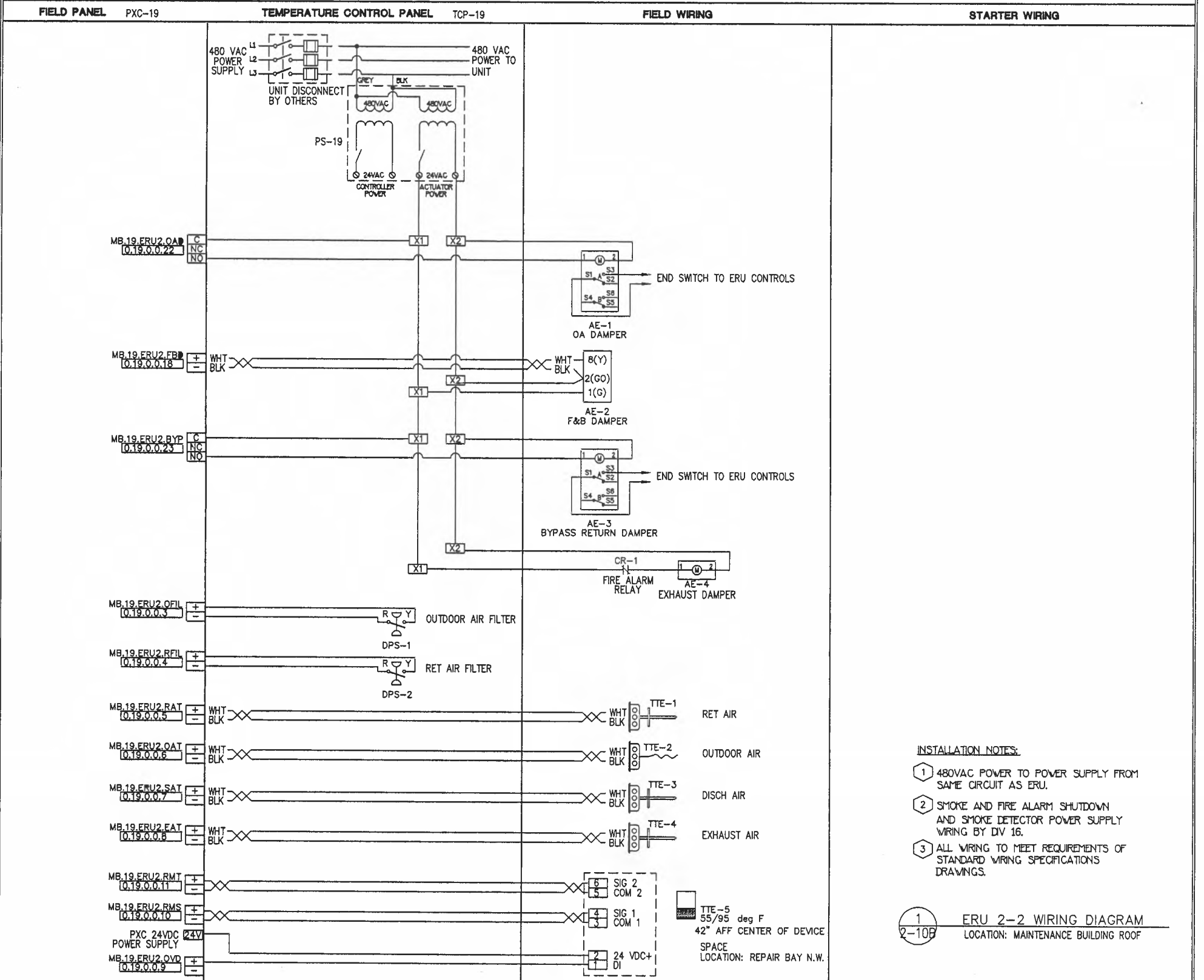
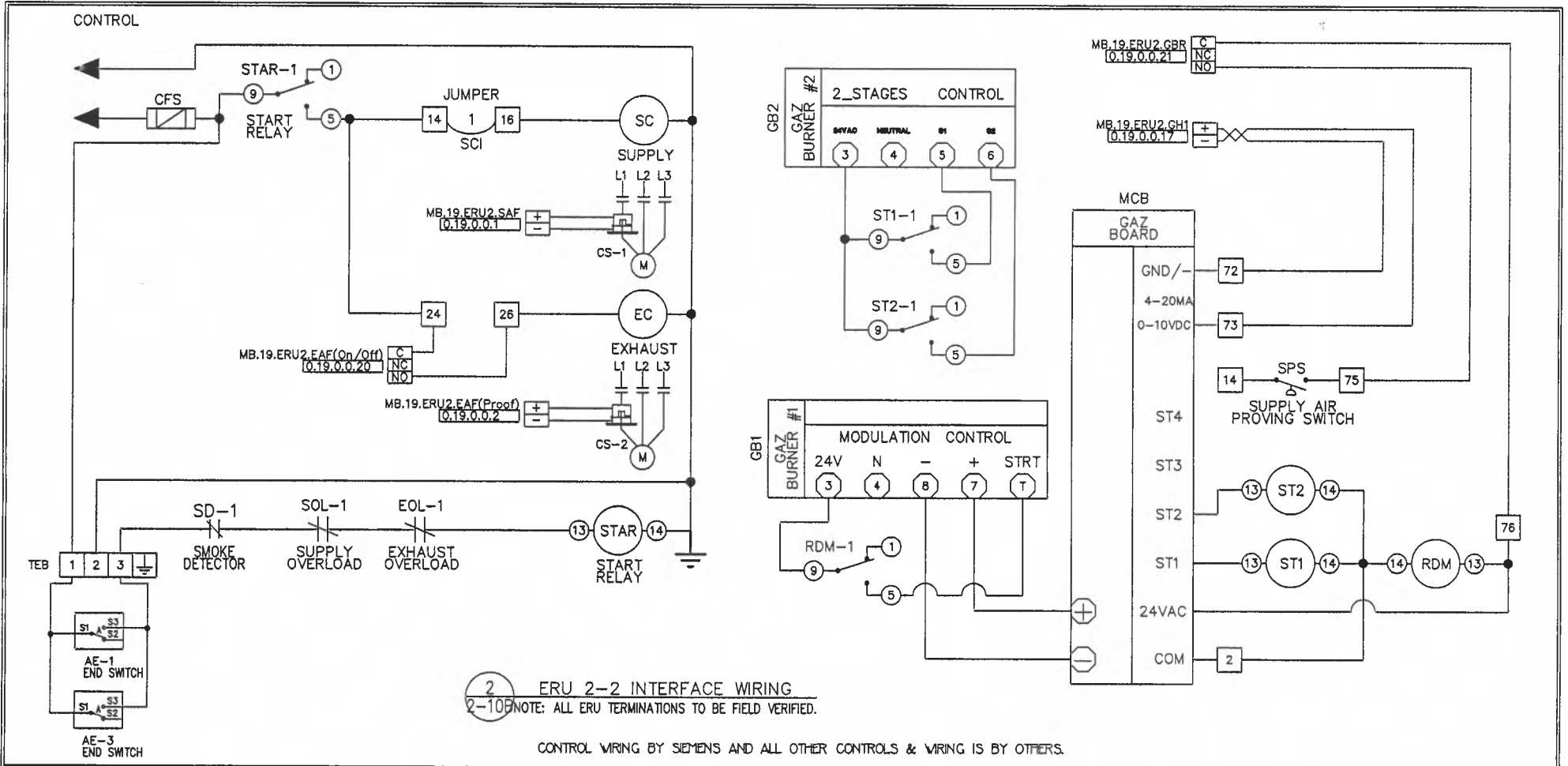
**ANN ARBOR MAINTENANCE FACILITY**

ENGINEER	ANN ARBOR, MI
DRAWN	SFM
CHECKED BY	SFM
INITIAL RELEASE	10/27/06
LAST EDIT DATE	11/30/07

440P-702374  
200

**2-10**





<b>REVISION HISTORY</b> 1   11/28/2007   KJ   AS-BUILT DRAWING		<b>SIEMENS</b> Siemens Building Technologies BAU		45470 Commerce Ctr. Dr. Plymouth Twp. MI. 48170 USA Phone: 734-458-3800 Fax: 866-815-0749		<b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI ENGINEER: SFM   DRAFTER: SFM   CHECKED BY: WJL   INITIAL RELEASE: 10/27/06   LAST EDIT DATE: 12/03/07		440P-702374 200 <b>2-10B</b>	
<b>ERU 2-2 WIRING DIAGRAM</b>									

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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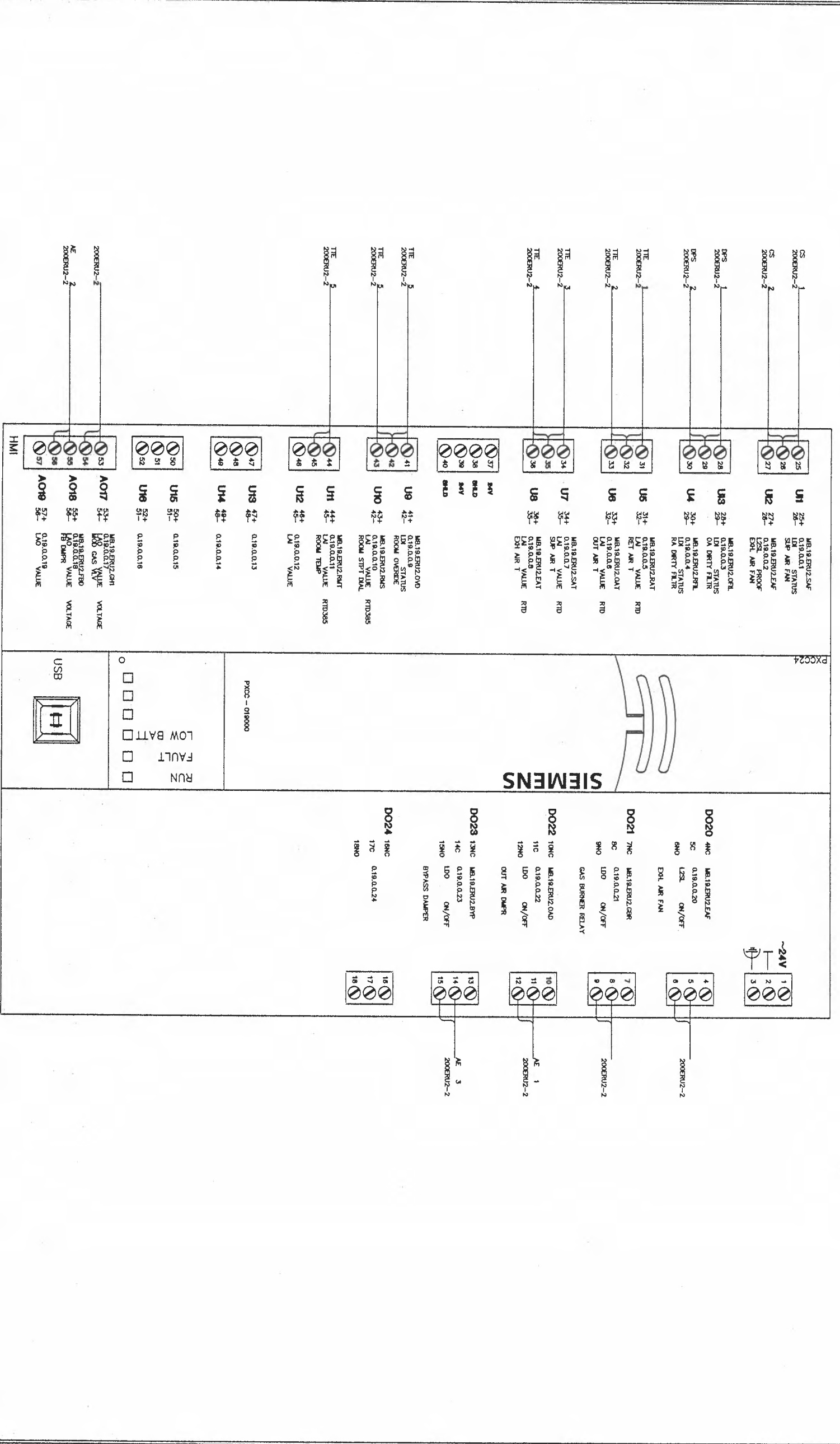
**SIEMENS**

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
Mt. Pleasant, MI 48170 USA  
Phone: 734-456-9800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**  
**ANN ARBOR, MI**

ENGINEER | DRAFTER | CHECKED BY | INITIAL RELEASE | LAST EDIT DATE  
SFM | SFM | *CJK* | 10/27/08 | 11/30/07

440P-702374  
200  
**2-11**



Control Device	Qty	Product Number	Manufacturer	Document Number	Description
<b>Field Mounted Devices</b>					
AE 1	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 2	1	GCA161.1P	SIEMENS	154001	MOD(V) SR,24V, MED. PLNM
AE 3	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 4	1	GCA121.1P	SIEMENS	154001	2 PT SR,24V,MED,PLNM
CS 1-2	2	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SETPT W/LED
ID					SEE DAMPER SUBMITTAL
DPS 1-2	2	141-0518	SIEMENS	155 052	SWITCH,AIR FLOW,1.0/12 WG
SD 1	1	FBO	N/A	N/A	FURNISHED BY OTHERS
TOP 21	1	A-20H16ALPP	HOFFMAN	N/A	20"X16"X16" NEMA 4 ENCLOSURES
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR,18"PRB,RD -40/240F
TTE 5	1	544-780FA	SIEMENS	149168	RM SNSR W/STPT,IND,OVRO,DEGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
<b>Panel Mounted Devices</b>					
PS 21	1	PSH75A/75AN	FUNCTIONAL DEVICES	1208cut145	DUAL PMSRPLY 75A/75A MLT-TAP
PXC 21	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP
TB 1	1	TB1.5/10WP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ct. Dr.  
Plymouth Twp., MA 048170  
USA  
PHONE: 734-468-3900  
FAX: 866-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>gfk</i>	10/27/06	11/30/07

#### ERU 2-3 CONTROL DIAGRAM

440P-702374

200

2-12A

**Occupied**  
The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

**Unoccupied**  
The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

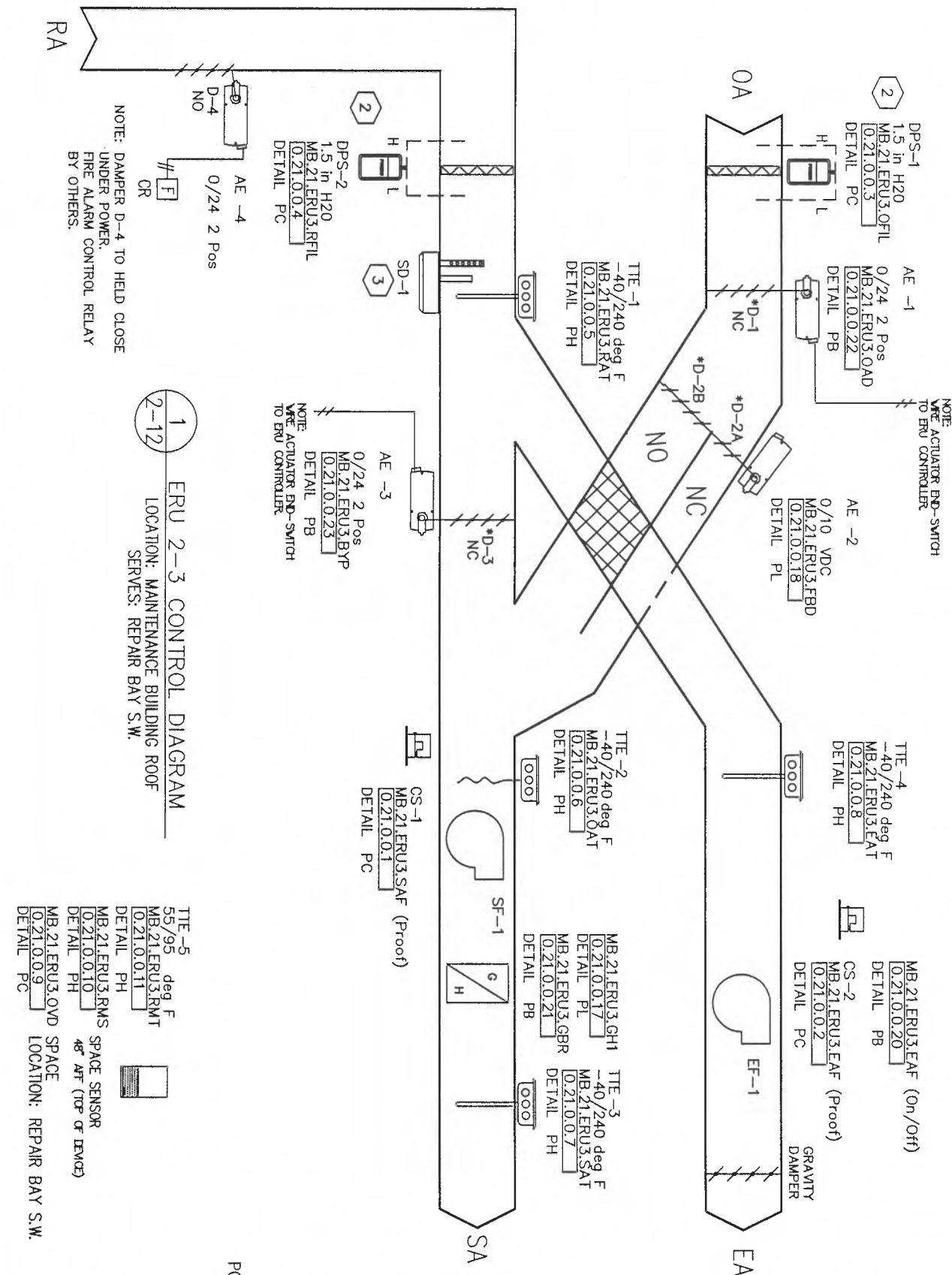
**Night Heating**  
Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

**Safety**  
Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**Gas Monitoring System**  
Damper D-4 installed on side of exhaust air riser shall be held closed under power. Upon alarm from the Gas Monitoring System, the local fire alarm control relay (By others) shall interrupt power to damper actuator opening the control damper.

- INSTALLATION NOTES:
- TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - FIELD VERIFY ALL ERU TERMINATIONS.
  - UNIT CONFIGURATION WILL BE FIELD VERIFIED.



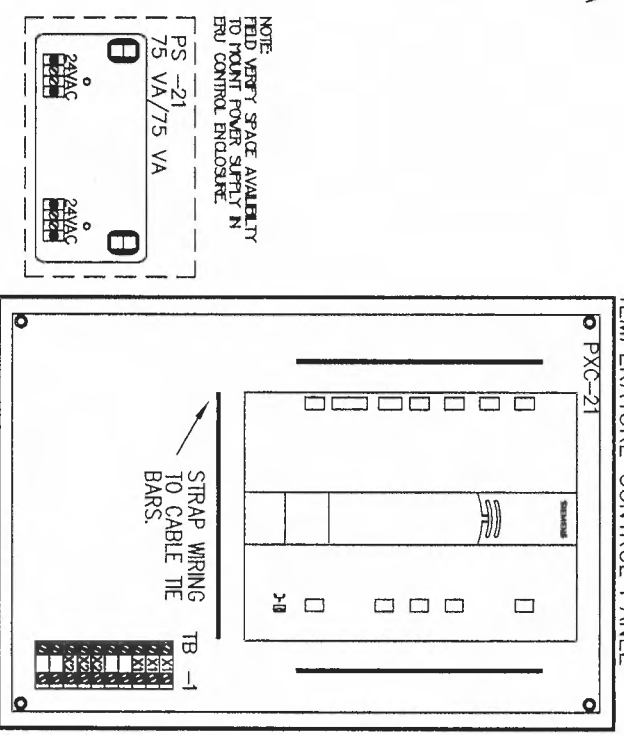
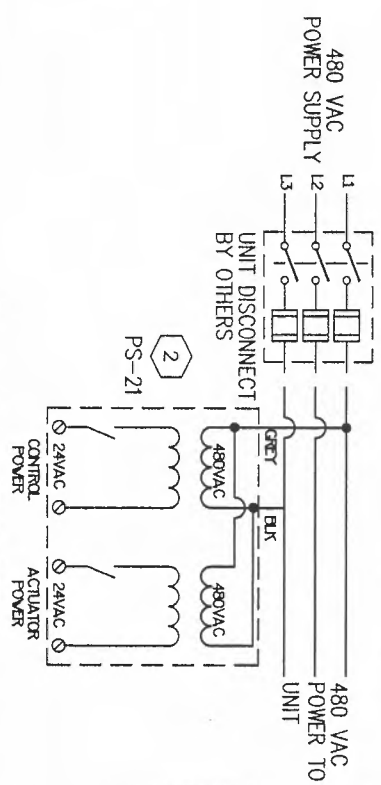
NOTE: DAMPER D-4 TO HELD CLOSE UNDER POWER. FIRE ALARM CONTROL RELAY BY OTHERS.

NOTE: ACTUATOR END-SWITCH TO ERU CONTROLLER

NOTE: ACTUATOR END-SWITCH TO ERU CONTROLLER

NOTE: FIELD VERIFY SPACE AVAILABILITY TO MOUNT SAFETY IN ERU CONTROL ENCLOSURE.

POWER SUPPLY WIRING DETAIL



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

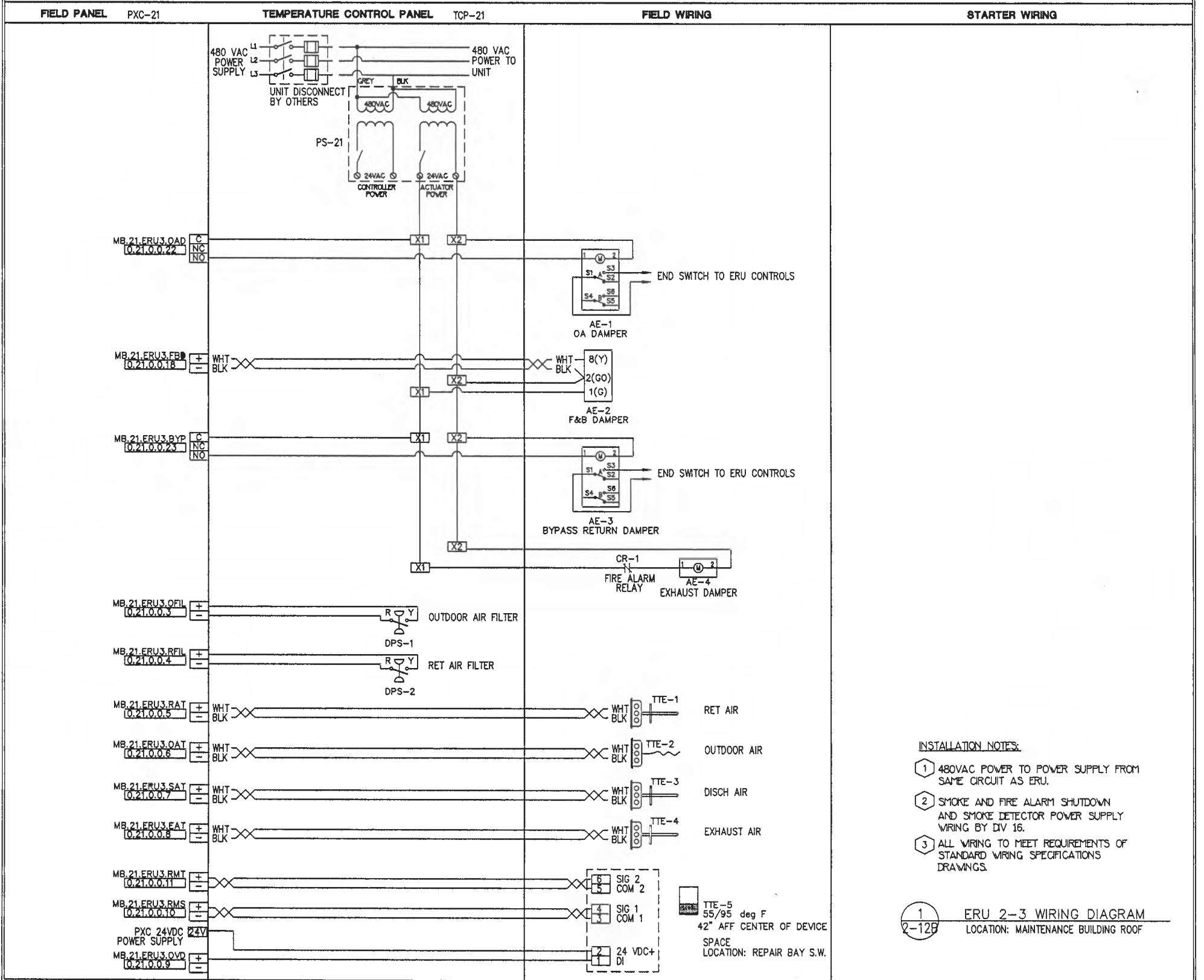
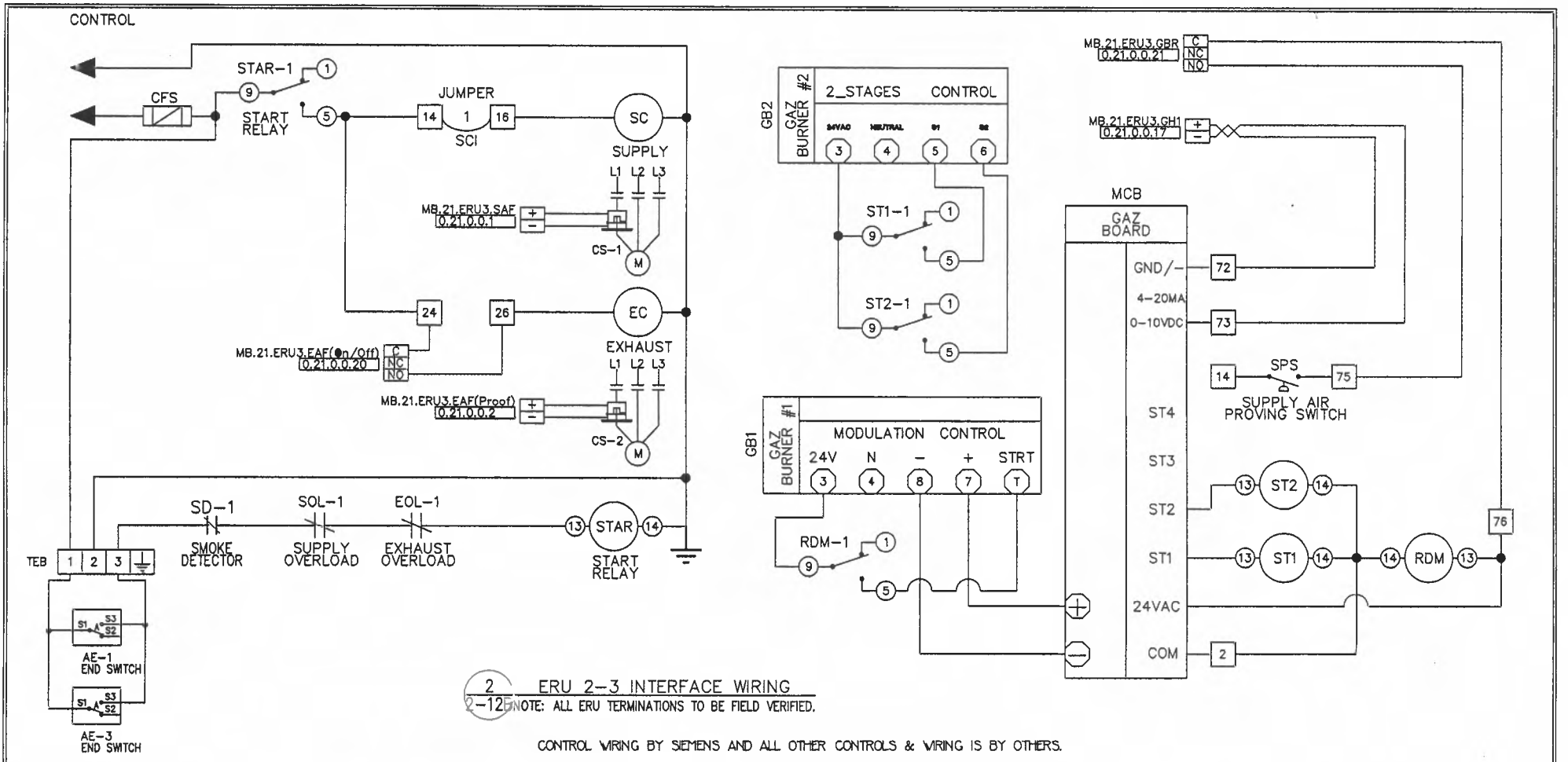
ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJL</i>	10/27/06	11/30/07

440P-702374  
200

2-12



<b>REVISION HISTORY</b>		<b>SIEMENS</b>		<b>ANN ARBOR MAINTENANCE FACILITY</b>		<b>440P-702374</b>	
1	11/28/2007	KJ	AS-BUILT DRAWING	ANN ARBOR, MI		200	
Siemens Building Technologies BAU				45470 Commerce Ctr. Dr. Plymouth Twp. MI 48170 USA Phone: 734-458-3800 Fax: 866-815-0749		ENGINEER: SFM DRAFTER: SFM CHECKED BY: LTH INITIAL RELEASE: 10/27/08 LAST EDIT DATE: 11/30/07	
						<b>2-12B</b>	
						<b>ERU 2-3 WIRING DIAGRAM</b>	

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**  
 Siemens Building Technologies  
 BAU

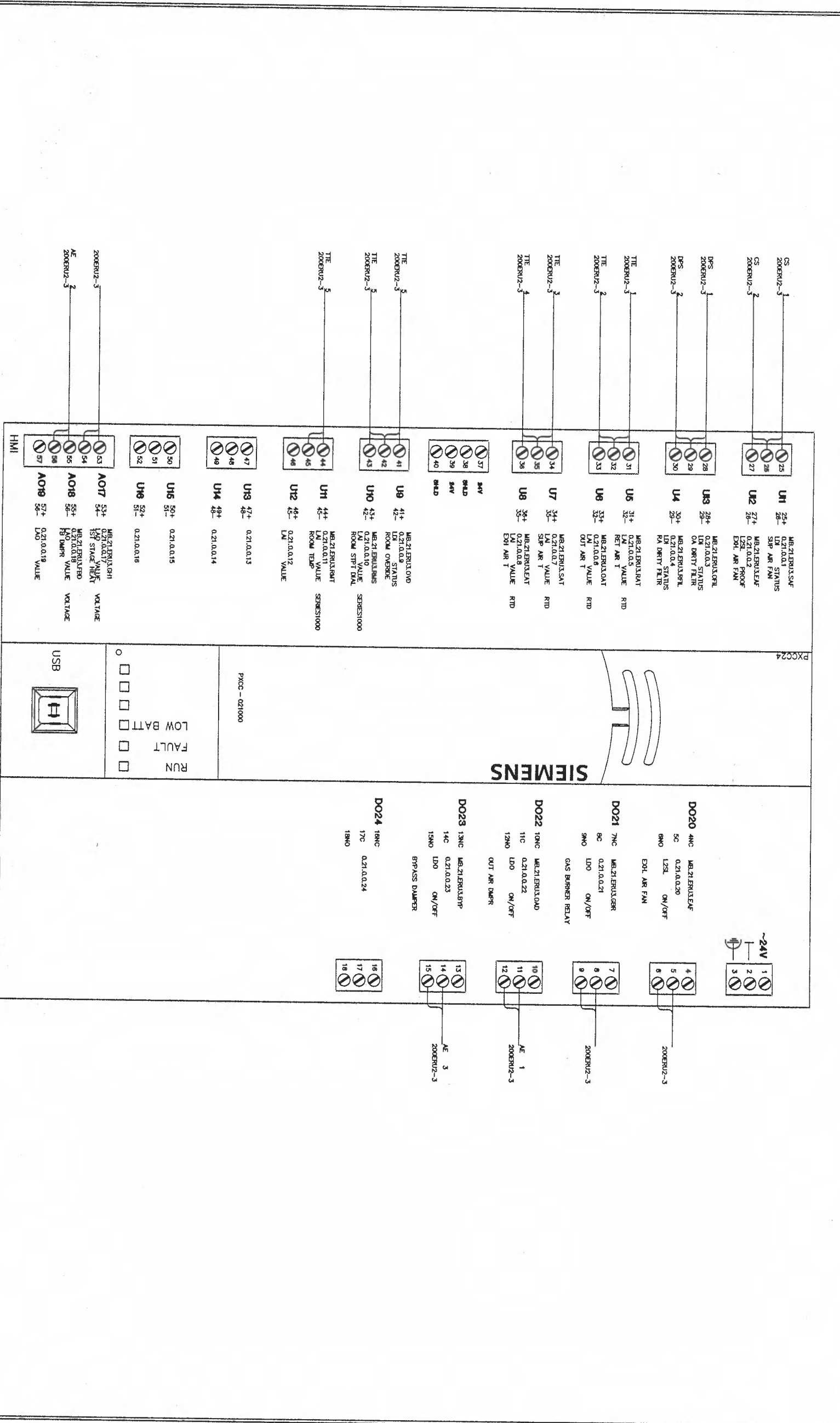
**ANN ARBOR MAINTENANCE FACILITY**  
 ANN ARBOR, MI

440P-702374  
 200

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-468-3800  
 Fax: 888-615-0749

ENGINEER: SFM  
 DRAFTER: SFM  
 CHECKED BY: SFM  
 INITIAL RELEASE: 10/27/06  
 LAST EDIT DATE: 11/30/07

**2-13**



Control Device	Qty	Product Number	Manufacturer	Document Number	Description
<b>Field Mounted Devices</b>					
AE 1-3	3	GCA126.1P	SIEMENS	154001	2 PT SR.24V/MED./S./PLNM.
AE 4	1	GCA121.1P	SIEMENS	154001	2 PT SR.24V/MED./PLNM
CS 1-2	2	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SETPT W/LED
SD 1	1	FBO	FBO	N/A	FURNISHED BY OTHERS
TOP 20	1	A-20H16ALPP	HOFMANN	N/A	20"x16"x16" NEMA A ENCLOSURE
TTE 1-4	4	544-343	SIEMENS	149 261	D./AV SNSR,18"PRB,RID -40/240F
TTE 5	1	544-780FA	SIEMENS	149 312	RM SNSR W/STPT,IND.OVRD.BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
<b>Panel Mounted Devices</b>					
DPS 1-2	2	141-0518	SIEMENS	155 052	SWTCH,AIR FLOW,1.0/12 WG
PS 20	1	PSH75A/75AN	FUNCTIONAL DEVICES	1208cut145	DUAL PWRSPLY 75A/75A M.L.T-TAP
PXC 20	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, RS-485, ROOFTOP
TB 1	1	TSL.5/10WP	N/A	149454	TERMINAL STRIP, 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### Occupied

The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or

greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

#### Unoccupied

The supply fan is off. The exhaust fan is off. The gas heating is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

#### Night Heating

Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

#### Safety

Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

#### Gas Monitoring System

Damper D-4 installed on side of exhaust air riser shall be held closed under power. Upon alarm from the Gas Monitoring System, the local fire alarm control relay (By others) shall interrupt power to damper actuator opening the control damper.

#### REVISION HISTORY

2	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-468-9800  
FAX: 888-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	2/21	10/27/08	11/30/07

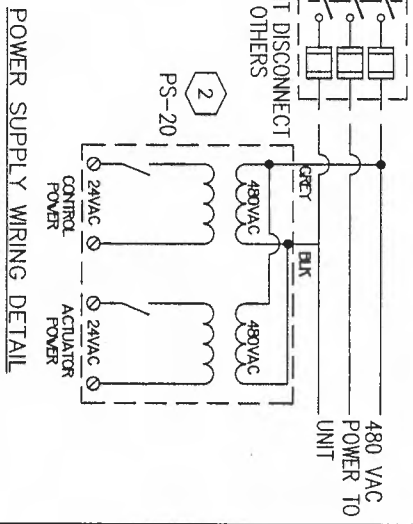
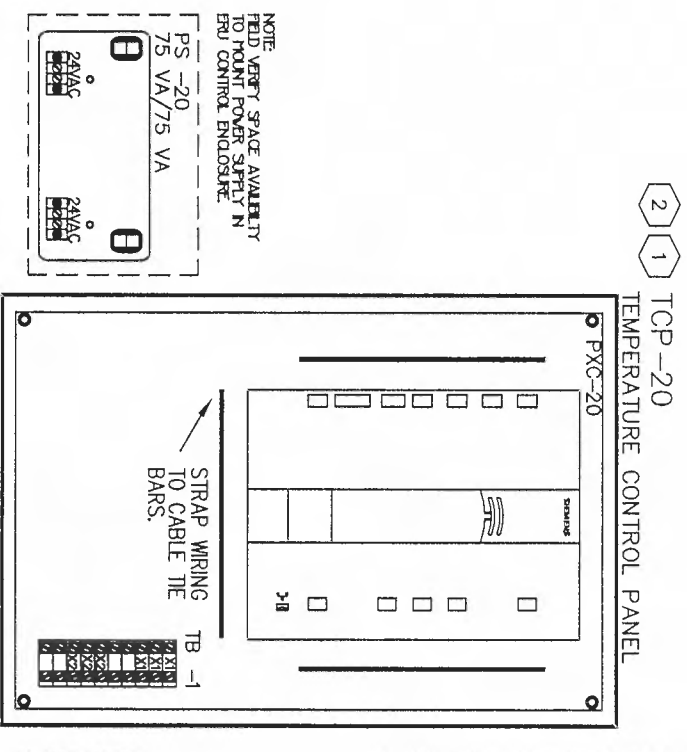
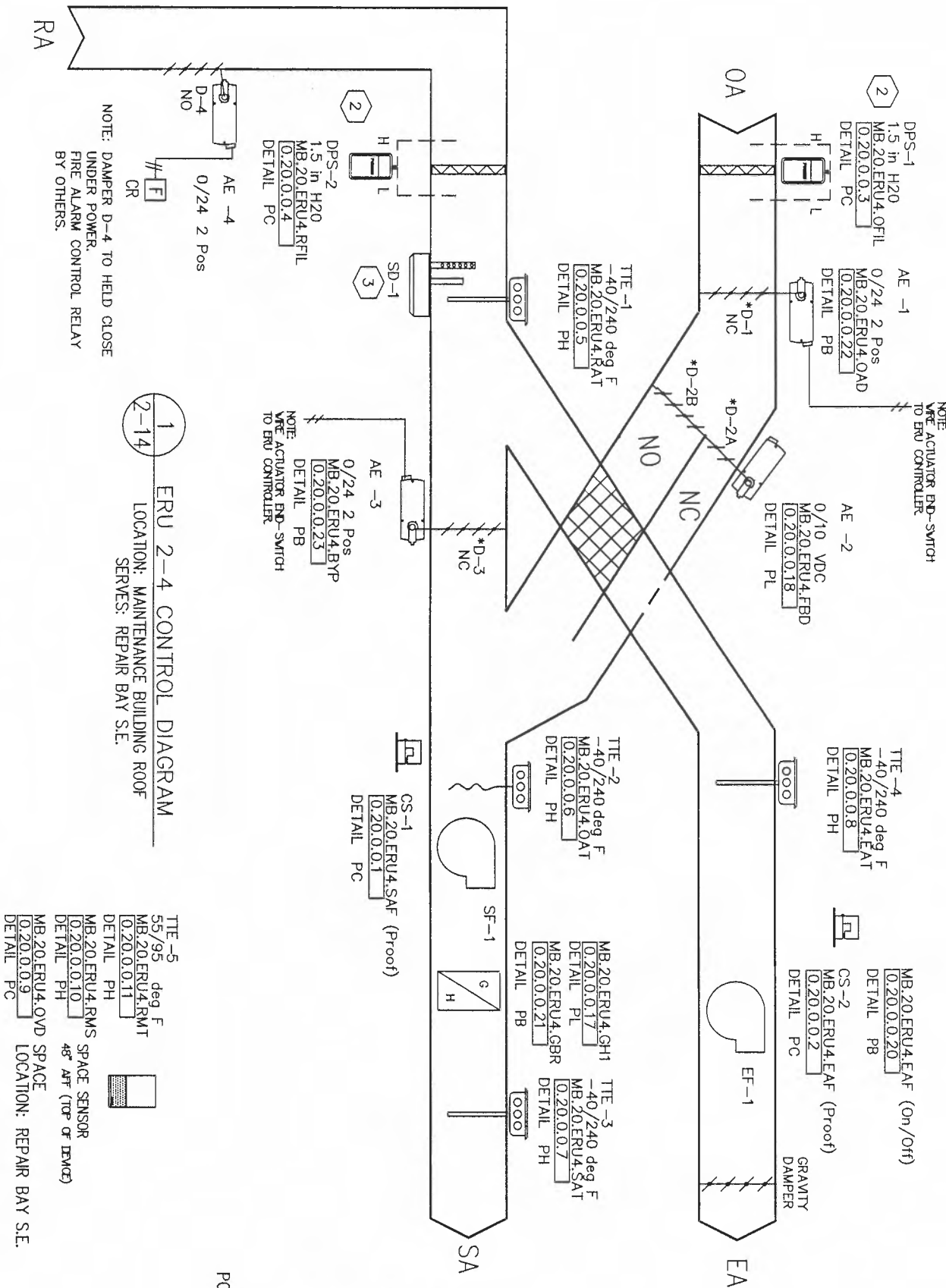
#### ERU 2-4 CONTROL DIAGRAM

440P-702374

200

2-14A

- INSTALLATION NOTES:**
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-458-3900  
Fax: 888-815-0749

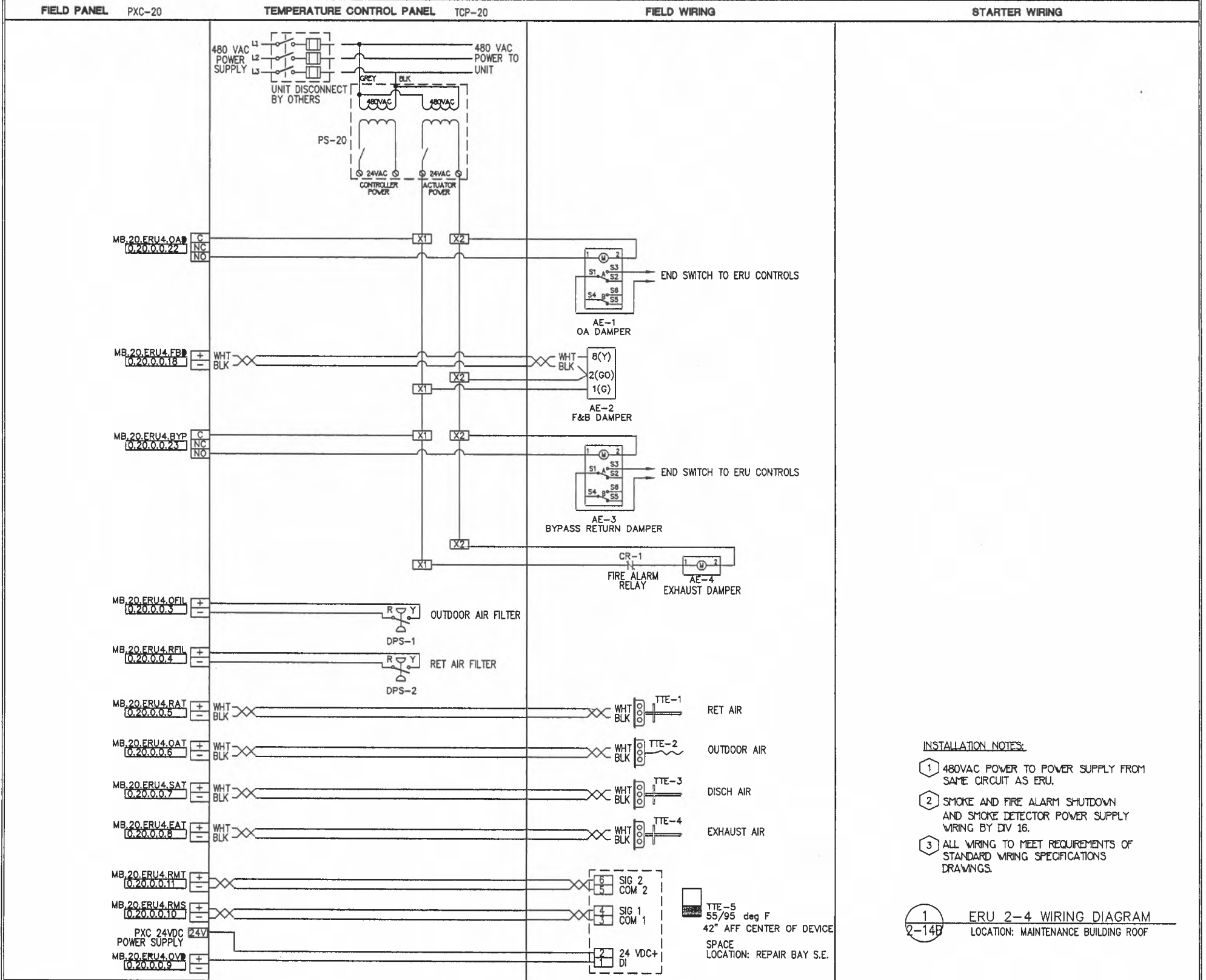
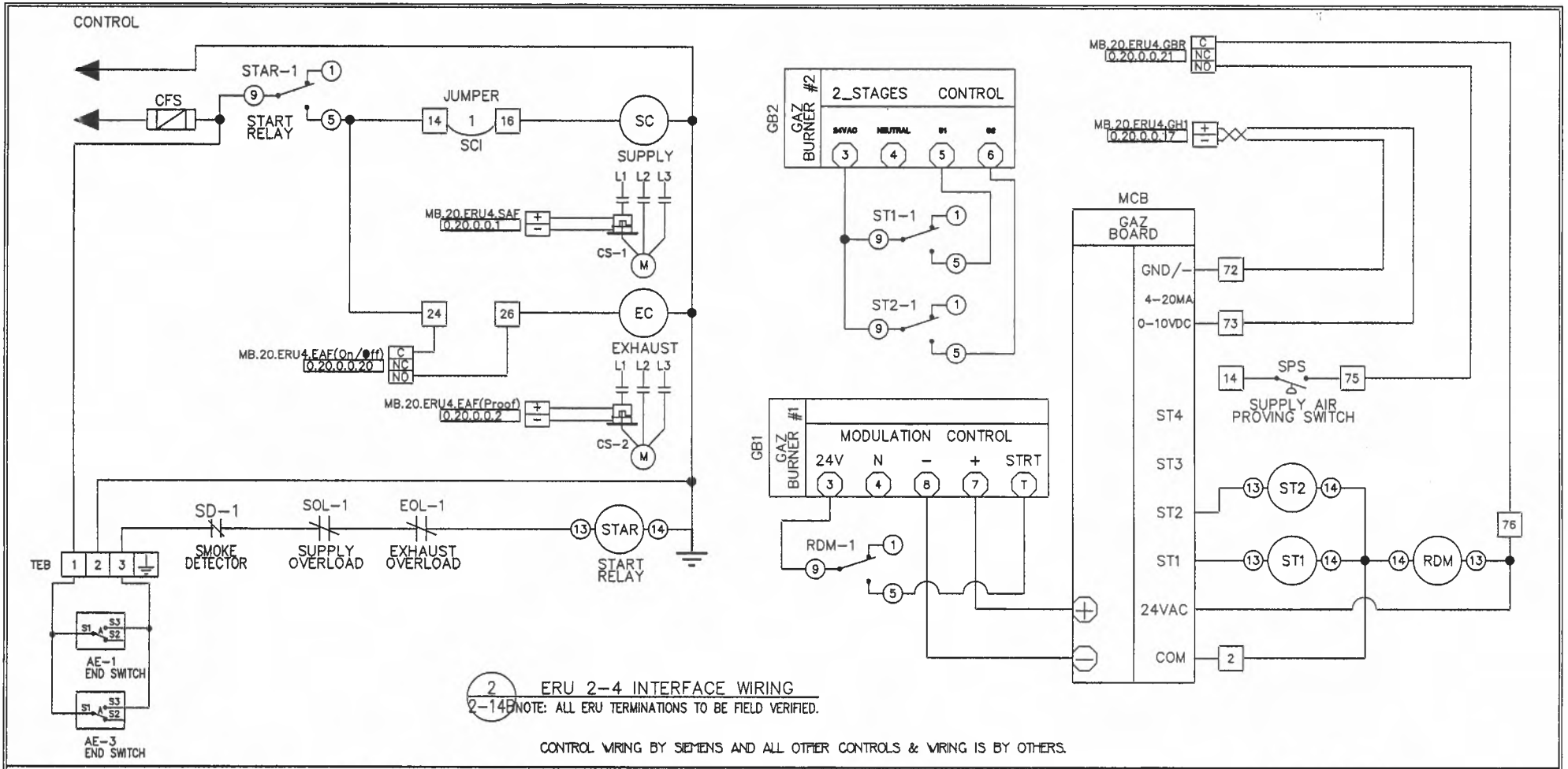
**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI  
ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: SFM  
INITIAL RELEASE DATE: 10/27/06  
LAST EDIT DATE: 11/30/07

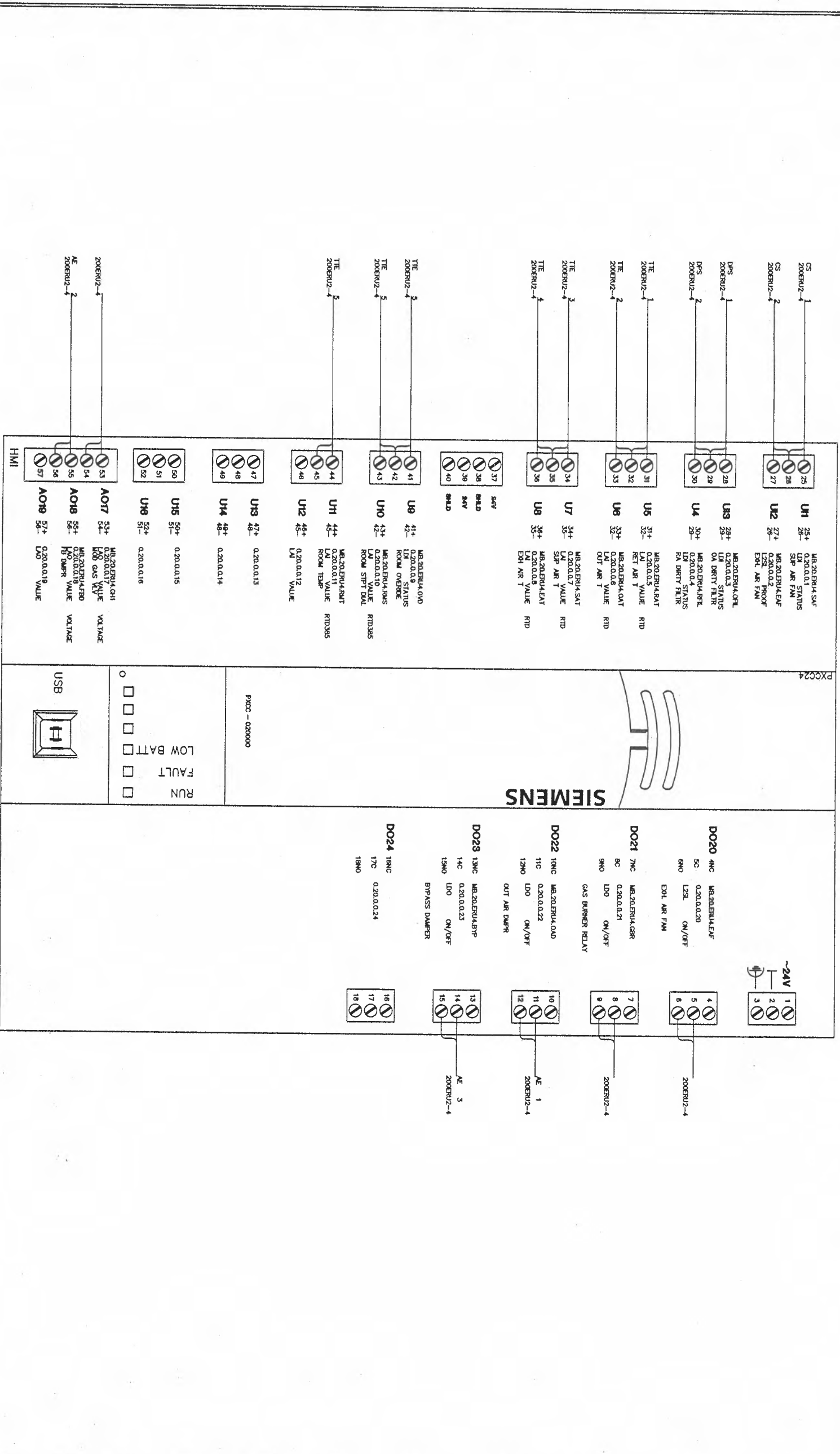
**440P-702374**

200  
ERU 2-4 CONTROL DIAGRAM





<b>REVISION HISTORY</b> 1 11/28/2007   KJ   AS-BUILT DRAWING	<b>SIEMENS</b> 45470 Commerce Ctr. Dr. Plymouth Twp. MI 48170 USA Phone: 734-458-3800 Fax: 888-815-0749	<b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI ENGINEER: SFM DRAFTER: SFM CHECKED BY: LJM INITIAL RELEASE: 10/27/08 LAST EDIT DATE: 11/30/07
<b>ERU 2-4 WIRING DIAGRAM</b>		440P-702374 200 <b>2-14B</b>



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 M. 48170 USA  
 Phone: 734-466-9800  
 Fax: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/30/07

**ERU 2-4 CONTROLLER**

440P-702374  
 200

**2-15**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1-3	3	GCA126.1P	SIEMENS	154001	2 PT SR24V/MED/S/PLUM.
CS 1-2	2	H608	VERIS	1006act016	QIR SW SPLICOR-ADJ SEPT W/LED
DPS 1-2	2	141-0518	SIEMENS	155 052	SWITCH,AIR FLOW,1.0/12 WG
SD 1	1	FBO	FBO	N/A	FURNISHED BY OTHERS
TCP 22	1	A-20H16AUPP	HOFMAN	N/A	20"X16"X16" NEMA A ENCLASURE
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR,18",PRB,RTD -40/240F
TTE 5	1	544-780FA	SIEMENS	149 312	RM SNSR W/STPT,IND,OVROD,BERGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOD MOUNTING PLATE KIT
Panel Mounted Devices					
PS 22	1	PSH75A75AN	FUNCTIONAL DEVICES	1208act145	DUAL PMRSPLY 75A/75A MLT-TAP
PXC 22	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT,RS-485, ROOFTOP
TB 1	1	TS1.5/10MP	N/A	N/A	TERMINAL STRIP, 15A, 22-14 AWG

**Energy Recovery Unit Sequence of Operations**

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

The energy recovery unit is scheduled for automatic operation on a time of day basis for Occupied and Unoccupied modes. Within the Occupied mode, the discharge air temperature setpoint is reset between 55 deg f and 95 deg f to maintain the space temperature setpoint. Within the Unoccupied mode, Night Heating is available when the space temperature drops below 62 deg F (adj.).

The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

**Occupied**

The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

**Unoccupied**  
The supply fan is off. The exhaust fan is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

**Night Heating**  
Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

**Safety**  
Maintain low limit temperature setpoint of 33 deg f (adj.) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-615-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

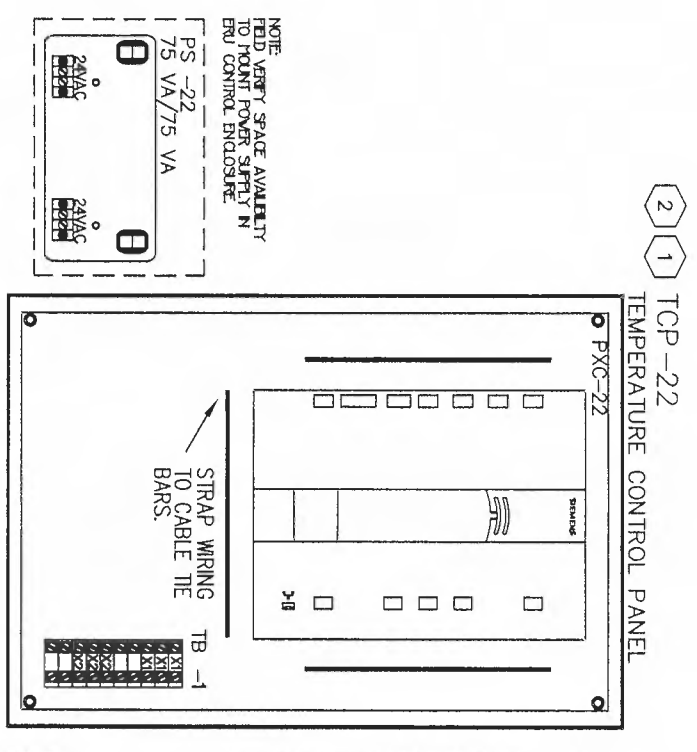
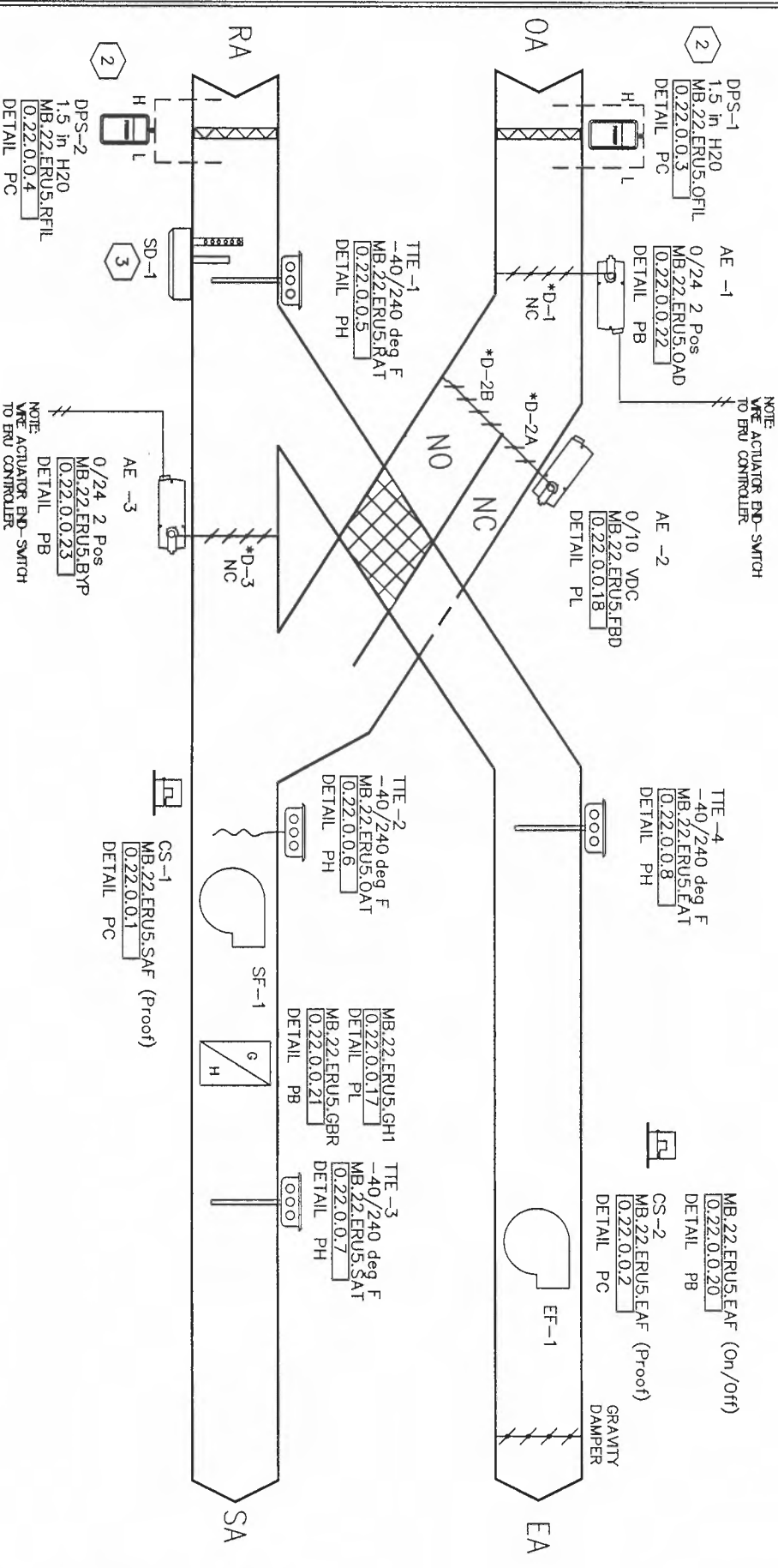
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SFM	SFM	CS/TL	10/27/06	11/30/07

**ERU 2-5 CONTROL DIAGRAM**

440P-702374  
200

**2-16A**

- INSTALLATION NOTES:
- TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - FIELD VERIFY ALL ERU TERMINATIONS.
  - UNIT CONFIGURATION WILL BE FIELD VERIFIED.



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
M. 48170 USA  
Phone: 734-456-3800  
Fax: 866-815-0749  
BAU

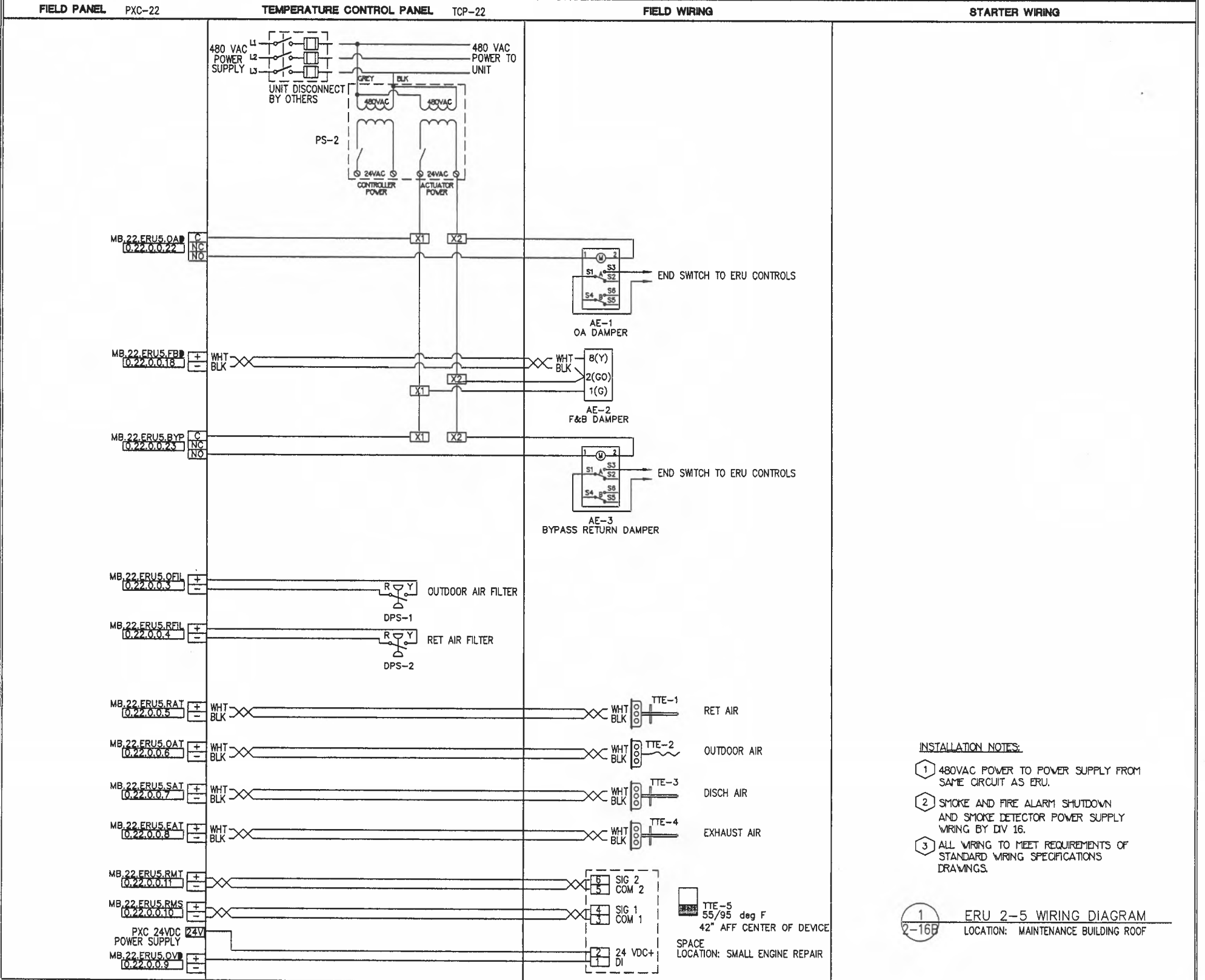
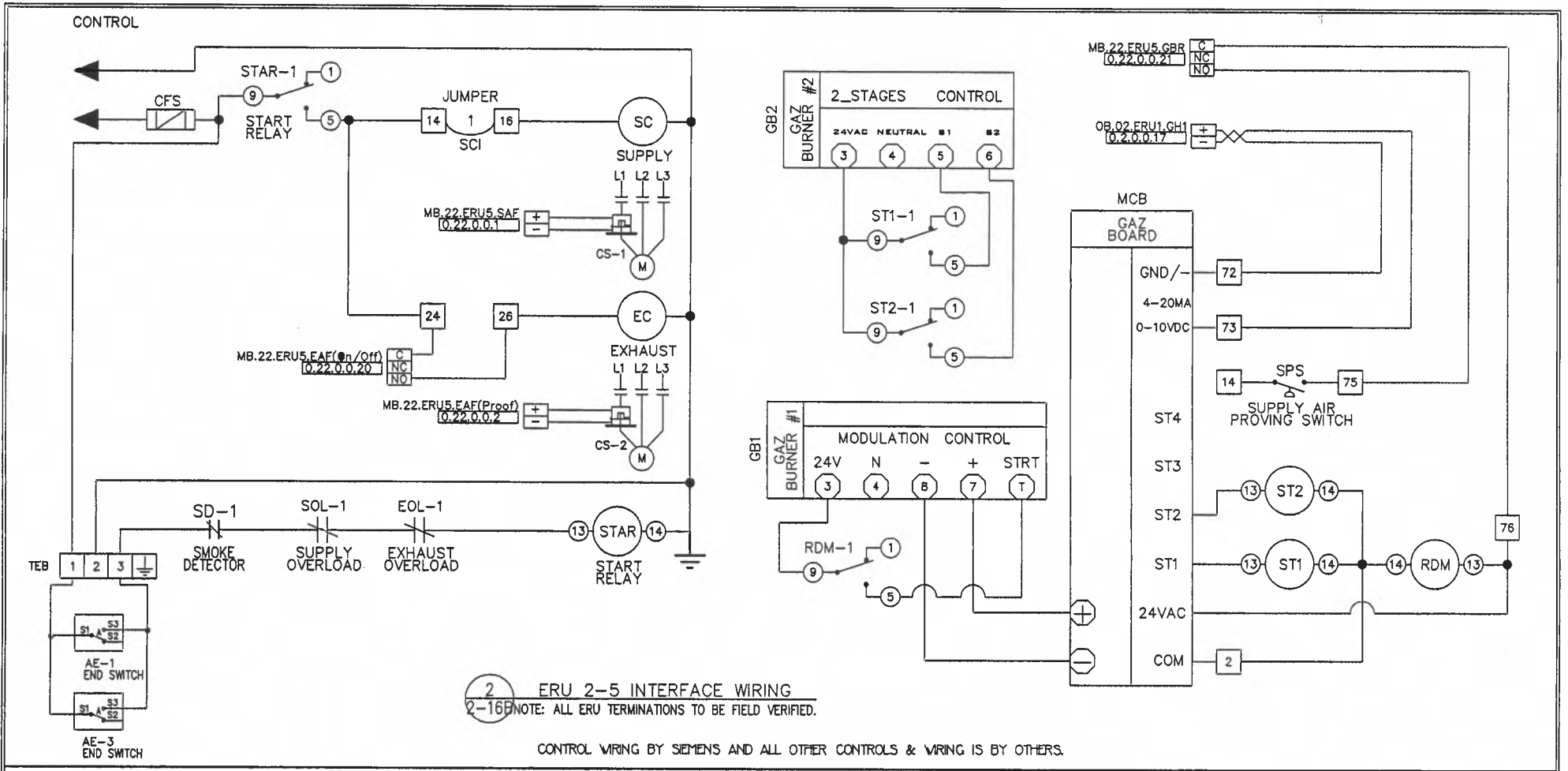
ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>ylc</i>	10/27/06	11/30/07

440P-702374  
200

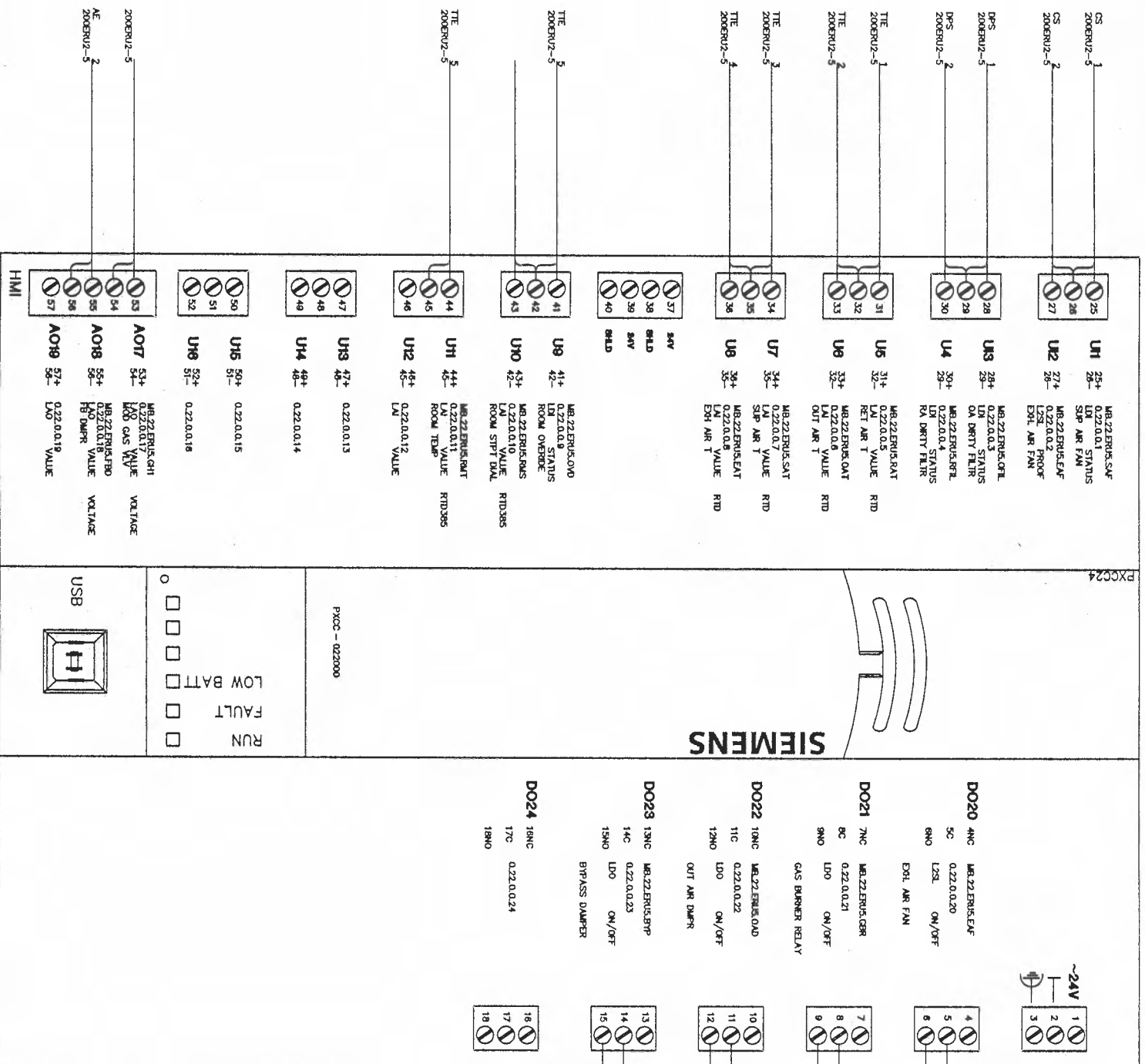
ERU 2-5 CONTROL DIAGRAM

2-16



- INSTALLATION NOTES:**
- 1 480VAC POWER TO POWER SUPPLY FROM SAME CIRCUIT AS ERU.
  - 2 SMOKE AND FIRE ALARM SHUTDOWN AND SMOKE DETECTOR POWER SUPPLY WIRING BY DIV 16.
  - 3 ALL WIRING TO MEET REQUIREMENTS OF STANDARD WIRING SPECIFICATIONS DRAWINGS.

<p><b>REVISION HISTORY</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">1</td> <td style="width: 15%;">11/28/2007</td> <td style="width: 10%;">KJ</td> <td style="width: 70%;">AS-BUILT DRAWING</td> </tr> </table>	1	11/28/2007	KJ	AS-BUILT DRAWING	<p><b>SIEMENS</b></p> <p>45470 Commerce Ctr. Dr. Plymouth Twp. MI 48170 USA Phone: 734-456-3800 Fax: 866-815-0749</p> <p>Siemens Building Technologies BAU</p>	<p><b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">ENGINEER</td> <td style="width: 15%;">DRAWER</td> <td style="width: 15%;">CHECKED BY</td> <td style="width: 15%;">INITIAL RELEASE</td> <td style="width: 40%;">LAST EDIT DATE</td> </tr> <tr> <td>SFM</td> <td>SFM</td> <td><i>[Signature]</i></td> <td>10/27/08</td> <td>11/30/07</td> </tr> </table> <p><b>ERU 2-5 WIRING DIAGRAM</b></p>	ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE	SFM	SFM	<i>[Signature]</i>	10/27/08	11/30/07	<p>440P-702374 100</p> <p style="font-size: 2em; font-weight: bold;">2-16B</p>
1	11/28/2007	KJ	AS-BUILT DRAWING														
ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE													
SFM	SFM	<i>[Signature]</i>	10/27/08	11/30/07													



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-458-3800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WY</i>	10/27/06	11/30/07

440P-702374  
200  
**2-17**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
AE 2	1	GCA161.1P	SIEMENS	154001	MOD(V) SR,24V, MED. PLNM
AE 3	1	GCA126.1P	SIEMENS	154001	2 PT SR,24V,MED/S/PLNM.
CS 1-2	2	H608	VERIS	1006aut016	CUR SW SPLICOR-ADJ SEPT W/LED
DPS 1-2	2	141-0518	SIEMENS	155 052	SWITCH,AIR FLOW,1.0/12 WG
SD 1	1	FBO	N/A	N/A	FURNISHED BY OTHERS
TCP 23	1	A-20H16ALPP	HOFMANN	N/A	20"x16"x16" NEMA 4 ENCLOSURES
TTE 1-4	4	544-343	SIEMENS	149 261	D/AV SNSR,16" PR,RD -40/240F
TTE 5	1	544-780A	SIEMENS	149168	RM SNSR W/STP,IND,OVRO,BEGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOD MOUNTING PLATE KIT
Panel Mounted Devices					
PS 23	1	PSH75A75AN	FUNCTIONAL DEVICES	1208cut145	DUAL PWRSPLY 75A/75A MLT-TAP
PXC 23	1	PXC24-PR.A	SIEMENS	149454	PXC COMPACT 24-PT, P2 RS-485, ROOFTOP
TB 1	1	TS1.5/10WP	SIEMENS	N/A	TERMINAL STRIP 15A, 22-14 AWG

#### Energy Recovery Unit Sequence of Operations

The constant volume energy recovery unit consists of a fixed plate exchanger with face and bypass, outdoor, bypass return, and exhaust air dampers, pre-filter, return filter, gas heating section, supply and exhaust fans. The unit is DDC controlled using electric actuation.

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The energy recovery unit operates in Occupied, Unoccupied, Night Heating and Safety modes as follows (All suggested set points and settings are adjustable.):

#### Occupied

The outside air damper is 100% open, supply and exhaust fan starts. When the outside air dry bulb temperature is between 70 deg f and low limit setpoint, the fixed plate heat exchanger face and bypass dampers are in full face

position. When outside air dry bulb temperature is greater than 70 deg f and less than 80 deg F, the fixed plate heat exchanger face and bypass dampers will be in full bypass position. When outside air dry bulb temperature is 80 deg f or greater, the fixed plate heat exchanger face and bypass dampers will be in full face position. The gas heating is staged to maintain room temperature setpoint. Bypass return damper is 100% closed.

#### Unoccupied

The supply fan is off. The exhaust fan is off. The outdoor air damper is closed 100%. Bypass return damper is 100% closed. Fixed plate heat exchanger face and bypass damper is in full face position.

#### Night Heating

Return bypass damper is 100% open, supply fan starts. The gas heating is staged to maintain room temperature setpoint. Exhaust fan remains off. Outside damper remains closed. Face and bypass damper is in full face position.

#### Safety

Maintain low limit temperature setpoint of 33 deg f (adj) exhaust air temperature by modulating face and bypass dampers. Smoke detector in the return air stream de-energizes the supply and exhaust fans upon activation.

A current switch is installed in the supply and exhaust fan starter. The DDC system uses this switch to confirm the fan is in the desired state (i.e. on or off) and generates an alarm if status deviates from DDC start/stop control.

#### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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#### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ct. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-466-3900  
FAX: 888-815-0749

#### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

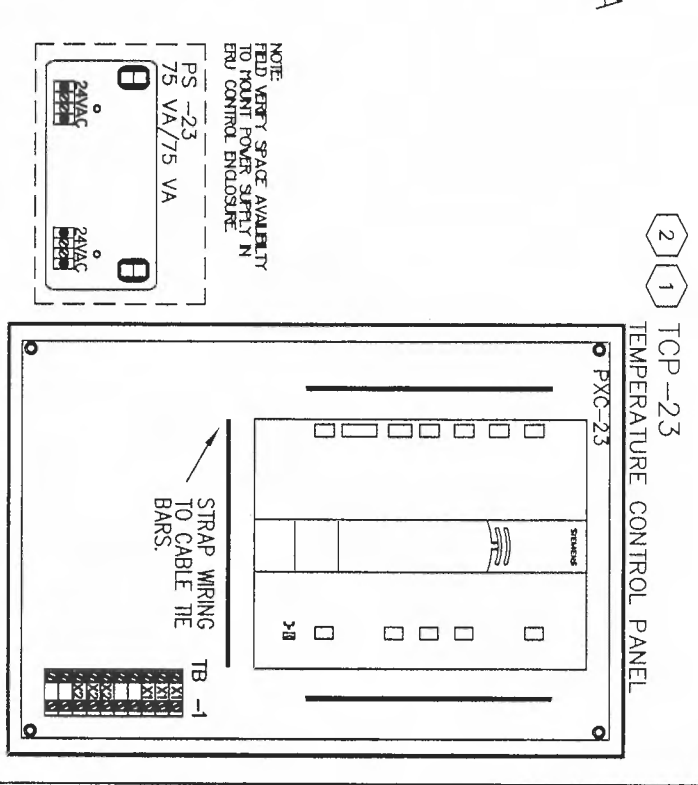
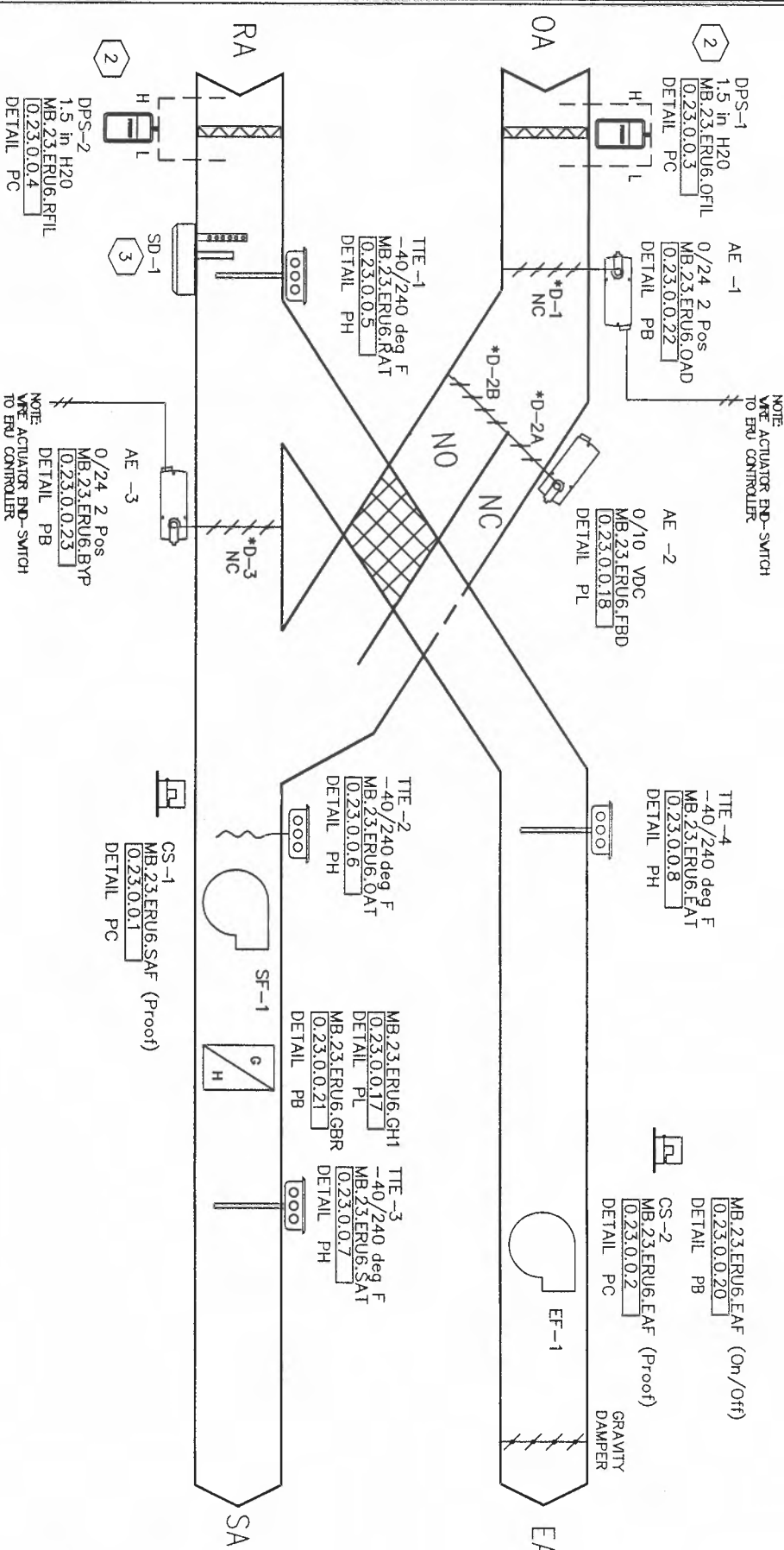
ENGINEER	DESIGNER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>gyl</i>	10/27/08	11/30/07

#### ERU 2-6 CONTROL DIAGRAM

440P-702374  
200

2-18A

- INSTALLATION NOTES:
- 1 TEMPERATURE CONTROL PANEL MOUNTED ON EXTERIOR OF ERU.
  - 2 FIELD VERIFY SPACE AVAILABILITY TO MOUNT CONTROL DEVICES IN ERU CONTROL ENCLOSURE.
  - 3 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 4 FIELD VERIFY ALL ERU TERMINATIONS.
  - 5 UNIT CONFIGURATION WILL BE FIELD VERIFIED.



REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-458-3800  
Fax: 866-815-0749

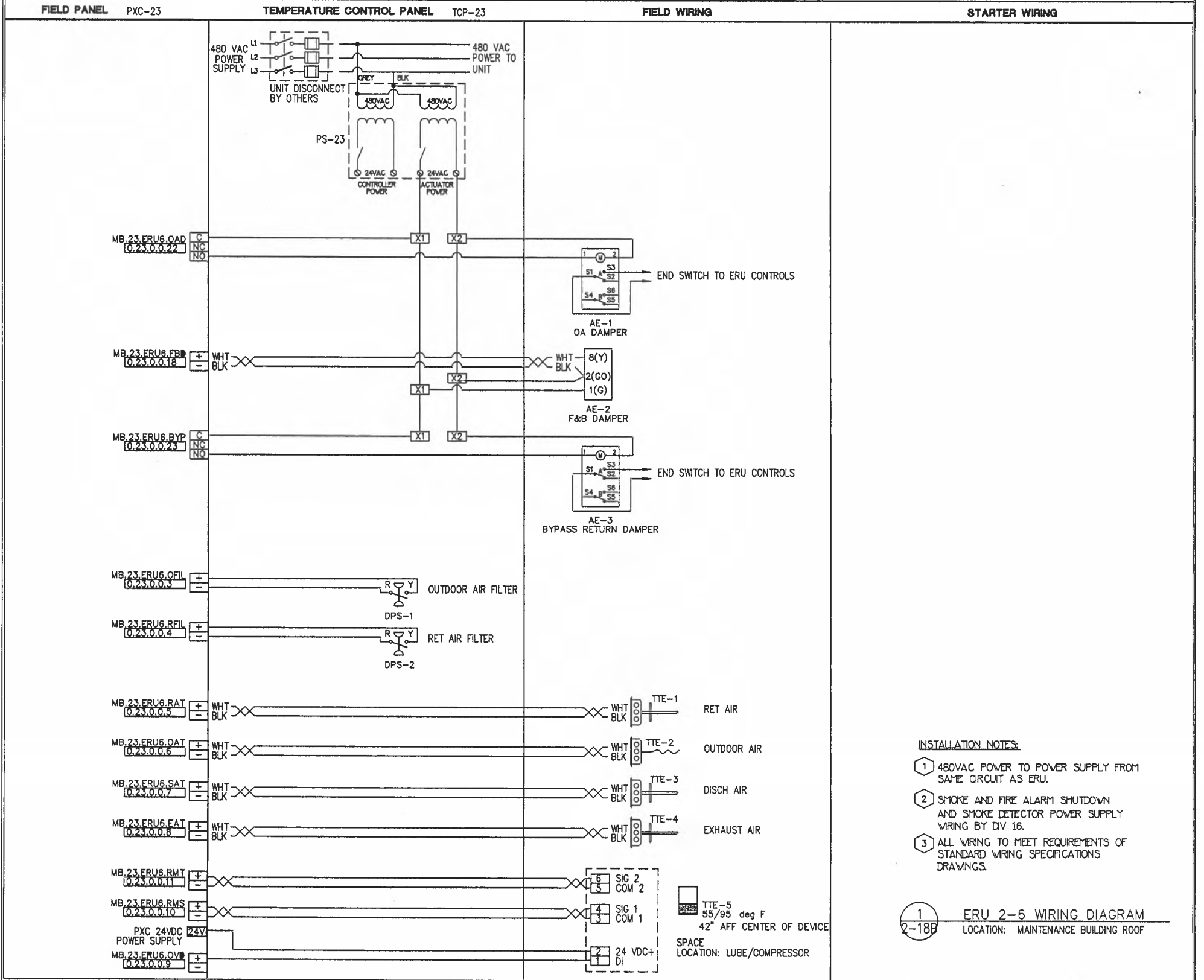
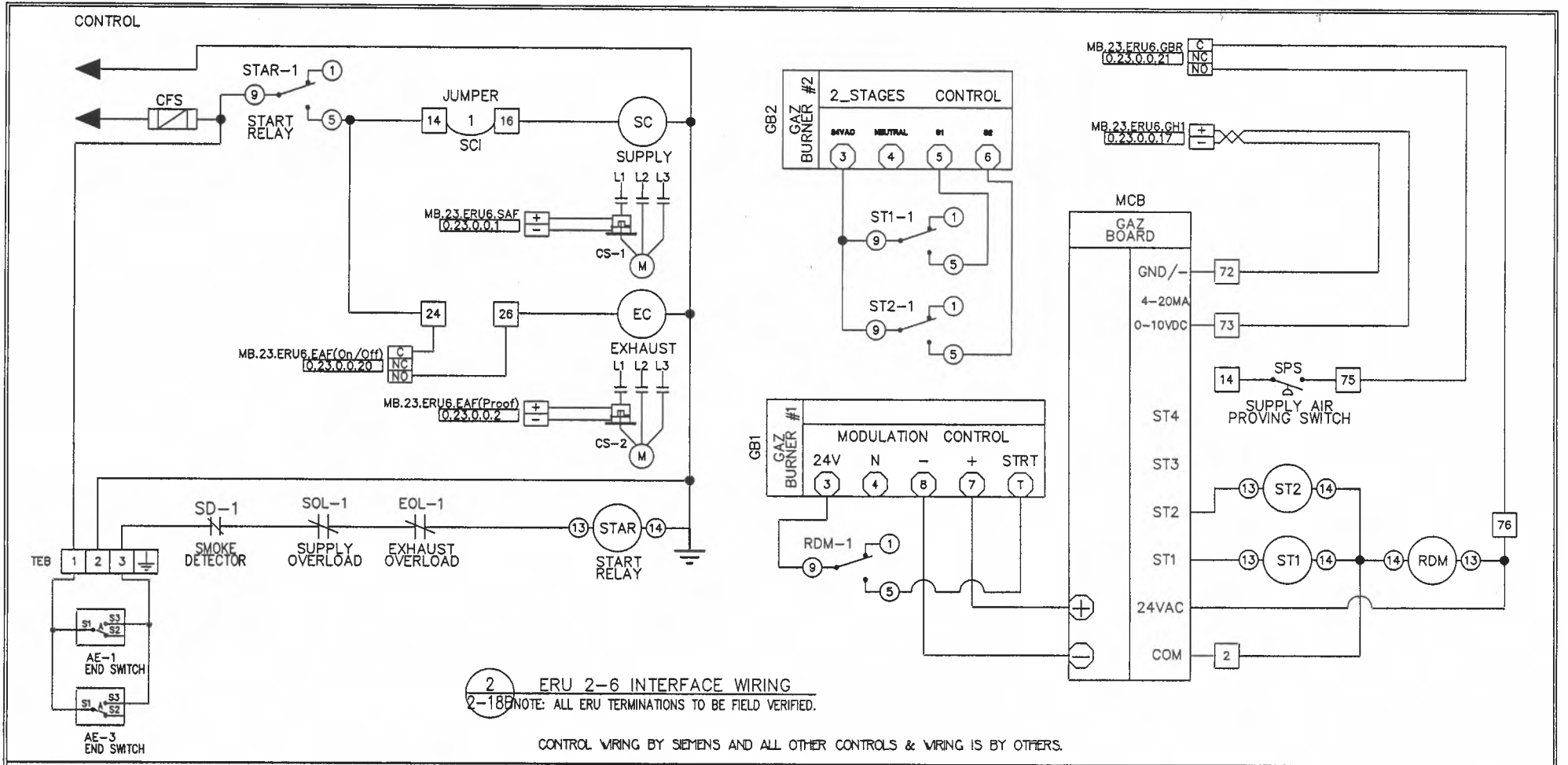
ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: SFM  
INITIAL RELEASE DATE: 10/27/06  
LAST EDIT DATE: 11/30/07

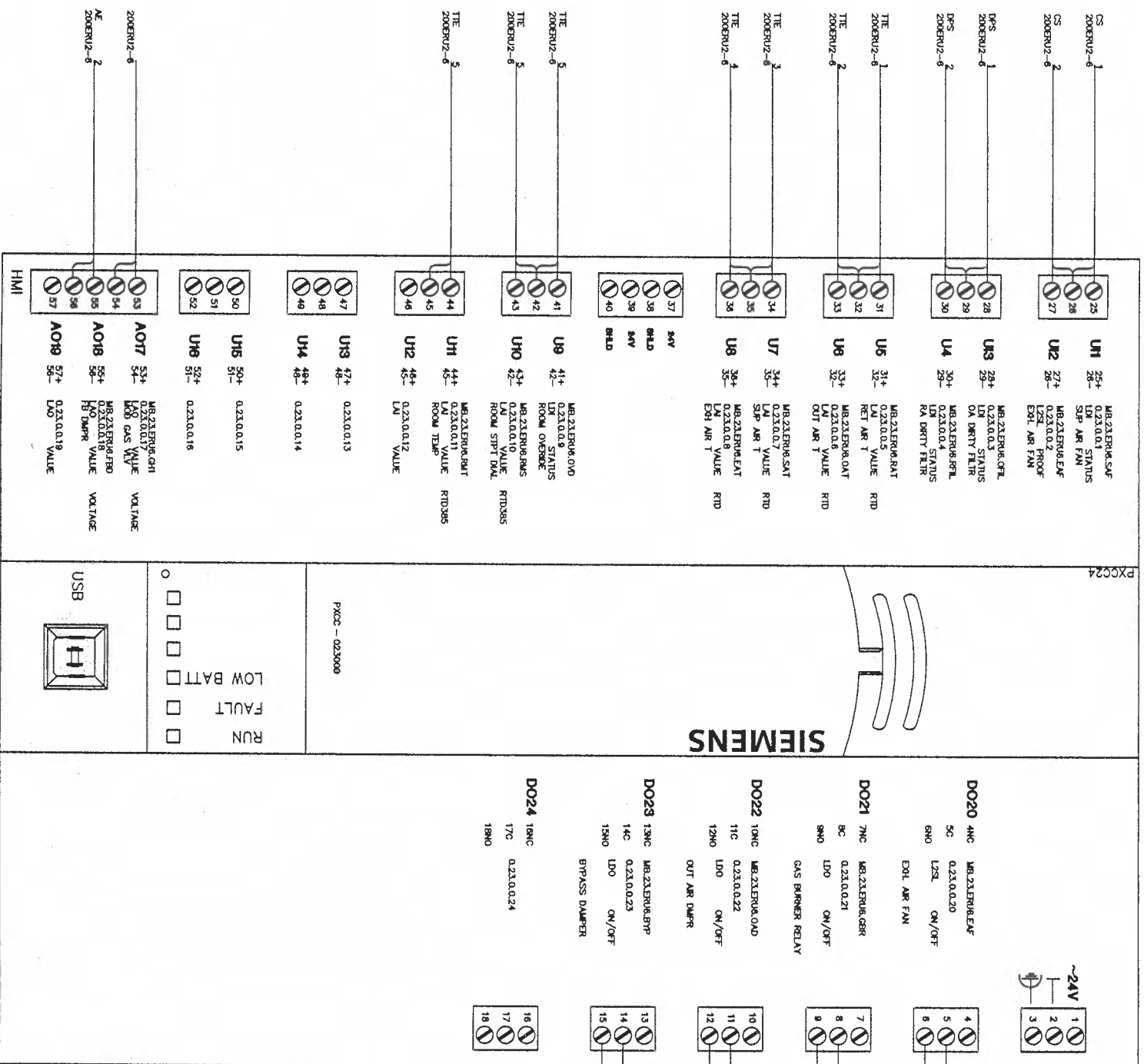
440P-702374  
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<b>REVISION HISTORY</b>		<b>SIEMENS</b>	45470 Commerce Ctr. Dr. Plymouth Twp. MI. 48170 USA Phone: 734-456-3800 Fax: 866-815-0749	<b>ANN ARBOR MAINTENANCE FACILITY</b> ANN ARBOR, MI		440P-702374 200
1	11/28/2007 KJ AS-BUILT DRAWING			Siemens Building Technologies BAU	ENGINEER SFM DRAFTER SFM CHECKED BY [Signature] INITIAL RELEASE 10/27/08 LAST EDIT DATE 11/30/07	<b>2-18B</b>

ERU 2-6 WIRING DIAGRAM



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**  
Siemens Building Technologies  
BAU

ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

440P-702374  
200  
**2-19**

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-458-3800  
Fax: 888-815-0749

ENGINEER: SFM  
DRAWN: SFM  
CHECKED BY: [Signature]  
INITIAL RELEASE DATE: 10/27/06  
LAST EDIT DATE: 11/30/07

ERU 2-6 CONTROLLER

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
RE 1-2	2	RIBUC	FUNCTIONAL DEVICES		1208cut013	RIB 120VAC 24VAC/DC SPDT

**Automatic Transfer Switch Monitoring (ATS-0)**

DDC system shall monitor the transfer switch for normal position.  
DDC system shall monitor the transfer switch for emergency position.

**Load Shedding**

Load Shedding upon overload signal from the generator/generator meter.

- a. Prevent Roof Tops Units and Air Handling Units, Split Systems, ETC supplied by the generator from operating their respective air conditioning compressors.

**Maintenance Building**

- a. ERU 2-1 and RTU 2-3 to be controlled through Building Management System not to operate until 2 minutes after generator are running.
- b. 50 horse power compressor to be controlled through Building Management System not to operate until 5 minutes after generator is running.

REVISION HISTORY		
1	11/28/2007	SFM AS-BUILT DRAWING

**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MA 01870  
USA  
PHONE: 734-458-3800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

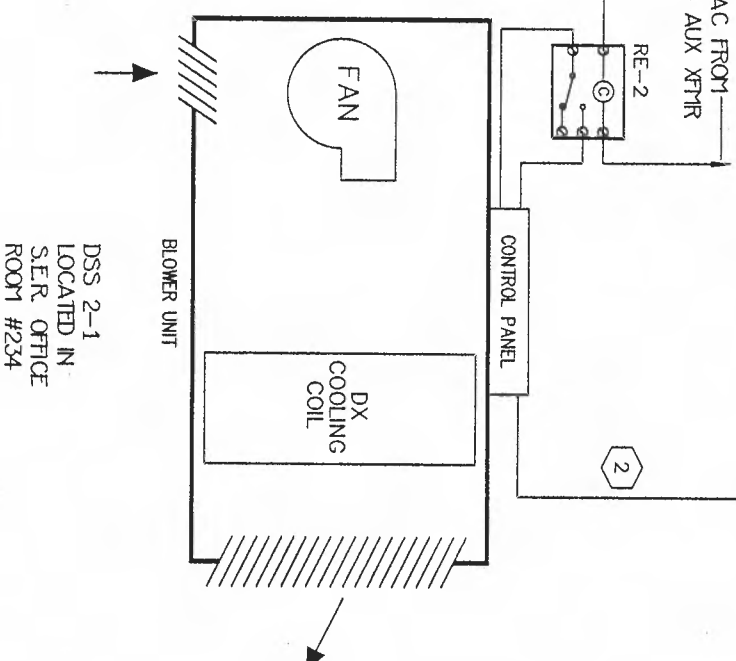
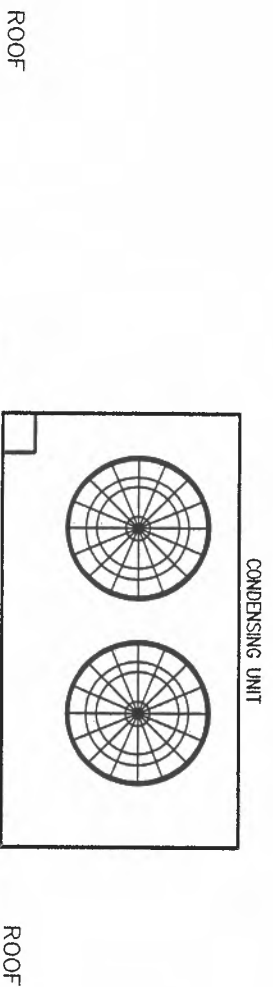
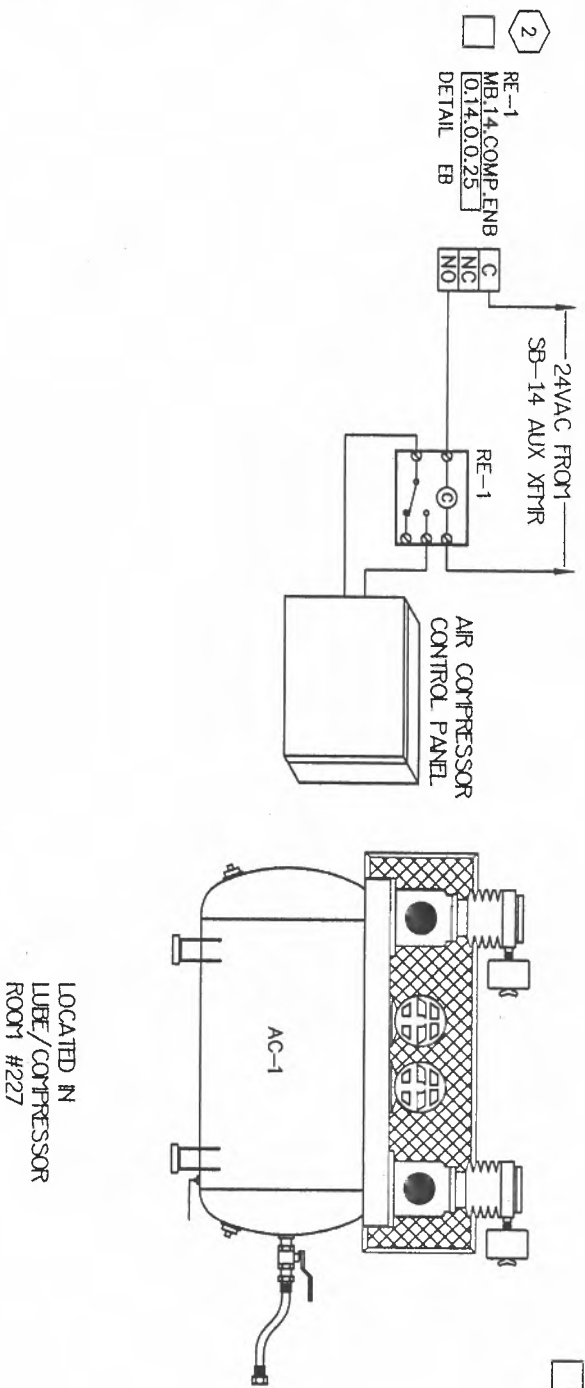
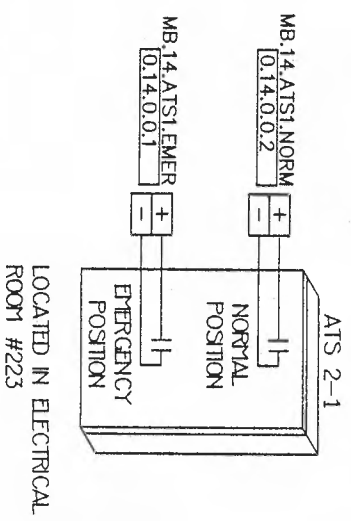
ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>cyk</i>	10/27/08	11/28/07

**GENERATOR SYSTEM INTERFACE**

440P-702374  
200

**2-20A**



INSTALLATION NOTES:

- 1 AIR COMPRESSOR BY OTHERS.
- 2 TERMINATION POINTS PENDING VENDOR SUBMITTAL.

1 GENERATOR SYSTEM INTERFACE  
 2-20 LOCATION: ELECTRICAL ROOM #223  
 SERVICES: MAINTENANCE BUILDING EMERGENCY POWER

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**  
 Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-458-9800  
 FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**  
 ANN ARBOR, MI

ENGINEER: SFM  
 DRAFTER: SFM  
 CHECKED BY: [Signature]  
 INITIAL RELEASE: 10/27/06  
 LAST EDIT DATE: 12/03/07

**GENERATOR SYSTEM INTERFACE**

440P-702374  
 200  
**2-20**

**Vehicle Building Lighting Sequence of Operations**

BMS shall communicate to Vehicle Building lighting panels via BACnet TC/IP protocol. BMS shall turn on/off interior and exterior lighting according to a time a day schedule.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WV</i>	10/27/08	12/03/07

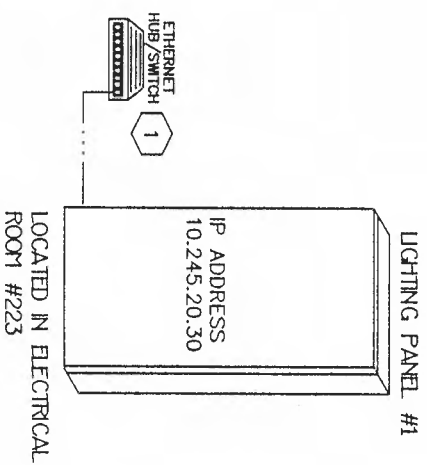
**LIGHTING SYSTEM INTERFACE**

440P-702374  
200

**2-21A**

INSTALLATION NOTES:

- 1 ETHERNET DROP TO BE PROVIDED BY OTHERS.
- LIGHTING INTEGRATION POINTS  
 NOTE: LIGHTING INTEGRATION POINTS TO BE COORDINATED WITH LIGHTING VENDOR.



1  
 2-21  
 LIGHTING CONTROL  
 LOCATION: MAINTENANCE BUILDING  
 SERVICES: MAINTENANCE BUILDING  
 INTERIOR/EXTERIOR LIGHTS

REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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SIEMENS

Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-458-3800  
 FAX: 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJL</i>	10/27/06	12/03/07

LIGHTING SYSTEM INTERFACE

440P-702374

200

2-21

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
TE 1-2	2	134-1084	SIEMENS	PCI-13	155 017	TSTAT/H/CLINE VOLT CON/EXP

**Exhaust Fan EF 2-1, 2-4 Sequence of Operations**  
 The power roof vent exhaust fan runs constantly (Not shown on control drawings).

**Exhaust Fan EF 2-2, 2-3 Sequence of Operations**  
 The space thermostat cycles the power roof vent exhaust fan to maintain the space temperature at set point.

REVISION HISTORY		
1	11/28/2007	KJ AS-BUILT DRAWING

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 Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-466-3800  
 FAX: 888-815-0749

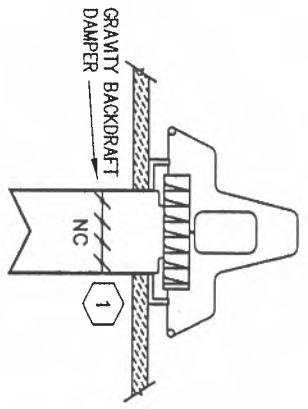
**ANN ARBOR MAINTENANCE FACILITY**  
**ANN ARBOR, MI**

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WPK	10/27/06	12/03/07

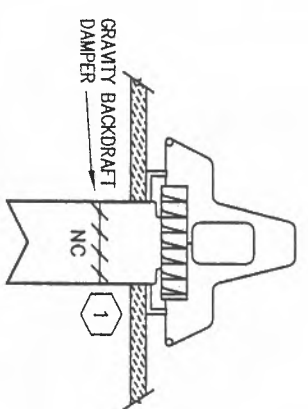
**EXHAUST FAN CONTROL**

440P-702374  
 200  
**2-22A**

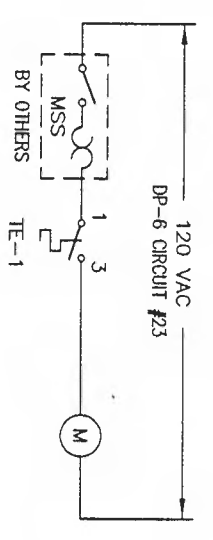
INSTALLATION NOTES:  
 1 GRAVITY DAMPER PROVIDED BY OTHERS.



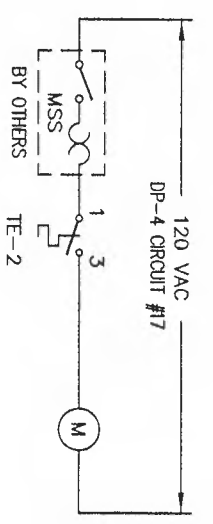
TE-1  
 40/90 F  
 80 F  
 LOCATE ROOM THERMOSTAT  
 AS SHOWN ON PLANS  
 48" AFF (TOP OF DEVICE)



TE-2  
 40/90 F  
 80 F  
 LOCATE ROOM THERMOSTAT  
 AS SHOWN ON PLANS  
 48" AFF (TOP OF DEVICE)



1 EXHAUST FAN EF2-2 CONTROL  
 2-22 LOCATION: OPERATION BUILDING ROOF  
 SERVICES: ELECTRIC ROOM #223  
 LOCATE THERMOSTAT ON THE CENTER OF NTH WALL



2 EXHAUST FAN EF2-3 CONTROL  
 2-22 LOCATION: OPERATION BUILDING ROOF  
 SERVICES: ELECTRICAL ROOM #226

REVISION HISTORY

1	11/28/2007	KU	AS-BUILT DRAWING
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Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-458-3800  
 FAX: 888-815-0749

ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	LSY	10/27/06	12/03/07

440P-702374  
 200  
 2-22



Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
TE 1-2	2	FBO	FBO			FURNISHED BY OTHERS

**Gas Unit Heater Sequence of Operations**  
 A unit mounted electric thermostat cycles the unit heater fan and gas heat to maintain the space temperature at set point.

REVISION HISTORY		
1	11/28/2007	KJ AS-BUILT DRAWING

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Siemens Building Technologies  
 BAU

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-456-3800  
 FAX: 988-815-0749

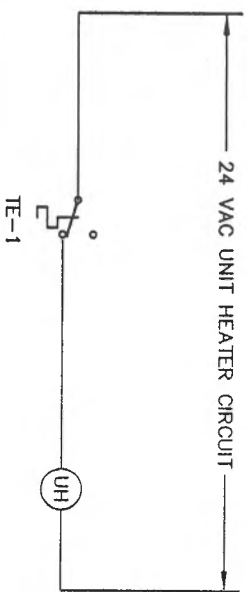
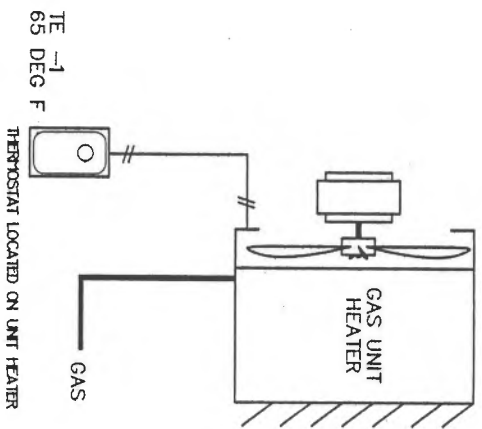
ANN ARBOR MAINTENANCE FACILITY  
 ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	12/03/07

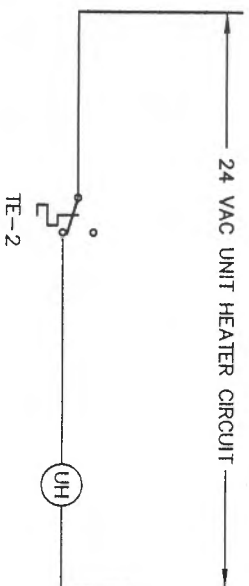
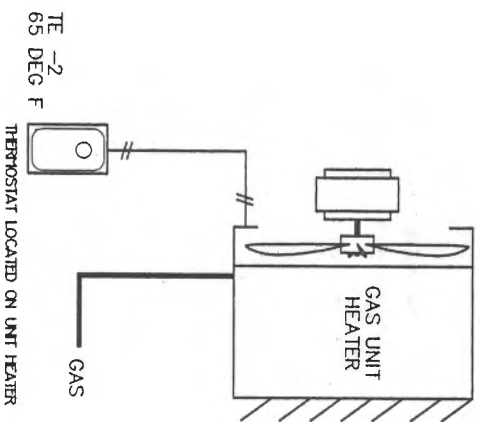
UNIT HEATER CONTROL

440P-702374  
 200

**2-23A**



1  
2-23 GAS UNIT HEATER CONTROL  
LOCATION: MAINTENANCE BUILDING  
SERVES: CORRIDOR #224



2  
2-23 GAS UNIT HEATER CONTROL  
LOCATION: MAINTENANCE BUILDING  
SERVES: CORRIDOR #232

**REVISION HISTORY**

1 | 11/28/2007 | KJ | AS-BUILT DRAWING

**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	YKL	10/27/06	12/03/07

**UNIT HEATER CONTROL**

440P-702374

200

**2-23**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Panel Mounted Devices					
MEC 014000	1	549-617	SIEMENS	149 344	PWR MEC 1310-1/0 PB MDW HOA
	1	549-506	SIEMENS	149 344	SERVICE BOX,MEC,115V

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-466-3800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>SFM</i>	10/27/08	12/03/07

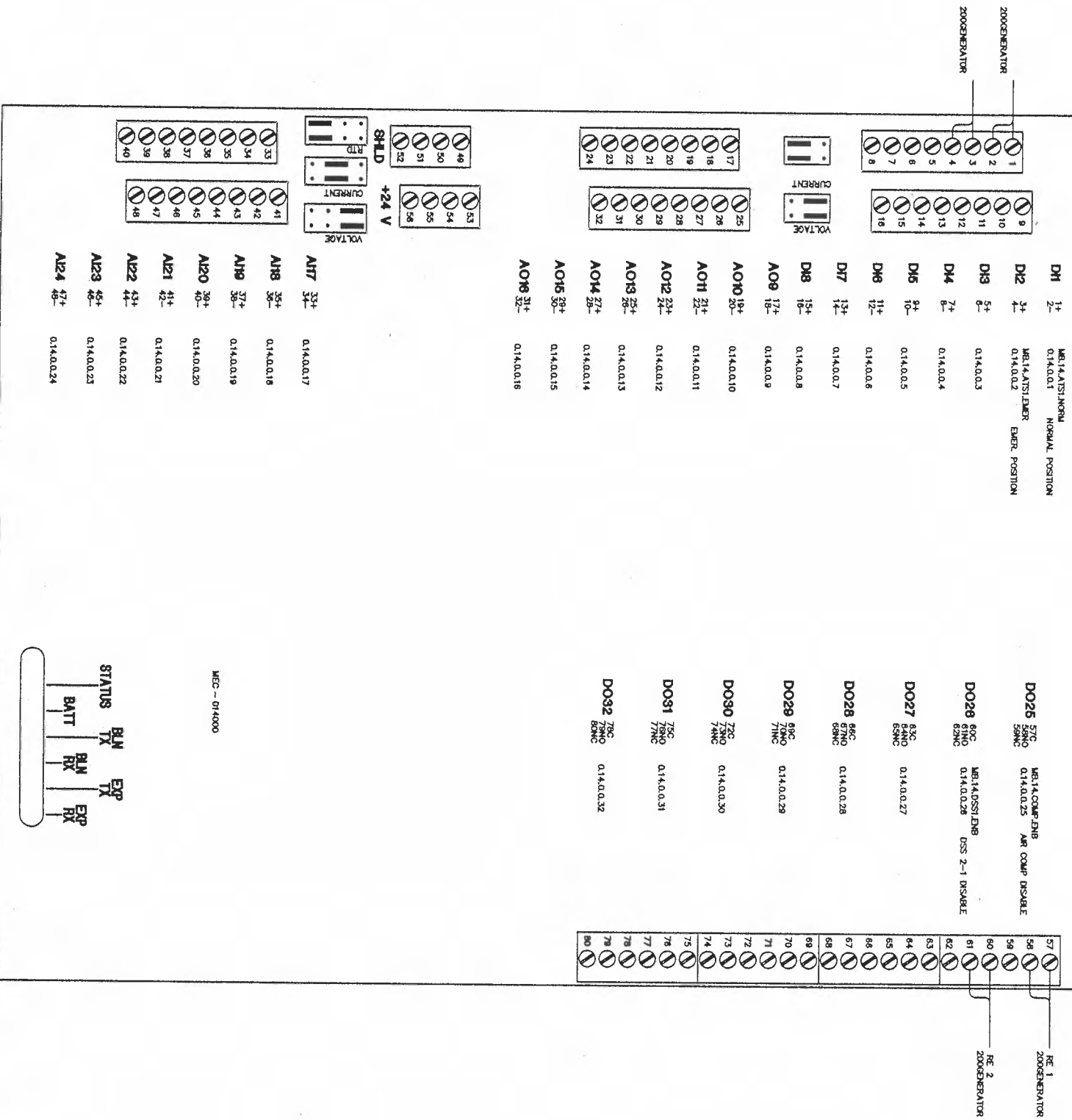
MB.14.COMM.222 LAYOUT

440P-702374

200

**2-24A**

**SIEMENS**



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-466-9800  
 Fax: 888-615-0149

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI  
 ENGINEER: SFM  
 DRAFTER: SFM  
 CHECKED BY: INITIAL RELEASE  
 LAST EDIT DATE: 10/27/06  
 12/03/07

440P-702374  
 200

**2-24**

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
TCP 14	1	549-505	SIEMENS		149 344	LARGE ENCLOSURE.MEC

**REVISION HISTORY**

1	11/28/2007	SFM	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-468-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>SFM</i>	10/27/06	11/28/07

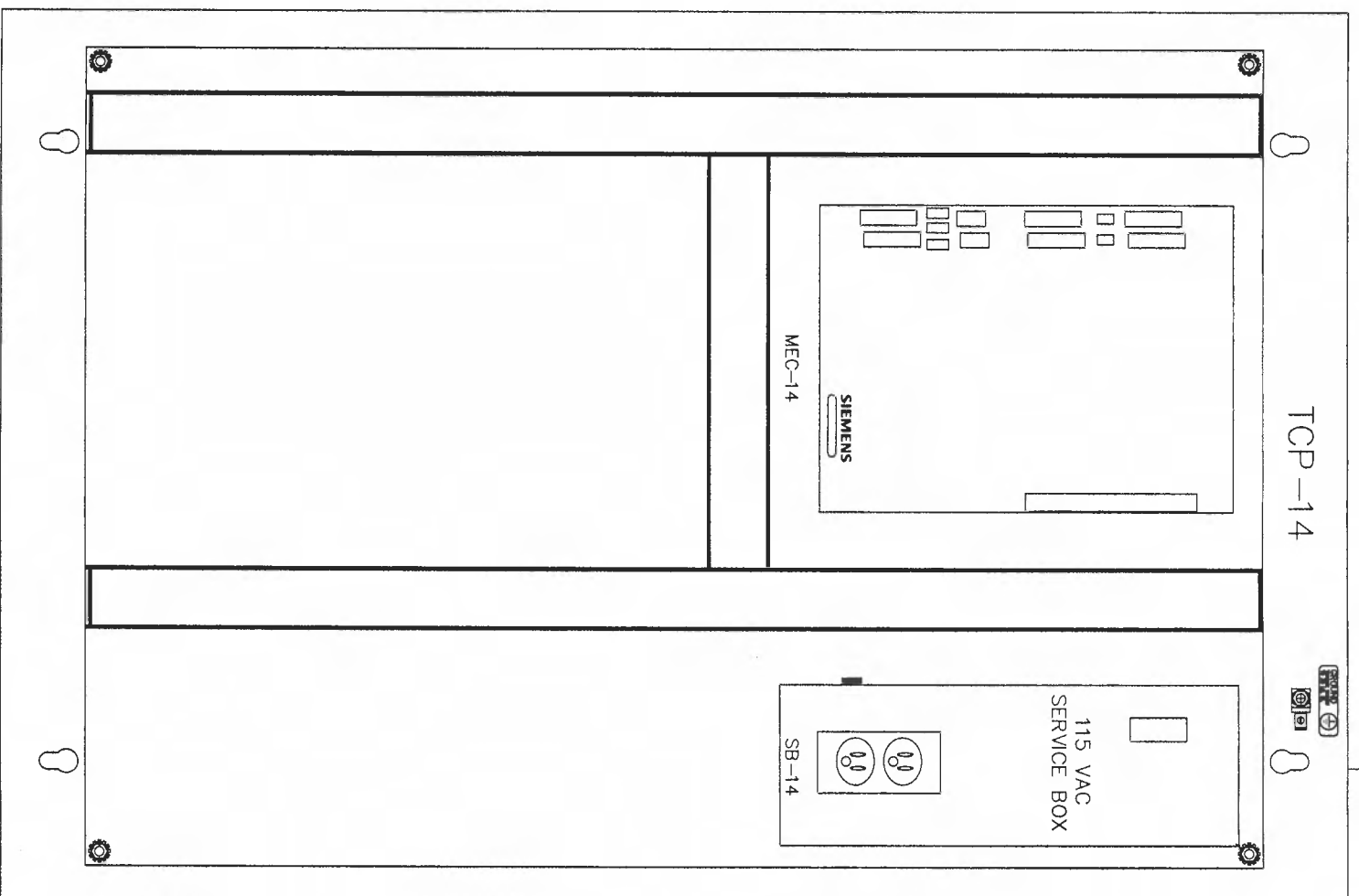
TCP-14 PANEL LAYOUT

440P-702374

200

**2-25A**

PROVIDE 120VAC IN  
RIGHT CORNER OF CABINET  
EMERGENCY PANEL SDP-1  
ELECTRICAL ROOM #223



1  
2-25

TCP-14 PANEL LAYOUT  
LOCATION: COMMUNICATIONS ROOM #222

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**  
Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp, MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

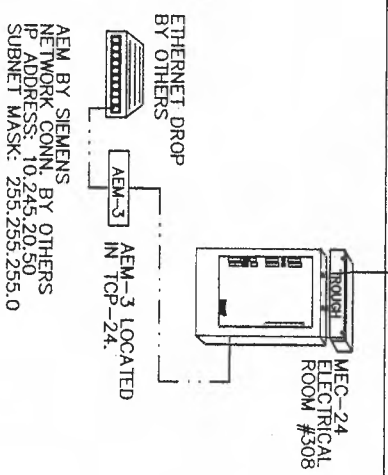
ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	2/24	10/27/06	12/03/07

**TCP-14 PANEL LAYOUT**

440P-702374  
200  
**2-25**

120VAC FROM  
EMERGENCY PANEL SPD-4  
COLUMN J-12



### VEHICLE BUILDING

### REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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### SIEMENS

Siemens Building Technologies  
BAU

45470 Commerce Ct. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-456-3800  
Fax: 866-815-0749

### ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL	RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJL</i>		10/27/06	12/03/07

### VEHICLE BUILDING RISER

44OP-702374

300

3-1

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1-4	4	FBO	N/A	N/A	FURNISHED BY OTHERS
CS 1-8	8	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SETPT W/LED
RE 1-4	4	RIBUIC	FUNCTIONAL DEVICES	1208cut013	RIB 120VAC 24VAC/DC SPDT
SD 1-4	4	FBO	N/A	N/A	FURNISHED BY OTHERS
TTE 1	1	544-760A	SIEMENS	149 312	ROOM SENSOR,DST BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
TTE 2	1	544-760A	SIEMENS	149 312	ROOM SENSOR,DST BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
TTE 3	1	544-760A	SIEMENS	149 312	ROOM SENSOR,DST BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT
TTE 4	1	544-760A	SIEMENS	149 312	ROOM SENSOR,DST BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOF MOUNTING PLATE KIT

The constant volume Make-up air unit consists of a pre-filter, gas heating section and supply fan. An exhaust fan is hardwired interlocked with the Make-up air unit.

The Make-up air unit is interlocked with its associated exhaust fan. Upon activation of the exhaust fan its associated make-up air unit will be energized. The make-up air unit's thermostat shall fire the unit's gas burner to maintain the building room temperature (by unit manufacturer).

**Safety**

Smoke detector in the supply air stream de-energizes the supply fan upon activation.

DDC system uses a current switch installed in the Make-up air unit to confirm supply fan status. If Make-up air supply fan status is not confirmed its associated exhaust fan will be deenergized.

**Monitoring**

DDC system uses a current switch installed in the Make-up air unit to confirm supply fan status.

DDC system uses a current switch installed in the Exhaust fan starter to confirm supply fan status.

**Emergency Power**

Upon notification of a generator overload, secure exhaust fans EF 3-2, EF 3-3, EF 3-4 and make-up air units MUAU 3-2, MUAU 3-3 and MUAU 3-4. DDC shall look at generator overload point every 15 minutes and turn on units when commercial power is restored.

**REVISION HISTORY**

1	11/28/2007	SFM	AS-BUILT DRAWING
---	------------	-----	------------------

**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Cir. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-466-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>W</i>	10/27/06	11/28/07

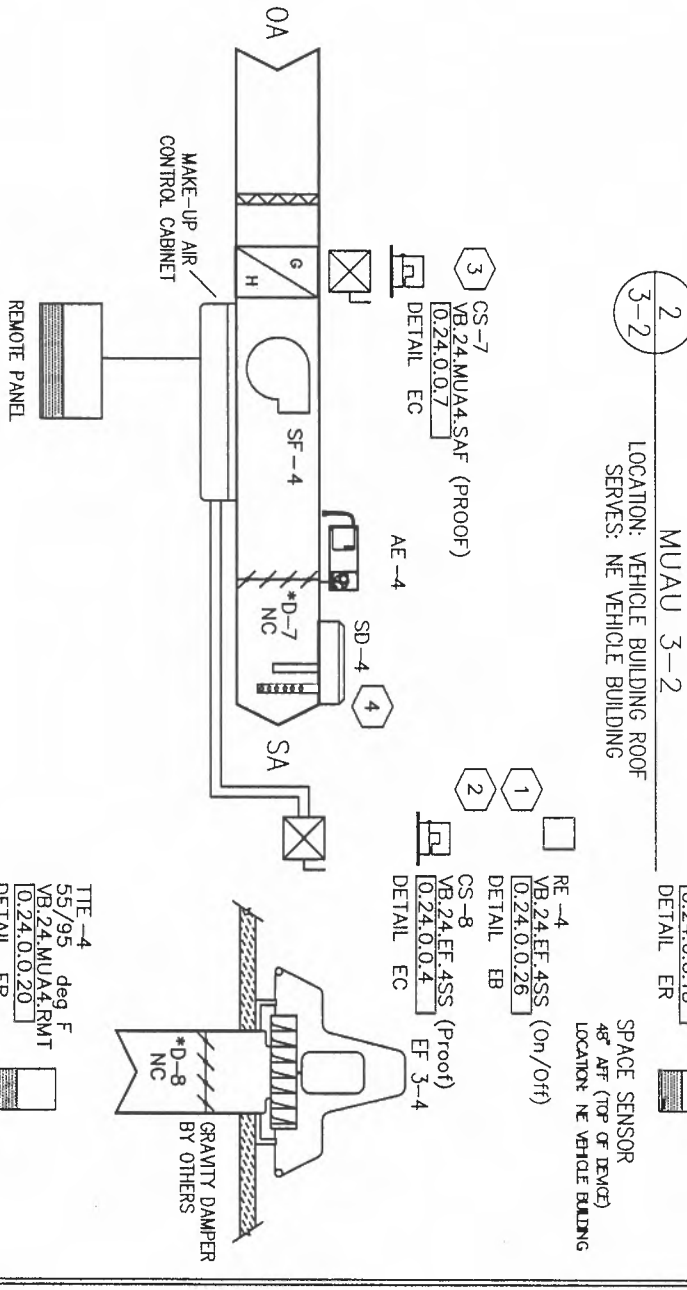
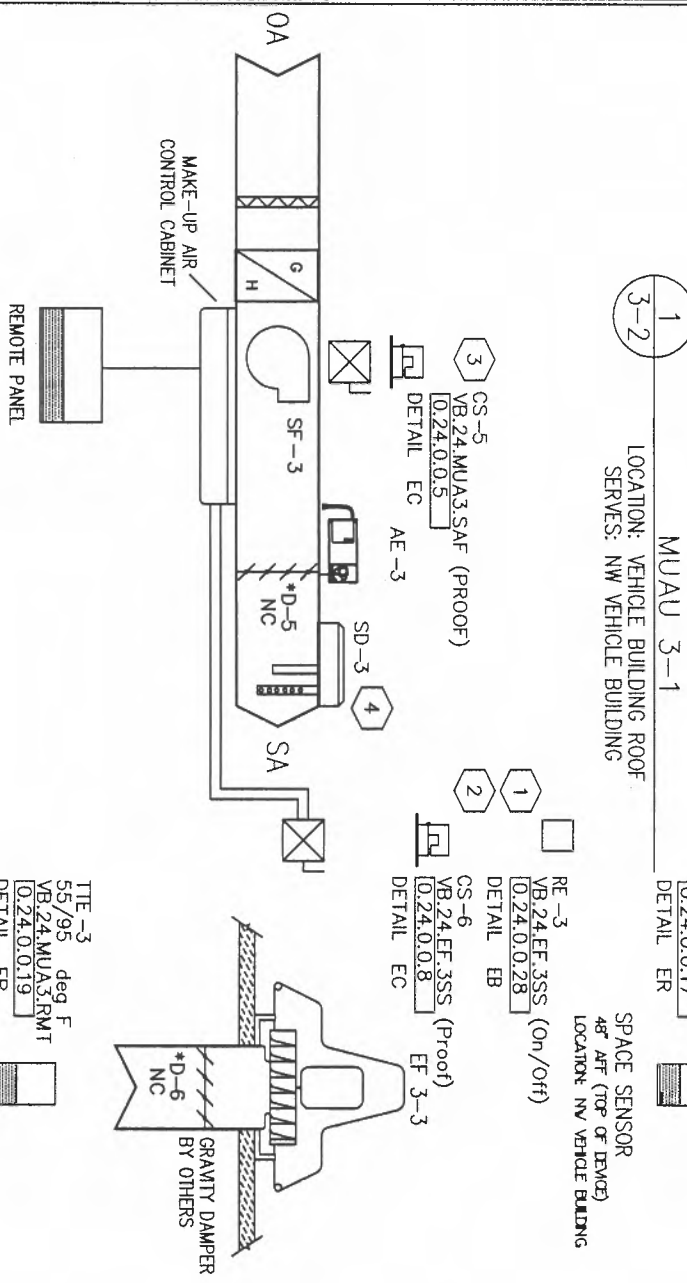
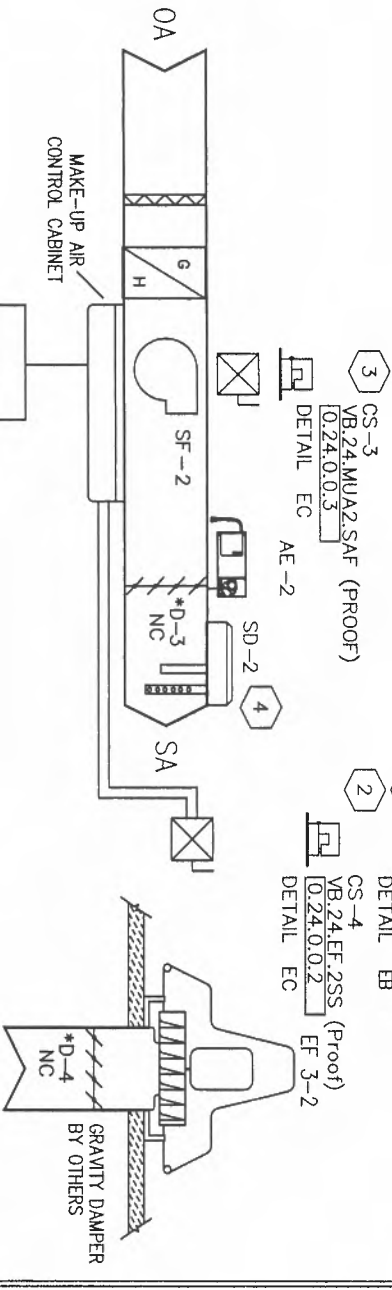
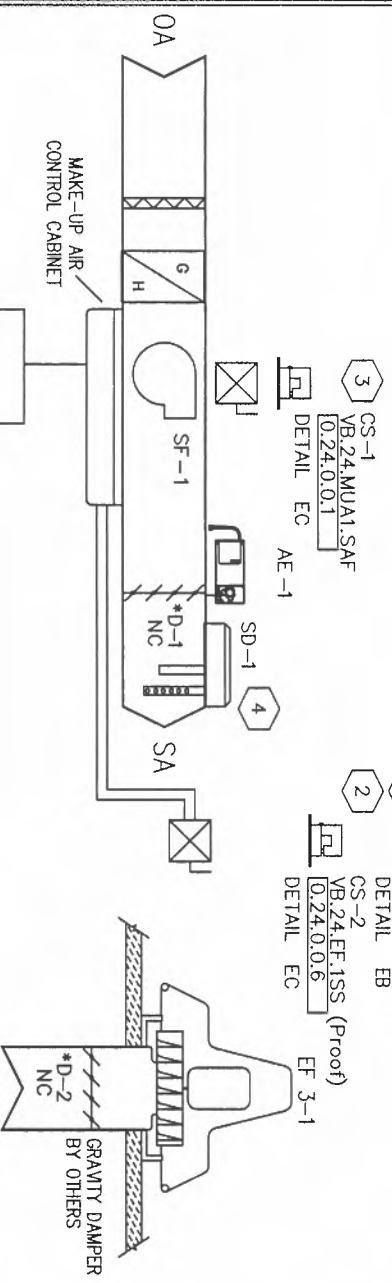
**MAKE-UP AIR CONTROL**

440P-702374

3-2A



- INSTALLATION NOTES:**
- 1 SEE WIRING DETAIL ON ELECTRICAL DRAWINGS
  - 2 CURRENT SENSORS AND RELAYS MOUNTED AT STARTER
  - 3 CURRENT SENSORS LOCATED AT MAKE-UP AIR UNIT CONTROL CABINET
  - 4 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16
  - 5 FIELD VERIFY REMOTE PANEL CABLE REQUIREMENTS NEED LOW AND HIGH VOLTAGE SEPARATION



**3**  
3-2

MUAU 3-3

LOCATION: VEHICLE BUILDING ROOF  
SERVES: SW VEHICLE BUILDING

**4**  
3-2

MUAU 3-4

LOCATION: VEHICLE BUILDING ROOF  
SERVES: SE VEHICLE BUILDING

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 888-815-0749

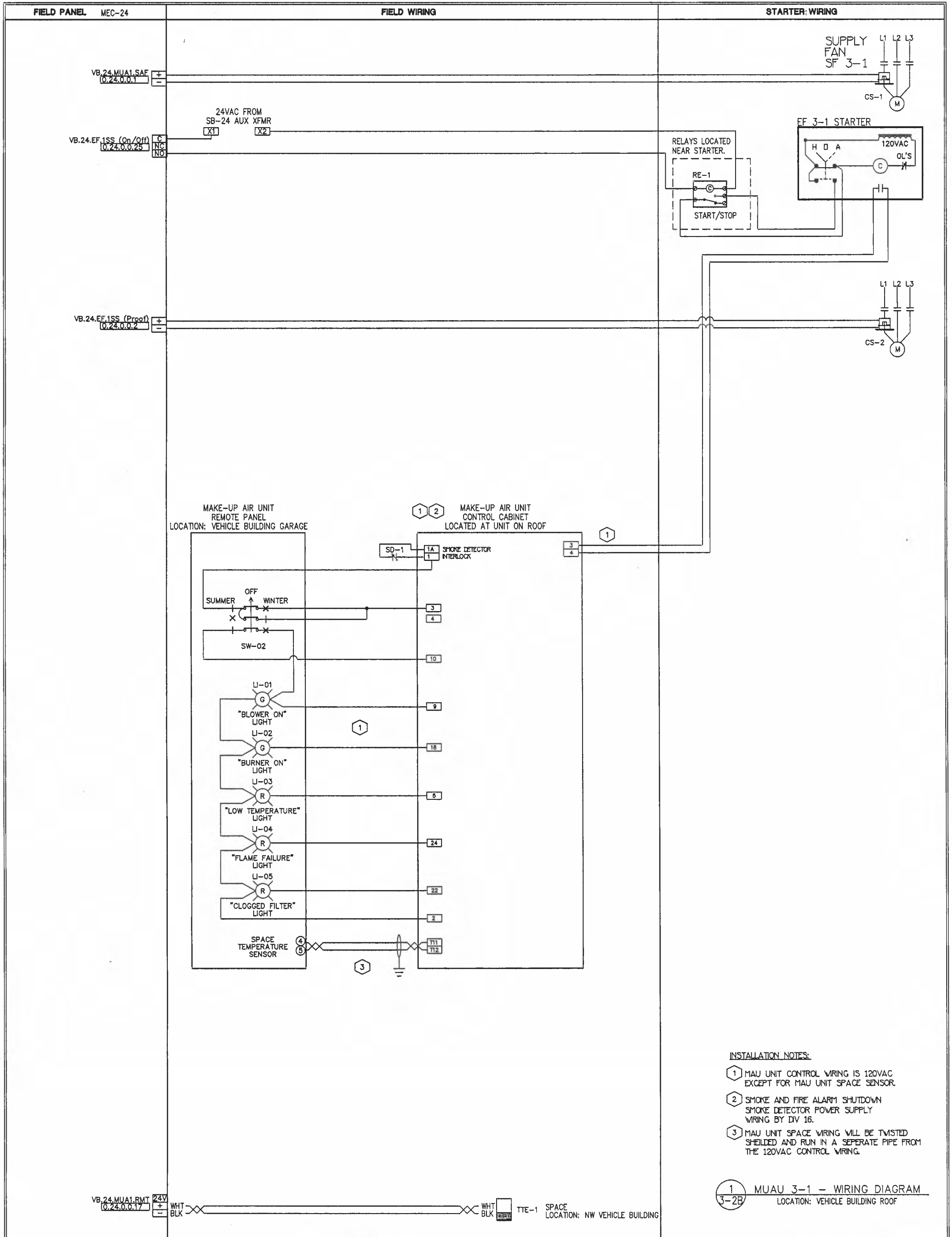
**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	12/03/07

440P-702374  
0

**3-2**



- INSTALLATION NOTES:**
- ① MAU UNIT CONTROL WIRING IS 120VAC EXCEPT FOR MAU UNIT SPACE SENSOR.
  - ② SMOKE AND FIRE ALARM SHUTDOWN SMOKE DETECTOR POWER SUPPLY WIRING BY DIV 16.
  - ③ MAU UNIT SPACE WIRING WILL BE TWISTED SHELDED AND RUN IN A SEPERATE PIPE FROM THE 120VAC CONTROL WIRING.

① MAU 3-1 - WIRING DIAGRAM  
③-2B LOCATION: VEHICLE BUILDING ROOF

REVISION HISTORY			
1	11/28/2007	KJ	AS-BUILT DRAWING

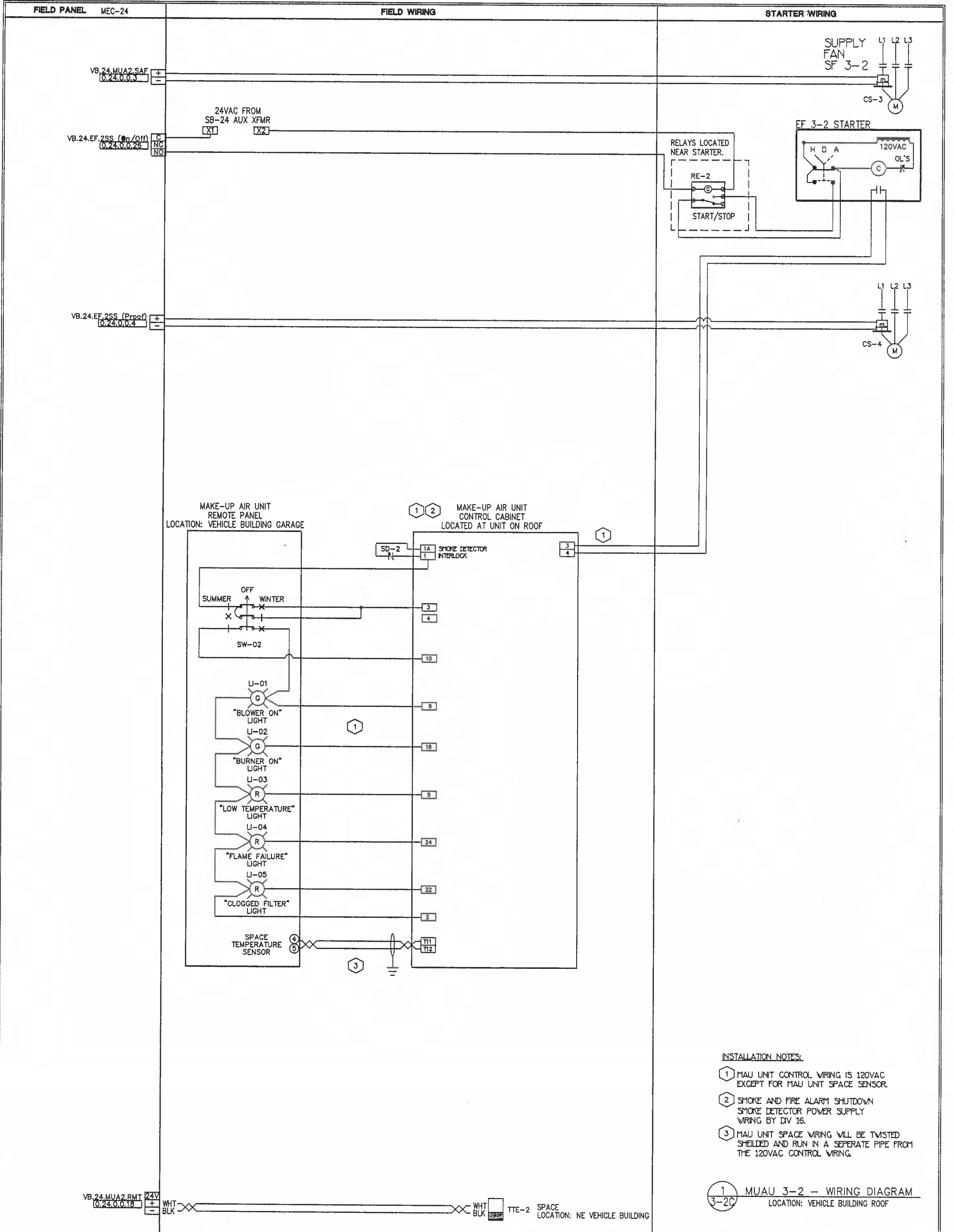
**SIEMENS**  
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Plymouth Twp., MI 48170  
USA  
Siemens Building Technologies  
BAU  
PHONE: 734-456-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI**

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJ</i>	10/27/08	12/03/07

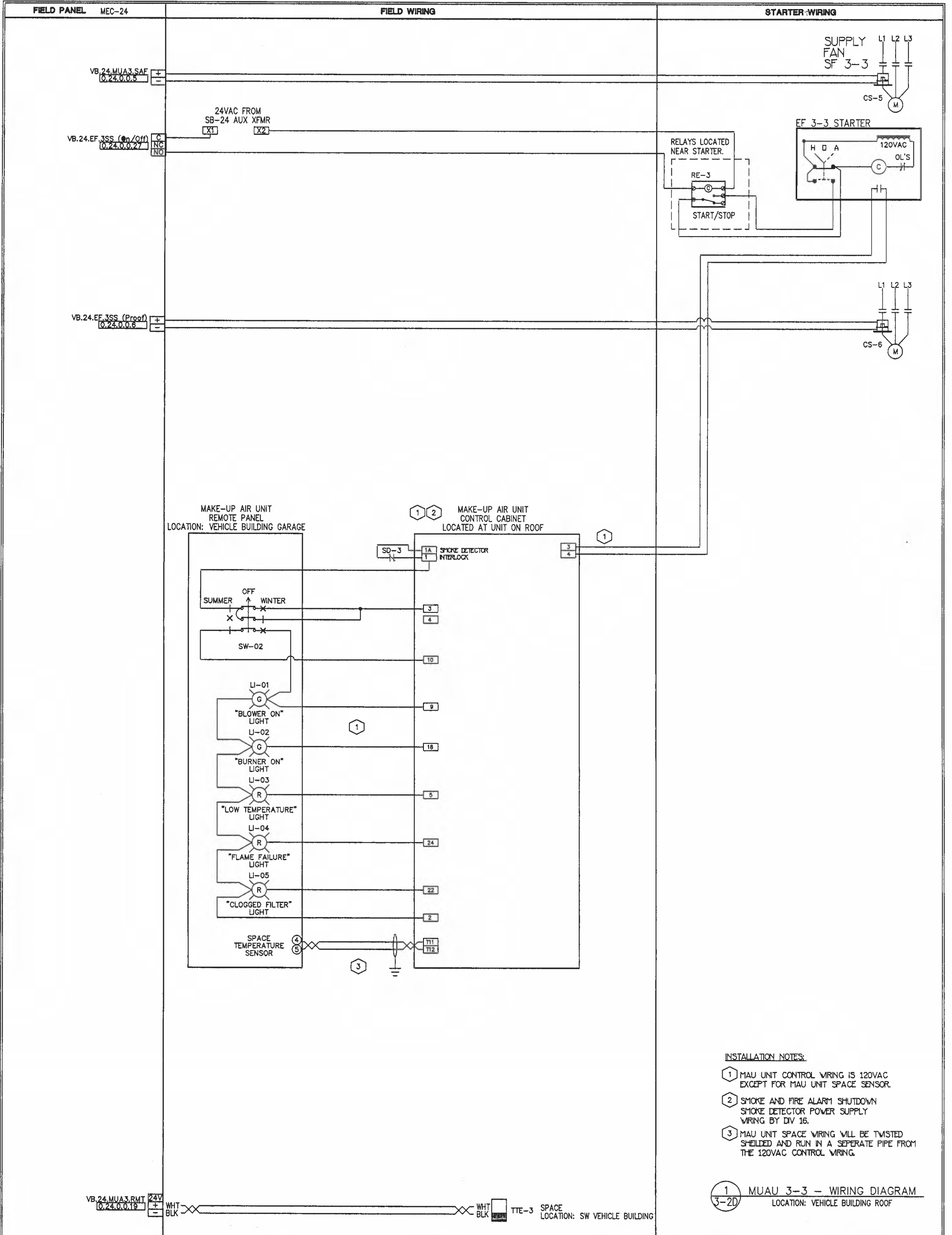
**MAU 3-1 WIRING**

440P-702374  
0  
**3-2B**



- INSTALLATION NOTES:
- ① MAU UNIT CONTROL WIRING IS 120VAC EXCEPT FOR MAU UNIT SPACE SENSOR.
  - ② SMOKE AND FIRE ALARM SHUTDOWN SMOKE DETECTOR POWER SUPPLY WIRING BY DIV 16.
  - ③ MAU UNIT SPACE WIRING WILL BE TWISTED SHIELDED AND RUN IN A SEPERATE PIPE FROM THE 120VAC CONTROL WIRING.
- ① MAU 3-2 - WIRING DIAGRAM  
③-2C LOCATION: VEHICLE BUILDING ROOF

<b>REVISION HISTORY</b>			<b>SIEMENS</b>		<b>ANN ARBOR MAINTENANCE FACILITY</b>		<b>440P-702374</b>	
1	11/28/2007	KJ	45470 Commerce Ctr. Dr. Plymouth Twp., MI 48170 USA		ANN ARBOR, MI		0	
AS-BUILT DRAWING			Siemens Building Technologies BAU		PHONE: 734-458-3800 FAX: 866-815-0749		<b>3-2C</b>	
					ENGINEER: SFM DRAFTER: SFM CHECKED BY: <i>lzf</i> INITIAL RELEASE: 10/27/08 LAST EDIT DATE: 12/03/07		<b>MUAU 3-2 WIRING</b>	



- INSTALLATION NOTES:
- ① MAU UNIT CONTROL WIRING IS 120VAC EXCEPT FOR MAU UNIT SPACE SENSOR.
  - ② SMOKE AND FIRE ALARM SHUTDOWN SMOKE DETECTOR POWER SUPPLY WIRING BY DIV 16.
  - ③ MAU UNIT SPACE WIRING WILL BE TWISTED SHIELDED AND RUN IN A SEPERATE PIPE FROM THE 120VAC CONTROL WIRING.

① MAU 3-3 - WIRING DIAGRAM  
3-2D LOCATION: VEHICLE BUILDING ROOF

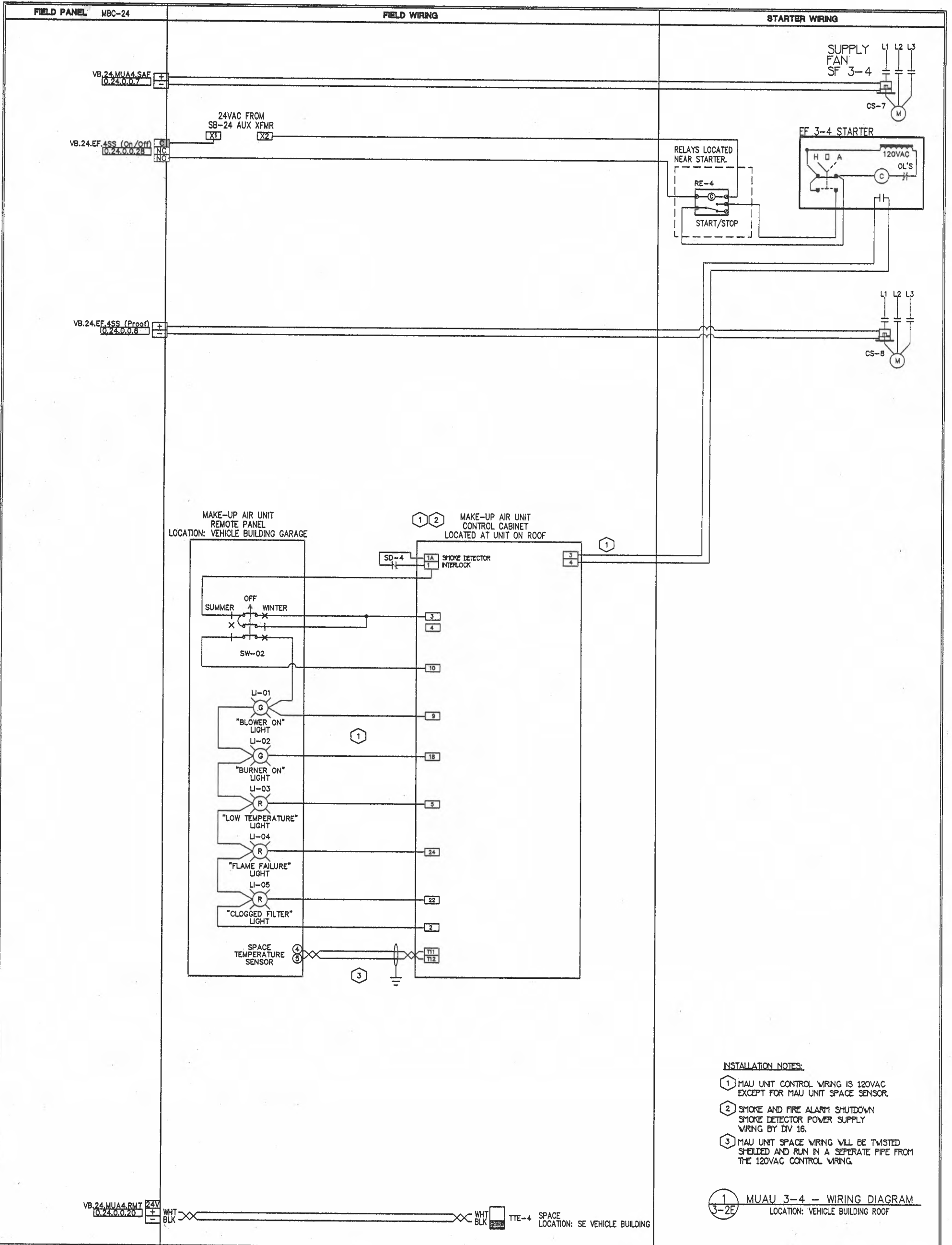
REVISION HISTORY			
1	11/28/2007	KJ	AS-BUILT DRAWING

**SIEMENS**  
45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
Siemens Building Technologies  
BAU  
PHONE: 734-456-3800  
FAX: 866-815-0749

ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI  
ENGINEER: SFM  
DRAFTER: SFM  
CHECKED BY: [Signature]  
INITIAL RELEASE: 10/27/08  
LAST EDIT DATE: 12/03/07  
**MUAU 3-3 WIRING**

440P-702374  
0  
**3-2D**





REVISION HISTORY			
1	11/28/2007	KJ	AS-BUILT DRAWING

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45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-450-3800  
FAX: 866-815-0749

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ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	274	10/27/06	12/03/07

MAU 3-4 WIRING

440P-702374  
0  
**3-2E**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
AE 1	1	FBO	N/A	N/A	FURNISHED BY OTHERS
AE 2	1	GCA221.1U	SIEMENS	154001	2 PT SR.115V,MED
CS 1-2	2	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SEIPT W/LED
SD 1	1	BY OTHERS	N/A	N/A	FURNISHED BY OTHERS
TTE 1	1	544-760A	SIEMENS	149 312	ROOM SENSOR,DST BEIGE
	1	544-782A	SIEMENS	149 359	SINGLE GOOD MOUNTING PLATE KIT

The constant volume Make-up air unit consists of a pre-filter, gas heating section and supply fan.

The make-up air unit's thermostat shall fire the unit's gas burner to maintain the building room temperature (by unit manufacturer).

**Safety**

Smoke detector in the supply air stream de-energizes the supply fan upon activation.

**Monitoring**

DDC system uses a current switch installed in the Make-up air unit to confirm supply fan status.

DDC system shall monitor the room air temperature.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-9800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJ</i>	10/27/08	12/03/07

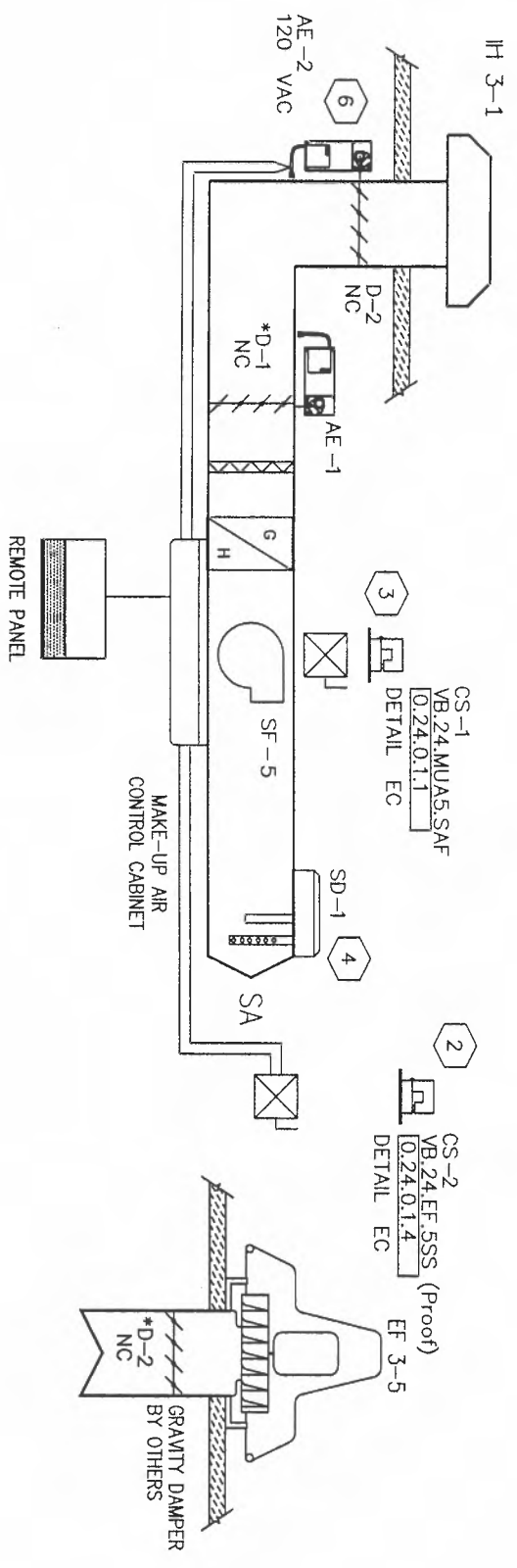
**MAKE-UP AIR CONTROL**

440P-702874

300

**3-3A**

- INSTALLATION NOTES:**
- 1 SEE WIRING DETAIL ON ELECTRICAL DRAWINGS
  - 2 CURRENT SENSORS AND RELAYS MOUNTED AT STARTER
  - 3 CURRENT SENSORS LOCATED AT MAKE-UP AIR UNIT CONTROL CABINET.
  - 4 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION 16.
  - 5 FIELD VERIFY REMOTE PANEL, CABLE REQUIREMENTS KEEP LOW AND HIGH VOLTAGE SEPARATED
  - 6 DAMPER MECHANICALLY LOCKED OPEN



1  
3-3

MUAU 3-5  
 LOCATION: VEHICLE BUILDING MEZZANINE  
 SERVICES: TOILETS/MUD ROOM

TTE -1  
 55/95 deg F  
 VB.24.MUAS.RMT  
 0.24.0.0.21  
 DETAIL ER

SPACE SENSOR  
 48" AFT (TOP OF DAMPER)  
 LOCATION: MUD ROOM

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-456-3800  
 FAX: 866-815-0749

Siemens Building Technologies  
 BAU

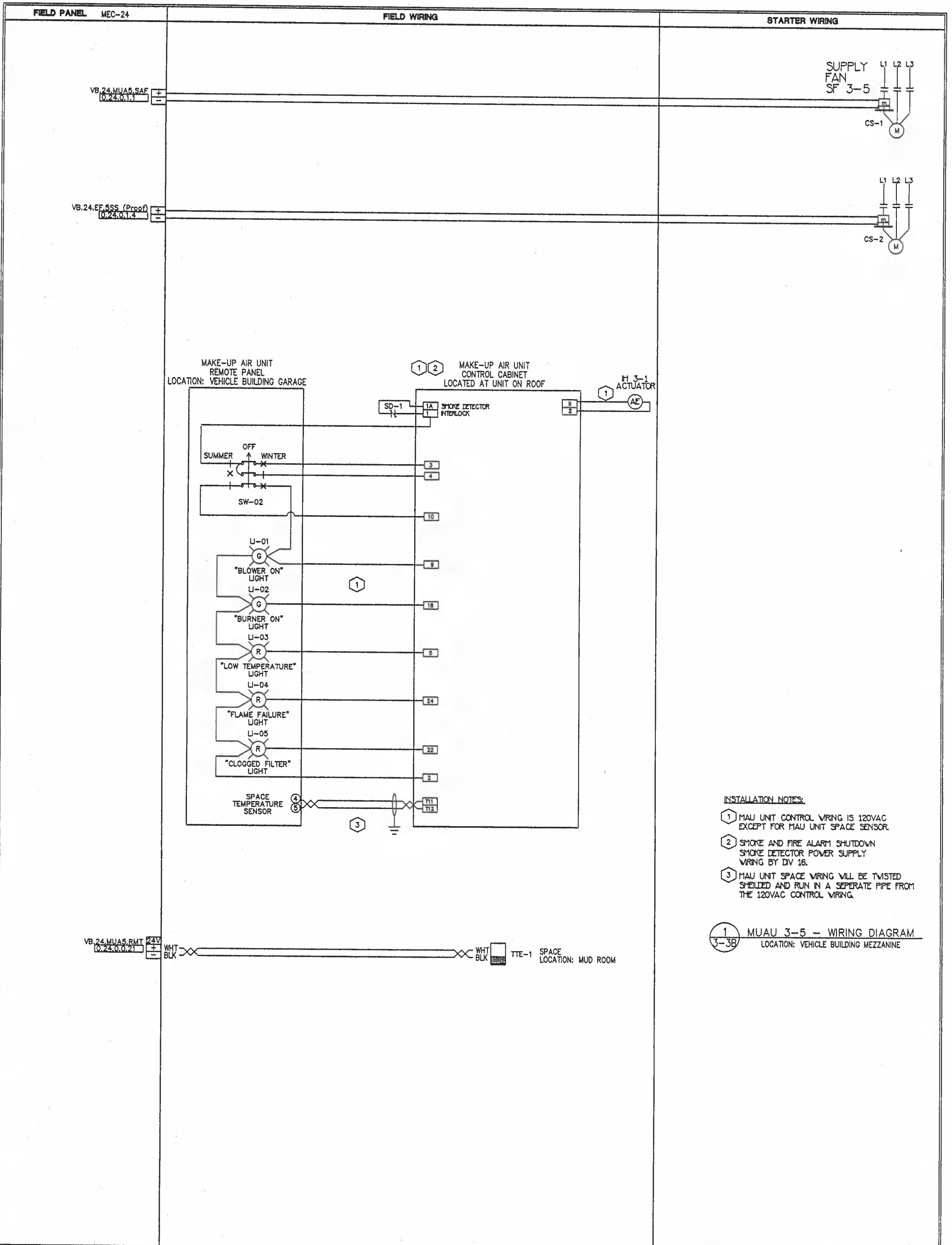
**ANN ARBOR MAINTENANCE FACILITY**

<b>ANN ARBOR, MI</b>			
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE
SFM	SFM	<i>[Signature]</i>	10/27/08
			12/03/07
<b>MAKE-UP AIR CONTROL</b>			

440P-702374  
300

3-3





- INSTALLATION NOTES:**
- ① MAU UNIT CONTROL WIRING IS 120VAC EXCEPT FOR MAU UNIT SPACE SENSOR
  - ② SMOKE AND FIRE ALARM SHUTDOWN SMOKE DETECTOR POWER SUPPLY WIRING BY DIV 16.
  - ③ MAU UNIT SPACE WIRING WILL BE TWISTED SHIELDED AND RUN IN A SEPERATE PIPE FROM THE 120VAC CONTROL WIRING.

① MUAU 3-5 -- WIRING DIAGRAM  
 3-3B LOCATION: VEHICLE BUILDING MEZZANINE

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

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 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-456-3800  
 FAX: 866-815-0749

ANN ARBOR MAINTENANCE FACILITY  
 ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>[Signature]</i>	10/27/06	12/03/07

**MUAU 3-5 WIRING**

440P-702374  
 0

**3-3B**

**Automatic Transfer Switch Monitoring (ATS-1, ATS-2)**

DDC system shall monitor the transfer switch for normal position.  
DDC system shall monitor the transfer switch for emergency position.

**Load Shedding**

Vehicle/Equipment Storage Building;

Load Shed Sequence:

- a. Upon notification of a generator overload, secure exhaust fans EF 3-2, EF 3-3, EF 3-4 and make-up air units MUAU 3-2, MUAU 3-3 and MUAU 3-4. Sequence of operation of each exhaust fan and make-up air unit noted above every 15 minutes until commercial power is restored.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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USA  
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**ANN ARBOR MAINTENANCE FACILITY**

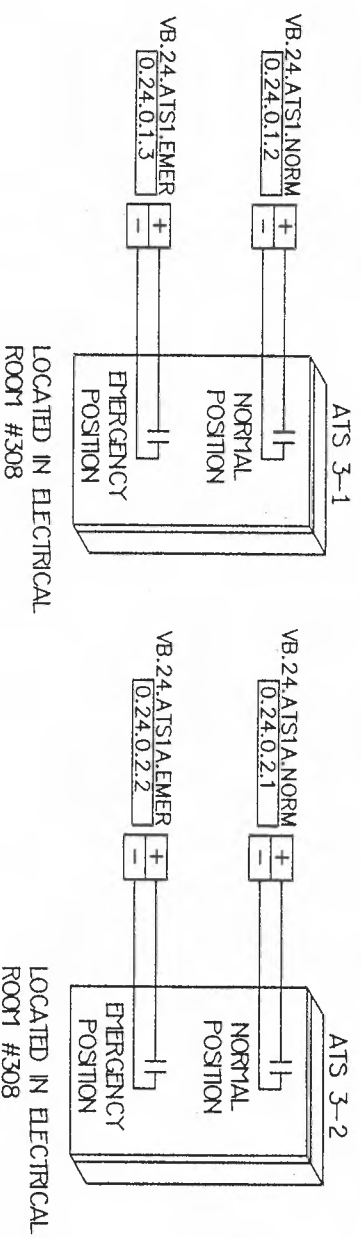
**ANN ARBOR, MI**

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>SFM</i>	10/27/06	12/03/07

**GENERATOR SYSTEM INTERFACE**

440P-702374  
300

**3-4A**



1  
3-4  
GENERATOR SYSTEM INTERFACE  
LOCATION: ELECTRICAL ROOM #308  
SERVES: VEHICLE BUILDING EMERGENCY POWER

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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BAU

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Plymouth Twp.  
Mn. 48170 USA  
Phone: 734-456-9800  
Fax: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJL</i>	10/27/06	12/03/07

440P-702374  
300  
**3-4**

**Vehicle Building Lighting Sequence of Operations**

BMS shall communicate to Vehicle Building lighting panels via BACnet TC/IP protocol. BMS shall turn on/off interior and exterior lighting according to a time a day schedule.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

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USA  
PHONE: 734-456-3800  
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**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	LJL	10/27/06	12/03/07

**LIGHTING SYSTEM INTERFACE**

440P-702374

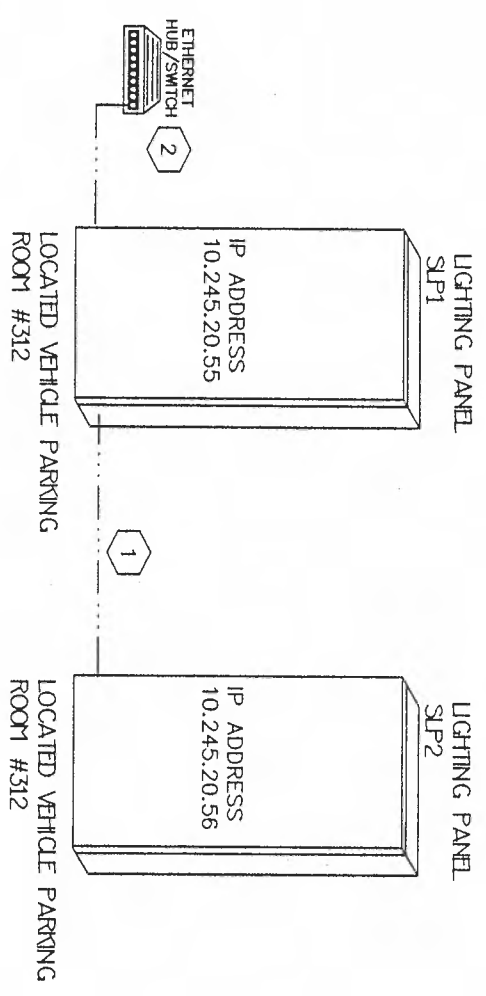
300

**3-5A**

**INSTALLATION NOTES:**

- 1 LIGHTING PANELS TO NETWORKED TOGETHER BY OTHERS
- 2 ETHERNET DROP TO BE PROVIDED BY OTHERS

**LIGHTING INTEGRATION POINTS**  
 NOTE: LIGHTING INTEGRATION POINTS TO BE COORDINATED WITH LIGHTING VENDOR



1  
3-5 VEHICLE BUILDING LIGHTING  
 LOCATION: VEHICLE BUILDING  
 SERVES: VEHICLE BUILDING LIGHTS

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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45470 Commerce Ctr. Dr.  
 Plymouth Twp, MI 48170  
 USA  
 PHONE: 734-458-3800  
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**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	CSM	10/27/06	12/03/07

**LIGHTING SYSTEM INTERFACE**

440P-702374  
 300  
**3-5**

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
AE 1	1	FBO	FBO			FURNISHED BY OTHERS
D						SEE DAMPER SUBMITTAL
TE 1	1	134-1084	SIEMENS	PCI-13	155 017	TSTAT/H/C/LINE VOLT CON/EXP

**Exhaust Fan EF 3-6 Sequence of Operations**  
The power roof vent exhaust fan runs constantly (Not shown on control drawings).

**Exhaust Fan EF 3-6 Sequence of Operations**  
The space thermostat cycles the power roof vent exhaust fan to maintain the space temperature at set point. The damper opens when the fan is started.

REVISION HISTORY		
1	11/28/2007	KJ AS-BUILT DRAWING

**SIEMENS**  
Siemens Building Technologies  
BAU

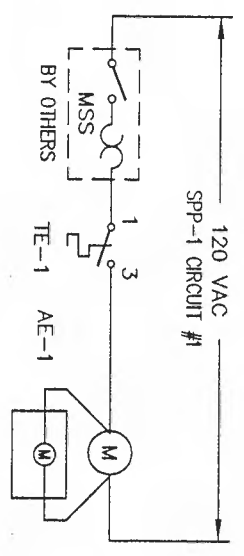
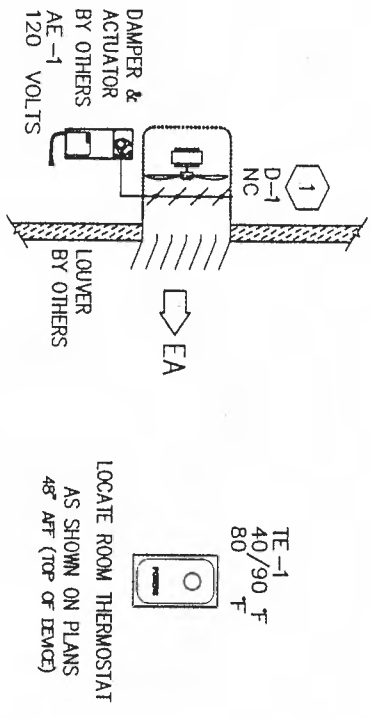
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USA  
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ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>sfm</i>	10/27/08	12/03/07

EXHAUST FAN CONTROL

440P-702374  
300  
**3-6A**



1 EXHAUST FAN EF 3-6 CONTROL  
 3-6  
 LOCATION: ELECTRICAL ROOM #308  
 SERVES: ELECTRIC ROOM #308

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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 USA  
 PHONE: 734-458-3800  
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**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI			
ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE
SFM	SFM	CJK	10/27/06
			LAST EDIT DATE
			12/03/07

440P-702374  
 300  
**3-6**

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
TE 1-2	2	FBO	FBO			FURNISHED BY OTHERS

**Electric Unit Heater Sequence of Operations**  
 A unit mounted electric thermostat cycles the unit heater fan to maintain the space temperature at set point.

**Gas Unit Heater Sequence of Operations**  
 A unit mounted electric thermostat cycles the unit heater fan and gas heat to maintain the space temperature at set point.

REVISION HISTORY	
1	11/28/2007 KJ AS-BUILT DRAWING

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 BAU

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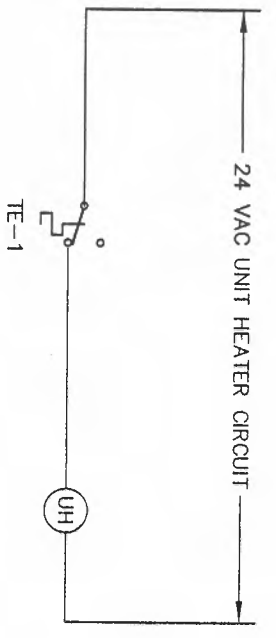
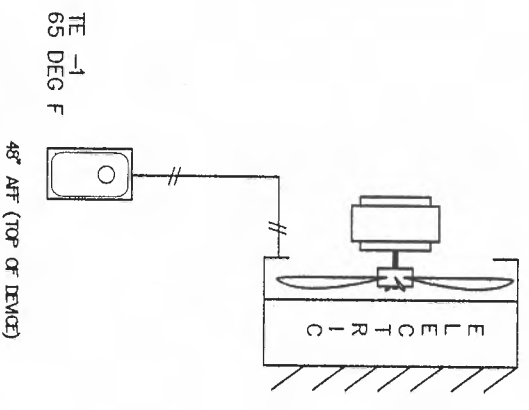
ANN ARBOR MAINTENANCE FACILITY  
 ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>CS</i>	10/27/08	12/03/07

UNIT HEATER CONTROL

440P-702374  
 300  
**3-7A**





**1**  
3-7  
**ELECTRIC UNIT HEATER CONTROL**  
LOCATION: VEHICLE BUILDING  
TYPICAL OF FIVE

**2**  
3-7  
**GAS UNIT HEATER CONTROL**  
LOCATION: MAINTENANCE BUILDING  
SERVES: CORRIDOR #232

**ELECTRIC UNIT HEATER SCHEDULE**

UNIT HEATER	SERVES
EUH 3-1	ROOM #304 N ENCLOSED STORAGE (SOLID WASTE)
EUH 3-2	ROOM #304 S ENCLOSED STORAGE (SOLID WASTE)
EUH 3-3	ROOM #305 TOOL CRIB (SOLID WASTE)
EUH 3-4	ROOM #317 JANITORIAL SUPPLIES (PARKS/F&H)
EUH 3-5	ROOM #318 ENCLOSED STORAGE (PARKS/F&H)

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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USA  
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**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRATER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	674	10/27/06	12/03/07

440P-702374  
300  
**3-7**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Panel Mounted Devices					
MEC 024000	1	549-617	SIEMENS	149 344	PWR MEC 1310-1/0 PB MDM HOA
MEC 024001	1	549-213	SIEMENS	N/A	DIGITAL POINT EXP.4DL400,HOA
MEC 024002	1	549-213	SIEMENS	N/A	DIGITAL POINT EXP.4DL400,HOA

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJK</i>	10/27/06	12/09/07

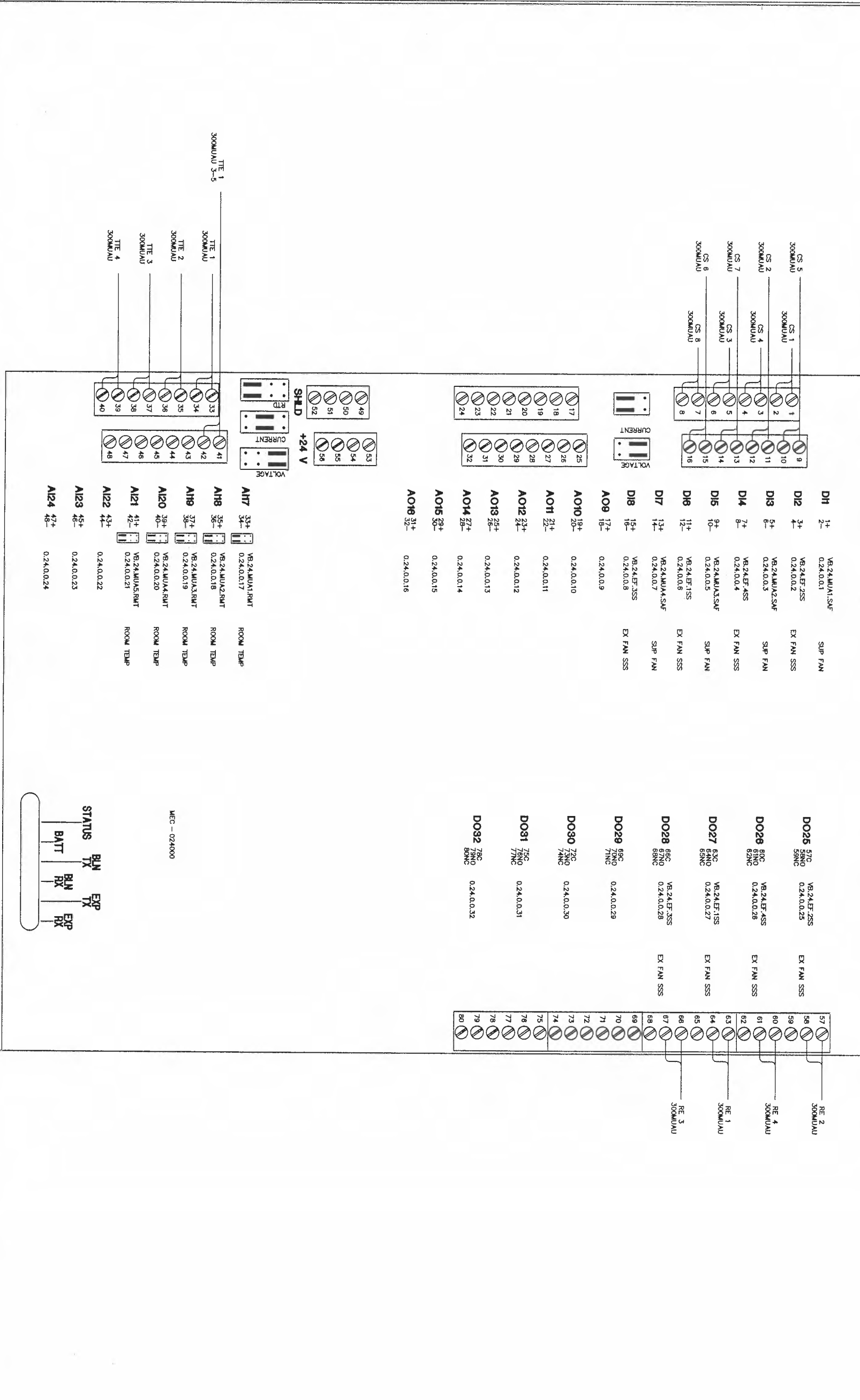
VB.24.ELECRROOM.308 LAYOUT

440P-702374

0

**3-8A**

**SIEMENS**



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

45470 Commerce Ctr. Dr.  
 Plymouth Twp.  
 MI 48170 USA  
 Phone: 734-458-3800  
 Fax: 866-815-0749

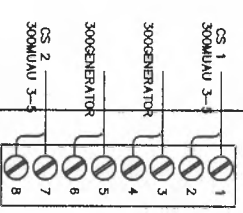
**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI  
 ENGINEER: SFM  
 DRAFTER: SFM  
 CHECKED BY: [Signature]  
 INITIAL RELEASE: 10/27/06  
 LAST EDIT DATE: 12/03/07

440P-702374  
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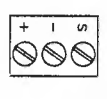
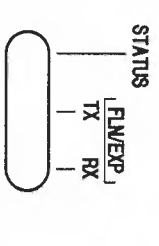
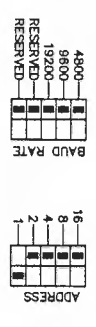
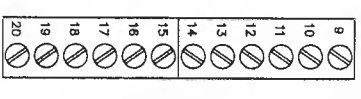
**3-8**

# SIEMENS



DH	1+	VB 24.MUJ.5.SAF 0.24.0.1.1	SUP FAN
DH	2+	VB 24.ATS1.NORM 0.24.0.1.2	NORMAL POSITION
DH	3+	VB 24.ATS1.EMER 0.24.0.1.3	EMER. POSITION
DH	4+	VB 24.EF.SSS 0.24.0.1.4	EX FAN SSS

DO5	9C 13NO 17NC	0.24.0.1.5
DO6	12C 13NO 17NC	0.24.0.1.6
DO7	15C 16NO 17NC	0.24.0.1.7
DO8	18C 19NO 20NC	0.24.0.1.8



## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

Siemens Building Technologies  
BAU

31823 Industrial Road  
Livonia, MI 48150  
Phone: 734-266-1486  
Fax: 734-266-1437

## ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

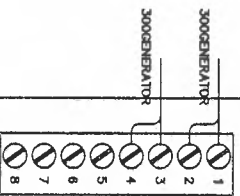
ENGINEER	DRAFTER	CHECKED BY	INITIAL	RELEASE	LAST EDIT	DATE
SFM	SFM	<i>SFM</i>				
				05/17/2006	12/03/07	

## VB.24.ELECRROOM.308-X1 LAYOUT

233-E-4185-00  
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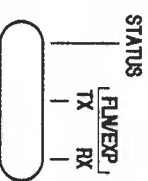
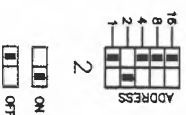
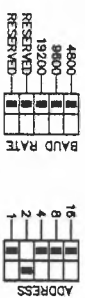
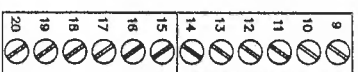
# 3-8B

# SIEMENS



DI1	1+	VB.24.ATS1A.NORM	NORMAL POSITION
	2-	0.24.0.21	
DI2	3+	VB.24.ATS1A.BER	BAK. POSITION
	4-	0.24.0.22	
DI3	5+	0.24.0.23	
	6-		
DI4	7+	0.24.0.24	
	8-		

DO5	9C	10NO	11NC	0.24.0.25
DO6	13C	13NO	14NC	0.24.0.26
DO7	15C	15NO	17NC	0.24.0.27
DO8	18C	18NO	20NC	0.24.0.28



## REVISION HISTORY

1	11/28/2007	KJ	AS-BUILT DRAWING
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## SIEMENS

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MI 48170 USA  
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Fax: 866-815-0749

## ANN ARBOR MAINTENANCE FACILITY

ANN ARBOR, MI

ENGINEER	DRAWN	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	SFM	10/27/06	12/03/07

VB.24.ELECRROOM.308-X2 LAYOUT

440P-702374

0

3-8C

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
TCP 24	1	549-505	SIEMENS		149 344	LARGE ENCLOSURE,MEC

**REVISION HISTORY**

1 | 11/28/2007 | KJ | AS-BUILT DRAWING

**SIEMENS**

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**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

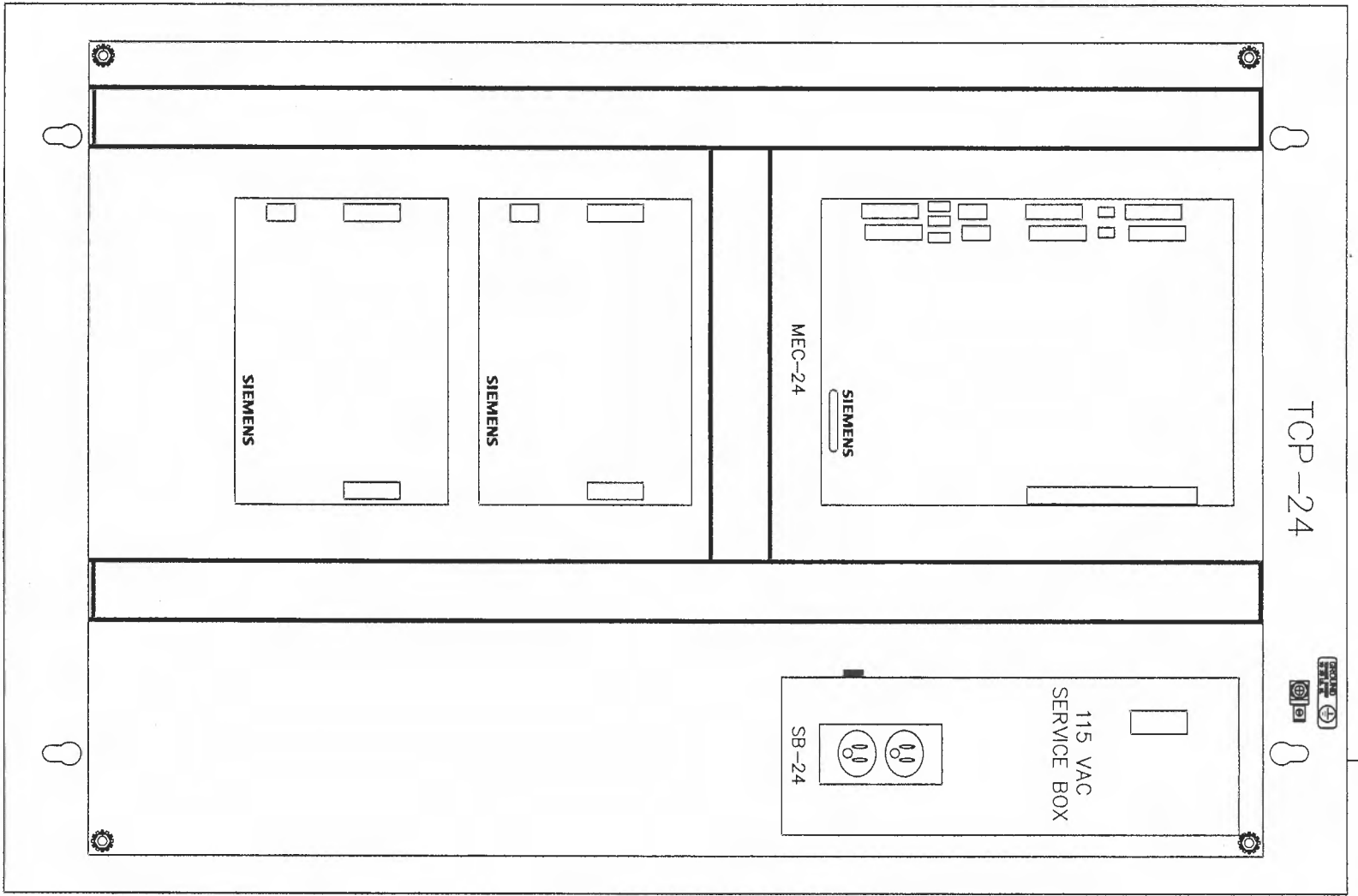
ENGINEER | DRAFTER | CHECKED BY | INITIAL RELEASE | LAST EDIT DATE  
SFM | SFM | *WJL* | 10/27/06 | 11/28/07

TCP-24 PANEL LAYOUT

233-E -4185-00  
300

**3-9A**

PROVIDE 120VAC IN  
RIGHT CORNER OF CABINET  
EMERGENCY PANEL SDP-4  
VEHICLE BUILDING COL. J-12



1  
3-9  
TCP-24 PANEL LAYOUT  
LOCATION: ELECTRICAL ROOM #308

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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USA  
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**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJA</i>	10/27/06	11/28/07

**TCP-24 PANEL LAYOUT**

440P-702374  
300

**3-9**

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**ANN ARBOR MAINTENANCE FACILITY**

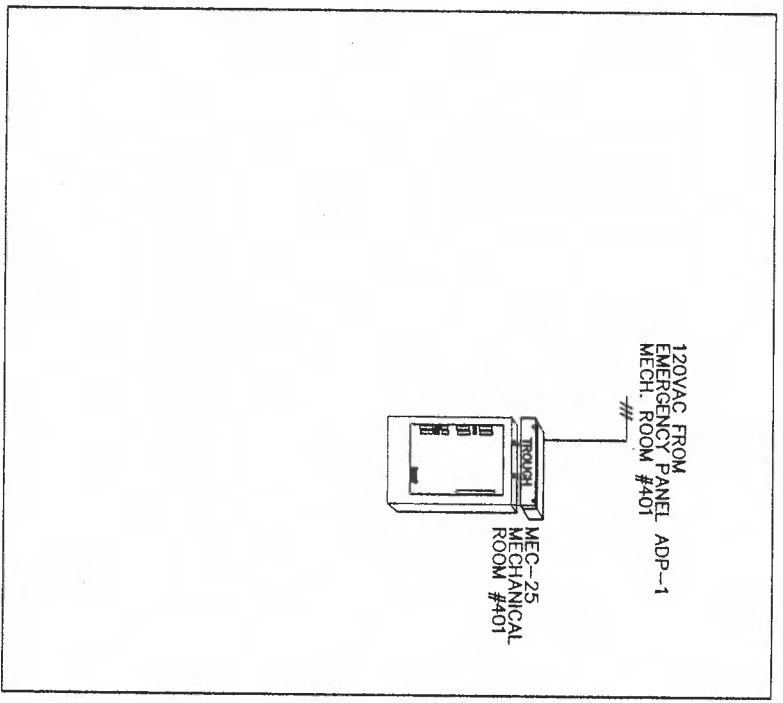
ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJL</i>	10/27/06	11/28/07

**TRUCK/AUTO WASH RISER**

440P-702374  
400

**4-1**



**TRUCK/AUTO WASH**



Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
CS 1	1	H608	VERIS	1006cut016	CUR SW SPLITCOR-ADJ SELPT W/LED
RE 1	1	RIBUIC	FUNCTIONAL DEVICES	1208cut013	RIB 120VAC 24VAC/DC SPDT
SD 1	1	BY OTHERS	N/A	N/A	FURNISHED BY OTHERS
TTE 1	1	544-577	SIEMENS	149 261	IMM TEMP SENS (-40/240F)

The constant volume Make-up air unit consists of a pre-filter, gas heating section and supply fan.

The Make-up air unit is controlled via it's own internal controls. The Make-up air unit cycles the supply fan and modulates the gas valve to maintain the room temperature.

**Safety**

Smoke detector in the supply air stream de-energizes the supply fan upon activation.

**Monitoring**

DDC system uses a current switch installed in the Make-up air unit to confirm supply fan status. DDC system shall monitor the room air temperature.

REVISION HISTORY		
1	11/28/2007	KJ AS-BUILT DRAWING

**SIEMENS**  
 Siemens Building Technologies  
 BAU

45470 Commerce Ct. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-458-9800  
 FAX: 888-815-0749

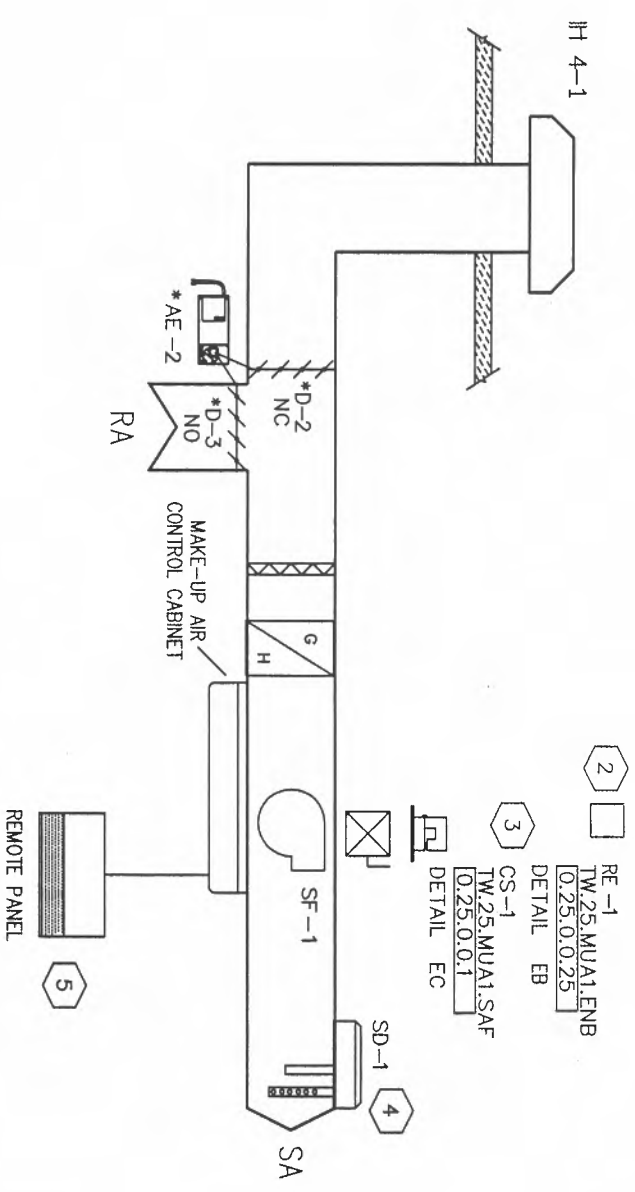
ANN ARBOR MAINTENANCE FACILITY  
 ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>WJK</i>	10/27/08	11/28/07

MAKE-UP AIR CONTROL

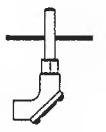
440P-702374  
 400  
**4-2A**

- INSTALLATION NOTES:
- 1 SEE WIRING DETAIL ON ELECTRICAL DRAWINGS.
  - 2 CURRENT SENSORS AND RELAYS MOUNTED AT STARTER.
  - 3 CURRENT SENSORS LOCATED AT MAKE-UP AIR UNIT CONTROL CABINET.
  - 4 SMOKE DETECTOR PROVIDED, MOUNTED, AND WIRED BY DIVISION IS.
  - 5 FIELD VERIFY REMOTE PANEL CABLE REQUIREMENTS. KEEP LOW AND HIGH VOLTAGE SEPARATED.



1  
4-2  
 MUAU 4-1  
 LOCATION: AUTO & TRUCK WASH  
 SERVICES: AUTO & TRUCK WASH

TTE -1  
 -40/240deg F  
 TW-25.MUA1.RMT  
 0.25,0.0,17  
 DETAIL ER  
 SPACE SENSOR  
 48" AFT (TOP OF TENCE)  
 LOCATION: TRUCK WASH #400



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

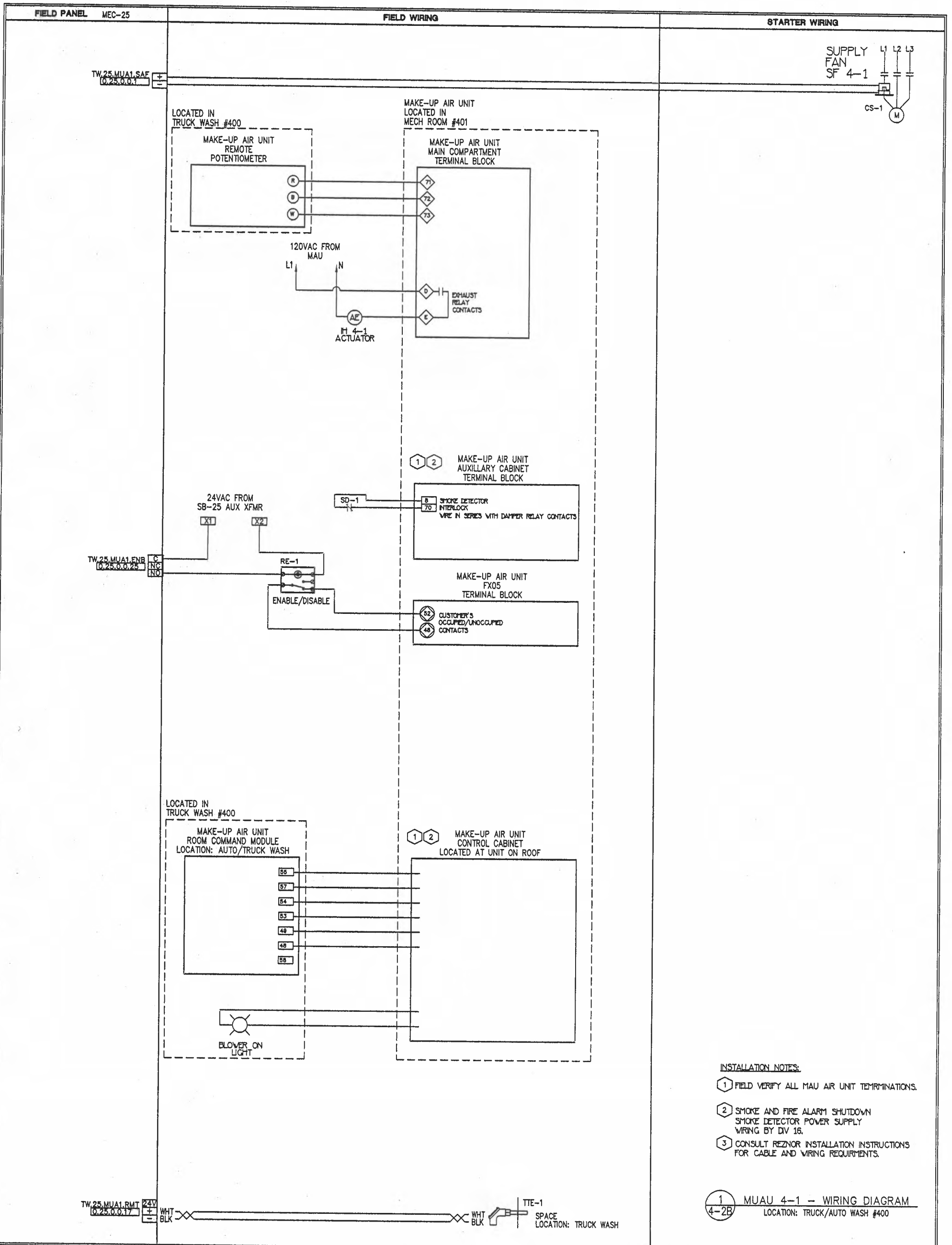
Siemens Building Technologies  
 BAU  
 45470 Commerce Ctr. Dr.  
 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-456-3800  
 FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI  
 ENGINEER: SFM  
 DRAFTER: SFM  
 CHECKED BY: w/l  
 INITIAL RELEASE: 10/27/06  
 LAST EDIT DATE: 11/28/07

440P-702374  
400

**4-2**



REVISION HISTORY		
1	11/28/2007	KJ AS-BUILT DRAWING

**SIEMENS**

46470 Commerce Ctr. Dr.  
Plymouth Twp., MI 48170  
USA  
PHONE: 734-458-3800  
FAX: 800-815-0749

Siemens Building Technologies  
BAU

ANN ARBOR MAINTENANCE FACILITY  
ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	2/21	10/27/06	11/28/07

**MAKE-UP AIR WIRING**

440P-702374  
400

**4-2B**

Control Device	Qty	Product Number	Manufacturer	SD Number	Document Number	Description
Field Mounted Devices						
TE	1	FBO	FBO			FURNISHED BY OTHERS

**Electric Unit Heater Sequence of Operations**  
 A unit mounted electric thermostat cycles the unit heater fan to maintain the space temperature at set point.

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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 BAU

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 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-458-3800  
 FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

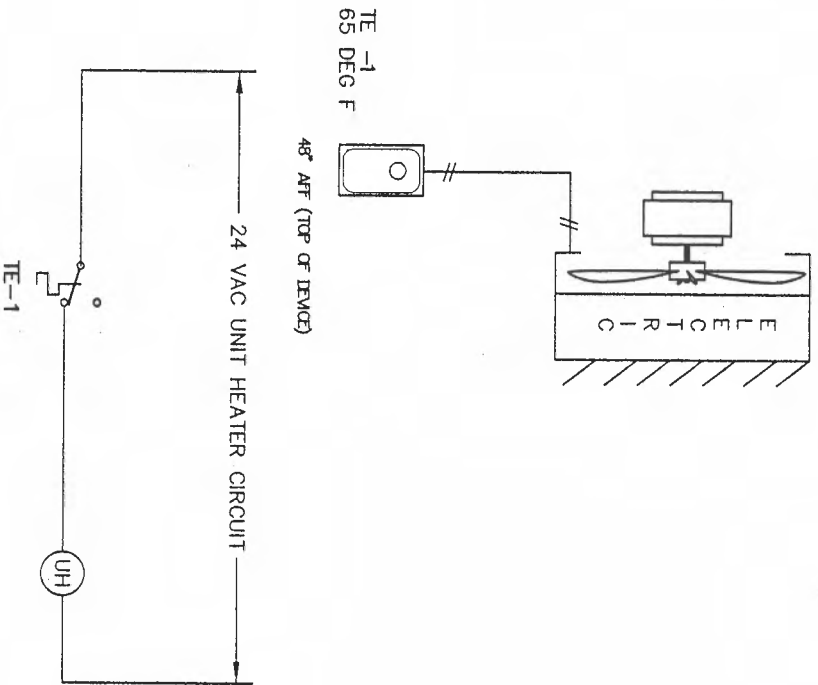
ENGINEER	DEALTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>SFM</i>	10/27/06	11/28/07

**UNIT HEATER CONTROL**

440P-702974

400

**4-3A**



**1** **4-3** **ELECTRIC UNIT HEATER CONTROL**  
 LOCATION: DECANT STATION  
 SERVES: ROOM 410 MECHANICAL ROOM

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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 Plymouth Twp., MI 48170  
 USA  
 PHONE: 734-458-3800  
 FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

**ANN ARBOR, MI**

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJ	10/27/06	11/28/07

**UNIT HEATER CONTROL**

440P-702374  
400

**4-3**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Panel Mounted Devices					
MEC 025000	1	549-617	SIEMENS	149 344	PWR MEC 1310-1/0 PB MDM HOA
	1	549-506	SIEMENS	149 344	SERVICE BOX.MEC.115V

**REVISION HISTORY**

1 | 11/28/2007 | KJ | AS-BUILT DRAWING

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Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 866-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WV	10/27/06	11/28/07

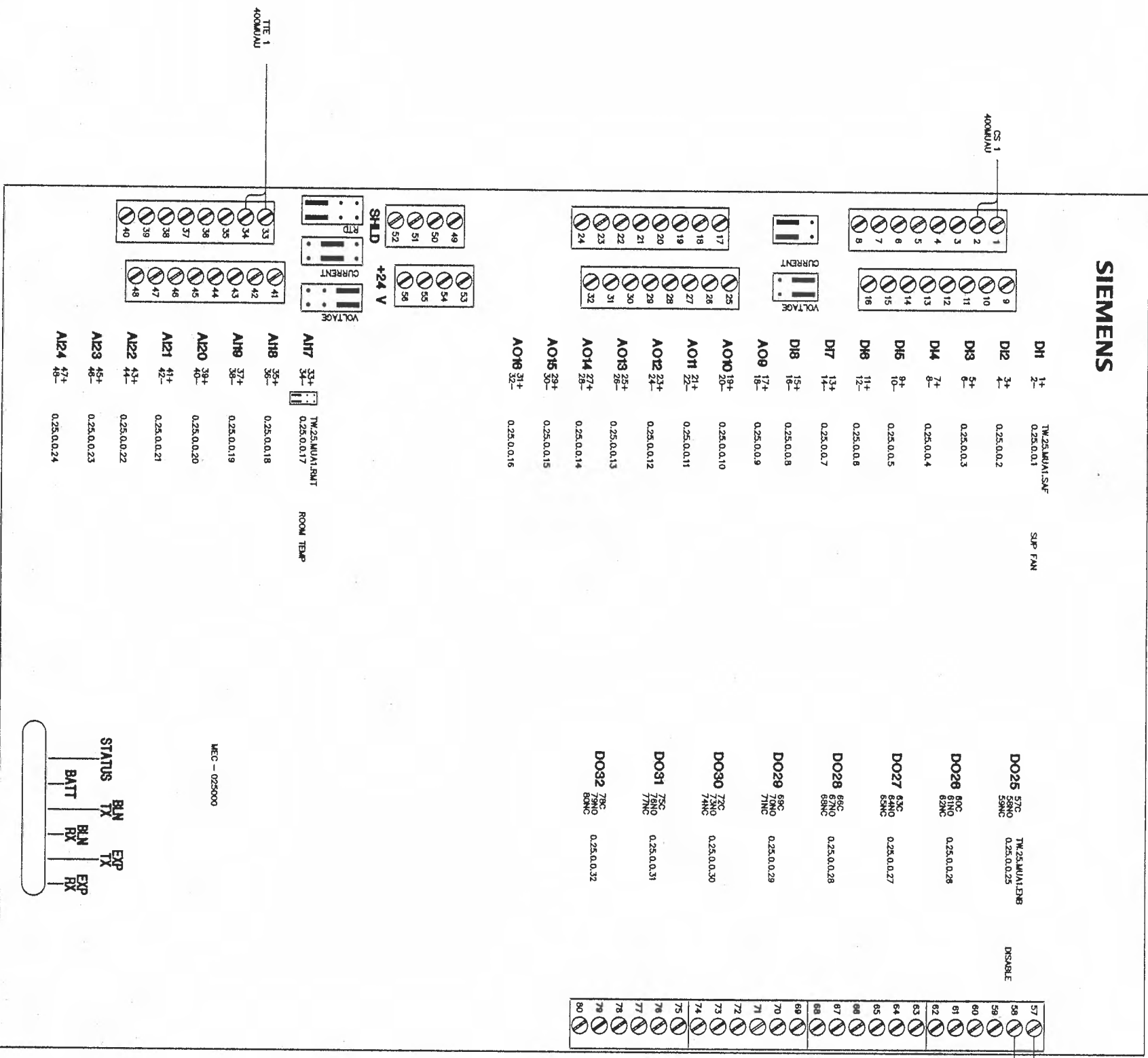
TW.25.MECHRROOM.401 LAYOUT

440P-702374

400

**4-4A**

**SIEMENS**



**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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**SIEMENS**

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BAU

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Plymouth Twp.  
MI 48170 USA  
Phone 734-458-3800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WPL	10/27/06	11/28/07

440P-702374  
400  
**4-4**

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Panel Mounted Devices					
TCP 25	1	A-24A24ALP	HOFMANN	N/A	24"X24"X6" NEMA A ENCLOSURE
	1	A-24P24	HOFMANN	N/A	SUBPANEL

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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Plymouth Twp., MI 48170  
USA  
PHONE: 734-456-3800  
FAX: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	<i>W/L</i>	10/27/06	11/28/07

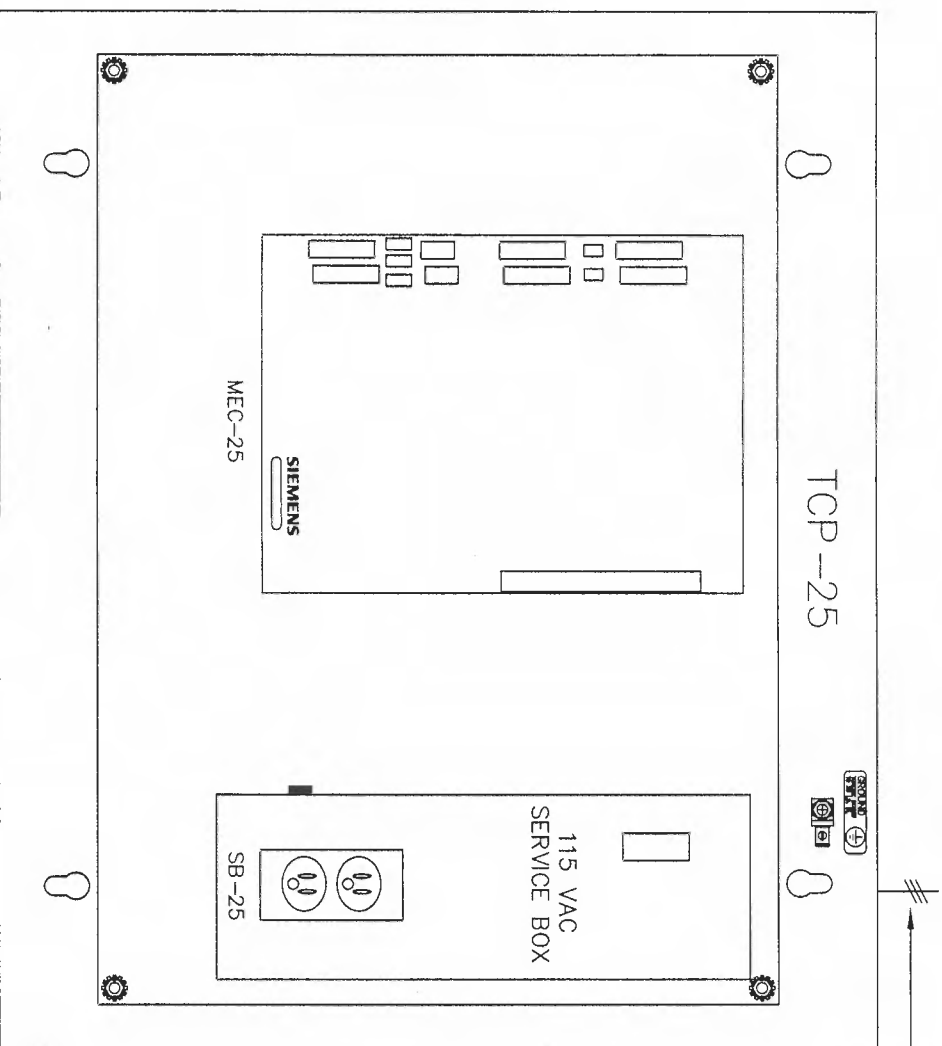
**TCP-25 PANEL LAYOUT**

440P-702374

400

**4-5A**





1  
4-5 TCP-25 PANEL LAYOUT  
LOCATION: MECHANICAL ROOM #401

**REVISION HISTORY**

1	11/28/2007	KJ	AS-BUILT DRAWING
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Siemens Building Technologies  
BAU

45470 Commerce Ctr. Dr.  
Plymouth Twp.  
MI 48170 USA  
Phone: 734-458-3800  
Fax: 888-815-0749

**ANN ARBOR MAINTENANCE FACILITY**

ANN ARBOR, MI

ENGINEER	DRAWER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SFM	SFM	WJL	10/27/06	11/28/07

TCP-25 PANEL LAYOUT

440P-702374  
400

**4-5**

## Modular Building Controller



Figure 1. Modular Building Controller.

### Description

The Modular Building Controller (MBC) is an integral part of the APOGEE® Building Automation System. It is a high performance, modular Direct Digital Control (DDC) supervisory field panel. The field panel operates stand-alone or networked to perform complex control, monitoring and energy management functions without relying on a higher level processor.

The MBC provides central monitoring and control for distributed Floor Level Network (FLN) devices and other building systems (e.g., chiller, boiler, fire/life

safety, security, and lighting). Up to 100 modular field panels communicate on a peer-to-peer network.

### Features

- Modular hardware components to match equipment to initial control requirements while providing for future expansion
- Modular, snap-in design simplifies installation and servicing
- Transparent viewing panels on the enclosure door to view the status indicator LEDs and override switch positions
- Integration platform for communications and interoperability with other systems and devices
- Proven program sequences to match equipment control applications
- Advanced Proportional Integral Derivative (PID) loop tuning algorithm for HVAC control to minimize oscillations and guarantee precise control
- Built-in energy management applications and DDC programs for complete facility management
- Comprehensive alarm management, historical data trend collection, operator control and monitoring functions
- Support for peer-to-peer communications over Industry standard 10/100 Base-T TCP/IP networks.

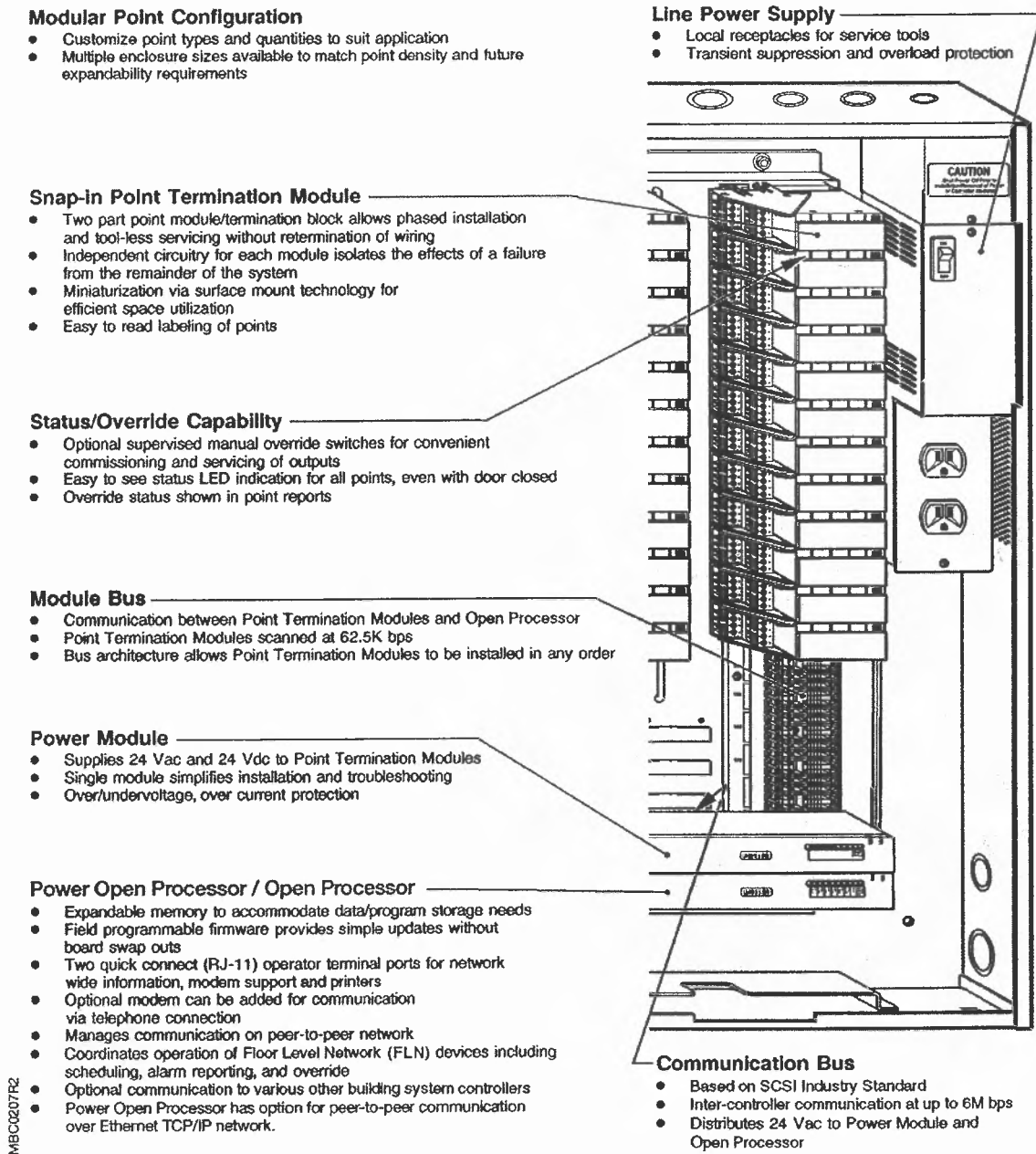


Figure 2. MBC components and key features.

## Hardware

The MBC consists of the following 4 major components:

- Enclosure Assembly - two sizes available to house internal components.
- Power Module - supplies 24 Vdc and 24 Vac to Point Termination Modules.
- Power Open Processor/Open Processor - contains the main processor and communications and is available with numerous communications options. Select the appropriate communications protocol from our list of over 150 systems and devices.
- Point Termination Modules - consist of an electronic point module that performs A/D or D/A conversion, signal processing, point command output and communication with the

Power Open Processor/Open Processor and a termination block for termination of field wiring or tubing.



Figure 3. Two sizes of enclosure assemblies.

### Enclosure Assembly

The enclosure assembly includes a backplane, rails to which the Power Open Processor or Open Processor, Power Module, and Point Termination Modules snap on, a duplex receptacle and a step-down isolation transformer.

The enclosure assembly houses both electronic and pneumatic components. The enclosure is available in the following two sizes to allow the enclosure size to match the point density of the application:

- 24 module size
- 40 module size

The enclosure is constructed of metal to accommodate secure conduit fittings and protect components against electrical transients.

The removable front door has see-through view panels to allow the user to see the status of inputs, outputs and override switches. The door is UL 94-5VA rated for fire and smoke control applications.

Enclosure assemblies allow space for easy wire terminations. Two unswitched 115 Vac outlets are included in each enclosure to power accessory devices such as modems and portable operator's terminals.

The NEMA 12 MBC-24 and MBC-40 UL listed panel assemblies provide control in areas requiring air-tight

protection against lint, dust, dirt, water seepage and dripping and external condensation of non-corrosive liquids.

### Power Module

The Power Module provides regulated power to the Point Termination Modules and active sensors. Only one Power Module is needed per enclosure assembly, simplifying installation and troubleshooting.

An on-board microprocessor controls its operation and works with the Power Open Processor or Open Processor to ensure smooth power up and down sequences of equipment controlled by the point modules, even through brown-out conditions.

The Power Module contains status LEDs to indicate 24 Vac supplied from the line power supply, 24 Vdc supplied to point modules and over voltage/under voltage condition.

### Open Processors

The Open Processor is a microprocessor-based multitasking platform for program execution and communications with other field panels, FLN devices, point modules and third-party equipment/systems (optional). The Open Processor scans field data, optimizes control parameters and manages operator requests for data in seconds.

The Open Processor is an open communications platform providing control of an extensive number of building systems including:

- Siemens Building Technologies, Inc. FLN. Each Open Processor supports up to 3 trunks for a total of 96 application specific control devices.
- Communications drivers to non-Siemens networks. As an option, an Open Processor can communicate to related building system controllers such as boilers, chillers, rooftop units, PLCs, power meters, lighting panels, fire alarm and life safety systems and access control systems.

Multiple Open Processors can co-exist in a single enclosure, providing flexibility in configuration and architecture. Up to 480 FLN devices can be supervised from one MBC with five Open Processors installed.

Two RS-232 operator terminal ports with quick connect phone jacks are included with each Open Processor for operator devices such as a simple CRT terminal, laptop PC, printer or modem.

The program and database information stored in the Open Processor RAM memory is battery-backed. This eliminates the need for time-consuming program and database re-entry in the event of an extended power failure. When battery replacement is necessary, the Open Processor illuminates a "battery low" status LED and can send an alarm message to selected printers or terminals.

The firmware including the operating system is stored in non-volatile flash memory. Flash is easily updateable at the job site. This provides for ease of upgrade as new firmware updates are made available.

Brownout protection and power recovery circuitry protects the Open Processor from power fluctuations.

### Power Open Processors

The Power Open Processor is an updated version of the Open Processor. It employs state-of-the-art technology to offer exceptional performance and memory capacity. It has support for peer-to-peer communications over industry standard TCP/IP networks through a direct connection to 10/100 BaseT.

### Point Termination Modules

The Point Termination Modules (refer to table) support one, two, or four points. Modules are available for analog input or output and digital input or output point types. Any custom mixture of the Point Termination Modules can be installed in the enclosures.

The Point Termination Module consists of two pieces: the electronic point module and the termination block, which provides wire or pneumatic tubing connections. Designed for phased installation, the electrician wires to all the termination blocks. The system technician installs the module electronics during start-up, thereby protecting electronics from harsh job site conditions. These modules quickly and easily snap into place without tools, and without having to re-terminate wires for fast servicing. Modules can be snapped in and out without powering down the field panel to minimize any system downtime.

Each module is supplied with a label insert that is customized to reflect the actual device connected to the module. Address keys provide addressing of the Point Termination Module to the processor and corresponds to the point address in the database.

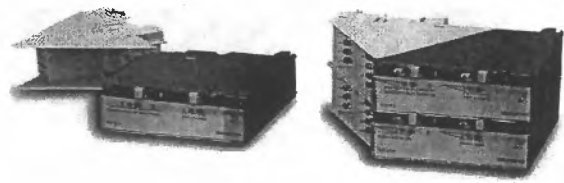


Figure 4. Point Termination Modules.

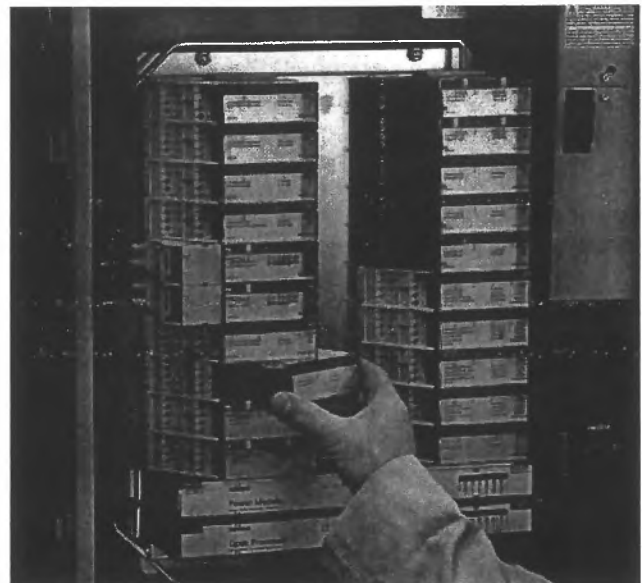


Figure 5. Snap-in Modules for easy replacement.

## Point Module Product Numbers

Description	# of Points/ Module	Part Number
<b>Analog Input</b>		
1000 $\Omega$ Platinum RTD, Industry Standard	2	PTM6.2P1K rd ←
100K $\Omega$ Thermistor	2	PTM6.2N100K
0-10 Vdc, Industry Standard	2	PTM6.2U10
4-20 mA, 2-Wire, 3-Wire, Industry Standard	2	PTM6.2I420
<b>Digital Input</b>		
Dry Contact, Potential Free, LED Indication of Input (On/Off)	2	PTM6.2D20
Dry Contact, Potential Free, LED Indication of Input (On/Off)	4	PTM6.4D20 ←
Pulse Accumulator, up to 25Hz, LED Indication of Input (On/Off)	2	PTM6.2C
Voltage Sensing, 250 Vac Max. Wired Parallel in Circuit, LED Indication of Input (On/Off)	2	PTM6.2D250
<b>Analog Output</b>		
0-10 Vdc, LED Indication of Output (Brightness), Industry Standard	2	PTM6.2Y10S
0-10 Vdc with Supervised Auto/Manual Switch per AO, Manual Gradual Switch Made Active In Manual Mode. LED Indication of Output (Brightness), Industry Standard	2	PTM6.2Y10S-M
4-20 mA, LED Indication of Output (Brightness), 2-Wire, 3-Wire, Industry Standard	2	PTM6.2Y420 ←
0-20 PSI (0-138 Kpa) Pneumatic Output with Supervised Auto/Manual Switch, LED Indication of Output (9 segment LED bar)	1	PTM6.1PSI20-M
<b>Digital Output</b>		
Contact Closure, 240 Vac, 4A, LED Indication (On/Off)	2	PTM6.2Q250
Contact Closure, 240 Vac, 4A, LED Indication (On/Off), Supervised Hand-Off-Auto Switch per DO	2	PTM6.2Q250-M ←

### Optional Manual Override Simplifies Troubleshooting

Manual override is available on digital and analog outputs to allow the user to manually control the position of the end device. This aids in system start-up and troubleshooting to test the equipment operation such as stroking valves and dampers. The manual override is supervised so the central operator is informed that an output is in the override position. A point log report indicates override position status. In addition, an alarm can be sent when the point module is placed in override.

Digital output provides the following manual override positions; on, off and automatic. Analog outputs provide two positions; automatic and manual. In

manual override the operator can adjust the output proportionally between full, open, and closed.

### Snap-In Hardware Simplifies Service

All hardware components snap into mounting rails to allow replacement of modules without re-terminating wires or pneumatic tubing in the unlikely event of failure. Individual Point Termination Modules can be replaced without interrupting the control process for any other modules; the Open Processor continues to function and control the other modules. The Point Termination Module, once replaced, is automatically re-addressed by inserting the appropriate address key into its slot.

## Modular Control Panels with Application Flexibility

The MBCs are high performance controllers with complete flexibility to allow the owner to customize each control panel with the exact hardware and program for the application.

The facility manager only purchases what is needed. For example, for monitoring applications, the control panel can be customized with the exact number and type of analog inputs to match the sensor devices. For monitoring and controlling a large number of (on-off) fans or motors, digital input and output Point Termination Modules are added.

The control program for each panel is customized to exactly match the application. Proven Powers Process Control Language (PPCL), a "BASIC" type programming language, provides direct digital control and energy management sequences to control equipment precisely and optimize energy usage.

For interaction between events and data on separate systems, Open Processors equipped with various communication drivers are utilized.

## Integrated Building Block Architecture

Every MBC is capable of communications with multiple systems. Each Power Open Processor or Open Processor provides stand-alone control for a family of up to 96 FLN devices. A total of 5 processors, potentially communicating with 5 other building systems, can reside in a single MBC panel. Powerful flexibility provides an unlimited number of configuration possibilities. For example, two Open Processors communicate with 192 FLN devices while a third processor controls lighting panels and a fourth processor communicates with a fire system or even a network of devices utilizing a standard protocol.

In a stand-alone configuration, the MBC can fulfill all requirements of a BMS supervisory network coordinator, managing operation schedules, alarms, dialing out to other building systems, printers and pagers, and communicating for the connected devices.

## Global Information Access

Each MBC is equipped with two RS-232 operator terminal ports. These ports support the connection of a modem, simple CRT terminal, laptop PC, or printer. Devices connected to the terminal port gain global information access.

## Multiple Operator Access

Multiple operators can access the network simultaneously. Multiple operator access ensures that alarms are reported to an alarm printer while an operator accesses information from a local terminal. When using the Ethernet BLN option, multiple Operators may also access the controller through concurrent Telnet sessions and/or local operator terminal ports.

## Menu Prompted, English Language Operator Interface

The MBC field panel has a simple, yet powerful menu driven English Language Operator Interface that provides, among other things:

- Point monitoring and display,
- Point commanding,
- Historical trend collection and display for multiple points,
- Equipment scheduling,
- Program editing and modification via Powers Process Control Language (PPCL),
- Alarm reporting and acknowledgment, and
- Continual display of dynamic information.

## Built-in Direct Digital Control Routines

The MBC provides stand-alone DDC to deliver precise HVAC control, and comprehensive information about system operation. The Open Processor receives information from sensors in the building, processes the information, and directly controls the equipment. The following functions are available in the MBC:

- Closed Loop Proportional, Integral and Derivative (PID) control,
- Advanced loop tuning algorithm for (PID) parameters,
- Logical sequencing,
- Alarm detection and reporting, and
- Reset schedules.

## Built-in Energy Management Applications

The following applications are programmed in the MBC and require simple parameter input for implementation:

- Peak demand limiting,
- Start-Stop time optimization,
- Equipment scheduling, optimization and sequencing,
- Duty cycling, and
- Economizer control.

## Specifications

Controller Type:	Open Processor, FW Rev 1.x	Power Open Processor, FW Rev 2.x
Processor Type	Motorola 68302	Motorola MPC 862T
Processor Clock Speed	16.67 MHz	48MHz
Memory Size:	3 MB (Protocol 2 or Standalone)	72 MB
Battery Backup of RAM	60 days (field replaceable, lithium)	20 days (field replaceable, AA Alkaline)
A/D Resolution (analog in)	12 bits	12 bits
D/A Resolution (analog out)	10 bits	10 bits
Local Communication Interface	Dual RS-232 ports	Dual RS-232 ports
Network Communication Speed	RS-485 BLN: 300 bps to 115.2K bps Ethernet BLN: not available	RS-485 BLN: 300 bps to 115.2K bps Ethernet BLN: 10/100 BaseT
Voltage Requirements	115 Vac @ 60 Hz or 230 Vac @ 50/60 Hz	115 Vac @ 60 Hz or 230 Vac @ 50/60 Hz
Enclosure Type	NEMA 1 or NEMA 12 (optional)	NEMA 1 or NEMA 12 (optional)
Ambient Operating Environment	+32°F to +120°F (0°C to +49°C) 5% to 95% RH (Non-condensing)	+32°F to +120°F (0°C to +49°C) 5% to 95% RH (Non-condensing)
Agency Listings	UL 864 UUKL ULC-C100 UUKL 7 UL 864 UDTZ UL 864 QVAX UL 916 PAZX CSA 22.2 No. 0, 0.4, and 205	UL 864 UUKL ULC-C100 UUKL 7 UL 864 UDTZ UL 864 QVAX UL 916 PAZX CSA 22.2 No. 0, 0.4, and 205
Agency Compliance	FCC, Part 15 Subpart B, Class A CISPR 22 Class A European EMC Directive (CE): Industrial Levels European Low Voltage Directive (LVD) Australian Compatibility Framework	FCC, Part 15 Subpart B, Class A CISPR 22 Class A European EMC Directive (CE): Industrial Levels European Low Voltage Directive (LVD) Australian Compatibility Framework
Dimensions:		
MBC-24	24" H x 20" W x 7" D (863.6 mm x 508.0 mm x 177.8 mm)	24" H x 20" W x 7" D (863.6 mm x 508.0 mm x 177.8 mm)
MBC-40	34" H x 20" W x 7" D (863.6 mm x 508.0 mm x 177.8 mm)	34" H x 20" W x 7" D (863.6 mm x 508.0 mm x 177.8 mm)
NEMA 12 MBC-24	36" H x 30" W x 10" D (914.4 mm x 762.0 mm x 254.0 mm)	36" H x 30" W x 10" D (914.4 mm x 762.0 mm x 254.0 mm)
NEMA 12 MBC-40	48" H x 30" W x 10" D (1219.2 mm x 762.0 mm x 254.0 mm)	48" H x 30" W x 10" D (1219.2 mm x 762.0 mm x 254.0 mm)
Mounting Surface	Building Wall or Structural Member	Building Wall or Structural Member



## Product Ordering Information

Description	Product Number
MBC-24 Enclosure Assembly with Styled Door, 115V	545-141
MBC-24 Enclosure Assembly with Metal Door, 115V	545-146
MBC-40 Enclosure Assembly with Styled Door, 115V	545-142 ←
MBC-40 Enclosure Assembly with Metal Door, 115V	545-147
MBC-24 NEMA 12 Enclosure Assembly, 115V	545-371
MBC-40 NEMA 12 Enclosure Assembly, 115V	545-372
MBC-24 Enclosure Assembly with Styled Door, 230V	545-114
MBC-24 Enclosure Assembly with Metal Door, 230V	545-116
MBC-40 Enclosure Assembly with Styled Door, 230V	545-115
MBC-40 Enclosure Assembly with Metal Door, 230V	545-117
MBC-24 NEMA 12 Enclosure Assembly, 230V	545-373
MBC-40 NEMA 12 Enclosure Assembly, 230V	545-374
Power Open Processor with RS-485 BLN and P1 FLN drivers with Revision 2.x Firmware	562-001 ←
Power Open Processor with Ethernet BLN and P1 FLN drivers with Revision 2.x Firmware	562-002
Open Processor with Protocol 2 and P1 FLN drivers - 3 MB Memory (1 Mb RAM) with Revision 1.x English Firmware	545-716
Open Processor with Protocol 2 and P1 FLN drivers – 3 MB Memory (1 MB RAM) with Revision 1.x French Firmware	555-601
Open Processor Stand-alone and P1 FLN drivers - 3 MB Memory (1 MB RAM) with Revision 1.x English Firmware	545-717
Power Module	545-714 ←
Memory Board Upgrade P2 - 8MB Memory (4 MB RAM) with Revision 2.x English Firmware	545-731
Memory Board Upgrade Stand-alone - 6MB Memory (2 MB RAM) with Revision 2.x English Firmware	545-727
Address Keys, (#1-16) used with System 600 APOGEE Revision 2.x firmware	545-825 ←
Address Keys, (#17-32) used with System 600 APOGEE Revision 2.x Firmware	545-826 ←
Address Keys, (#33-48) used with System 600 APOGEE Revision 2.x Firmware	545-827 ←
Address Keys, (#49-64) used with System 600 APOGEE Revision 2.x Firmware	545-828
Address Keys, (#65-80) used with System 600 APOGEE Revision 2.x Firmware	545-829
Address Keys, (#4-64) used with Revision 1.x Firmware	545-040
Address Keys, (#68-128) used with Revision 1.x Firmware	545-041
Address Keys, (#132-192) used with Revision 1.x Firmware	545-042
Address Keys, (#196-256) used with Revision 1.x Firmware	545-043
Address Keys, (#260-296) used with Revision 1.x Firmware	545-044

## Accessories Ordering Information

Description	Part Number
MBC-24 Replacement Steel Door with Siemens and APOGEE Automation System logos	545-105
MBC-24 Replacement Styled Door with Siemens and APOGEE Automation System logos	545-060
MBC-40 Replacement Steel Door Siemens and APOGEE Automation System logos	545-106
MBC-40 Replacement Styled Door Siemens and APOGEE Automation System logos	545-065
MBC Replacement Transformer Kit	545-555
MBC-24 Replacement Window Kit	545-074
MBC-24 Backplane Replacement Kit	545-077
MBC-40 Backplane Replacement Kit	545-078
MBC-24 and MBC-40 Service Box Kit, 115 Vac	545-508
MBC-24 and MBC-40 Service Box Kit, 230 Vac	545-509
Cable, MMI Extension	545-712
Lithium Battery (10/pkg.)	545-710
Cable, 9-pin (female to RJ-11)	540-143
PTM Label Paper (250 sheets/pkg.)	545-053
Modem to RJ-45 Cable	549-510
U.S. Robotics Sportster 56K bps, Dial-up, Fax, V.90 modem with RJ-11 cable and telephone transient surge suppressor	538-860
High/Low Voltage Wire Barrier	545-603

## Document Ordering Information

Description	Document Number
Modular Building Controller and Remote Building Controller Owner's Manual	125-1992
Powers Process Control Language (PPCL) User's Manual	125-1896
System 600 APOGEE Field Panel User's Manual	125-3000
System 600 Field Panel User's Manual	125-1895

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## Power Open Processor/Open Processor



### CAUTION:

The Power Open Processor/Open Processor MMI and MMI/Modem ports cannot be connected to a public telephone network without an authorized modem.

Connecting such equipment to a public telecommunications network in a European Community Member State is in violation of the national law implementing Directive 91/263/EEC on the approximation of the laws of the Member States concerning telecommunication terminal equipment, including the mutual recognition of their conformity.

### Product Description

The Open Processor or Power Open Processor attaches to the mounting rails, Module Bus (M-Bus) rails, and Communications Bus (C-Bus). The Power Open Processor/Open Processor contains the main processor, memory, and communications for the Modular Building Controller (MBC) or the Remote Building Controller (RBC).

### Product Numbers

- 562-040 *APOGEE Power Open Processor/BACnet* uses the EBLN port to communicate on a BACnet/IP ALN/BLN.
- 562-001 *APOGEE Power Open Processor/Protocol 2* uses the ALN/BLN port to communicate on a P2/P3 ALN/BLN. A firmware change allows you to use the Ethernet ALN/BLN (EBLN) port in place of the P2/P3 ALN/BLN.
- 562-002 *APOGEE Power Open Processor/Ethernet* uses the EBLN port to communicate on an Ethernet ALN/BLN. A firmware change allows you to use the ALN/BLN port in place of the EBLN port to communicate on a P2/P3 ALN/BLN.
- 545-730 *APOGEE Open Processor/Protocol 2*, 8 MB total memory (4 MB flash, 4 MB RAM) with Firmware 2.x (repaired only)
- 545-726 *APOGEE Open Processor/Stand-alone*, 6 MB total memory (4 MB flash, 2 MB RAM) with Firmware 2.x (repaired only)

- 545-719 *APOGEE Open Processor/Protocol 2*, 4 MB memory with Firmware 2.x (repaired only)
- 545-718 *APOGEE Open Processor/Protocol 2*, 3 MB memory with Firmware 2.x (repaired only)
- 545-720 *APOGEE Open Processor/Stand-alone*, 3 MB memory with Firmware 2.x (repaired only)
- 545-715 *Open Processor/Protocol 2*, 4 MB memory with Firmware 1.x (repaired only)
- 545-716 *Open Processor/Protocol 2*, 3 MB memory with Firmware 1.x
- 545-717 *Open Processor/Stand-alone*, 3 MB memory with Firmware 1.x
- 565-300 Series  
*Open Processor pre-APOGEE drivers.* See the *pre-APOGEE Open Processor Drivers Application Manual* (125-3140) for additional requirements.

### Accessories

- 545-710 Battery Replacement Kit (not used for Power Open Processor). See *Installation Instructions* (545-408).
- 545-712 MMI extension Cable. See *Installation Instructions* (545-407).
- 549-510 Modem Cable.

### Warning/Caution Notation

#### WARNING



Personal injury or property damage may occur if you do not follow a procedure as specified.

#### CAUTION:



Equipment damage or loss of data may occur if you do not follow a procedure as specified.

### Required Tools

None

### Expected Installation Time

7 minutes

## Prerequisites

- MBC or RBC mounted and AC power connected.
- All wiring terminated.
- CE Compliance requirements met, if needed.
- Power Module installed.
- Termination blocks installed, if any.
- Ethernet port installed, if any.
- Authorized modem installed if connection to a public telephone network is required.

Depending on the type of installation, other prerequisites may have to be completed.

### For Installations Requiring CE Compliance

#### WARNING



This is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

Products intended for sale in the European Economic Area (EEA) must bear the CE mark.

See *APOGEE Wiring Guidelines for Field Panels and Equipment Controllers (125-3002)* for CE compliance wiring requirements.

## Installation

There are two options for installation:

- Installing an Open Processor in a new MBC/RBC.
- Installing an additional Open Processor in an existing MBC/RBC.

Select the appropriate option for your installation.

### Installing a Power Open Processor/Open Processor in a New MBC/RBC

**NOTE:** Power Open Processors can be installed or removed while the MBC/RBC is powered.

1. Switch the MBC/RBC power switch OFF.

**NOTE:** Insert or remove the Open Processor only when the power switch is OFF.

2. Remove the temporary cover (card with attached pre-wired ALN/BLN or FLN connectors) that is wrapped around the mounting rails, M-Bus rails, and C-Bus (See Figure 1). Do not remove the connectors at this time.

3. Remove the C-Bus cover from the lowest available slot and discard (see Figure 2).
4. Remove any remaining M-Bus protective tape from the M-Bus rails (see Figure 2).
5. If there is a warning label over the C-Bus card on the back of the Power Open Processor/Open Processor, remove it (see Figure 4).
6. Remove the protective cap from the C-Bus card edge (see Figure 4).
7. Align the Power Open Processor/Open Processor with the slot number printed on the mounting rail (see Figure 2).
8. Align the Power Open Processor/Open Processor mounting guides with the right-hand edge of the M-Bus rail (see Figure 2).
9. Push firmly on the free end of the Open Processor so that the C-Bus card edge and M-Bus connector mate with the C-Bus connector and M-Bus rail (see Figure 2). You will hear a “click” when the Power Open Processor/Open Processor is properly attached to the mounting rail.
10. If the Power Open Processor/Open Processor needs repositioning, pull the metal latch. Pull the Power Open Processor/Open Processor forward from the C-Bus connector (see Figure 2) and repeat Steps 7 through 9.
11. Remove the pre-wired FLN connectors from the temporary cover and plug them into the corresponding ports on the left side of the Power Open Processor/Open Processor. These ports are labeled FLN 1, FLN 2, and FLN 3 (see Figure 3). The screws for the connector should be pointing down.
12. Do one of the following. If you are installing an:
  - a. *Open Processor/Protocol 2*; plug the ALN/BLN connector into the corresponding port on the right side labeled BLN + – S (see Figure 4). The screws for the connector should be pointing down.
  - b. *Power Open Processor/Protocol 2*; plug the ALN/BLN connector into the corresponding (right-hand) port labeled BLN. The screws for the connector should be pointing down.
  - c. *Power Open Processor/Ethernet or Power Open Processor/BACnet*; plug one end of the RJ-45 cable into the Ethernet jack box, and the other end into the corresponding (right-hand) Power Open Processor port labeled EBLN.

- d. For smoke control applications over Ethernet; You must connect to the Ethernet ALN/BLN or BACnet/IP ALN/BLN through an Ethernet switch UL Listed for Fire Signaling. The panel and the switch must be installed in the same room.

13. Discard the temporary connector cover.



**WARNING: Open Processor/Protocol 2 or Controller Module - Lithium Battery**

Only qualified service personnel or an authorized Siemens Building Technologies, Inc. representative can enable the Open Processor/Protocol 2 or Controller Module lithium battery.

Improper installation of battery P/N 545-710, or use of a different battery, may cause an explosion.

14. Enable the Power Open Processor/Open Processor battery by removing the piece of Mylar that separates the battery from its holder.

15. Switch the MBC/RBC power switch ON.

The installation is now complete.

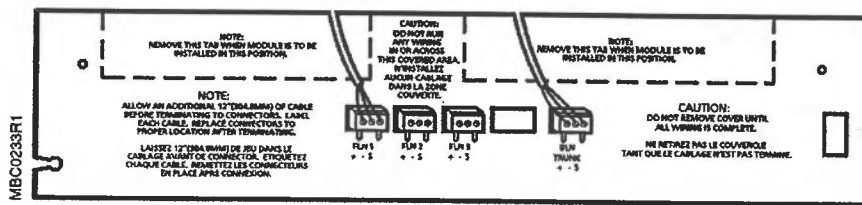


Figure 1. Temporary Cover with Pre-wired ALN/BLN and FLN Connectors Attached.

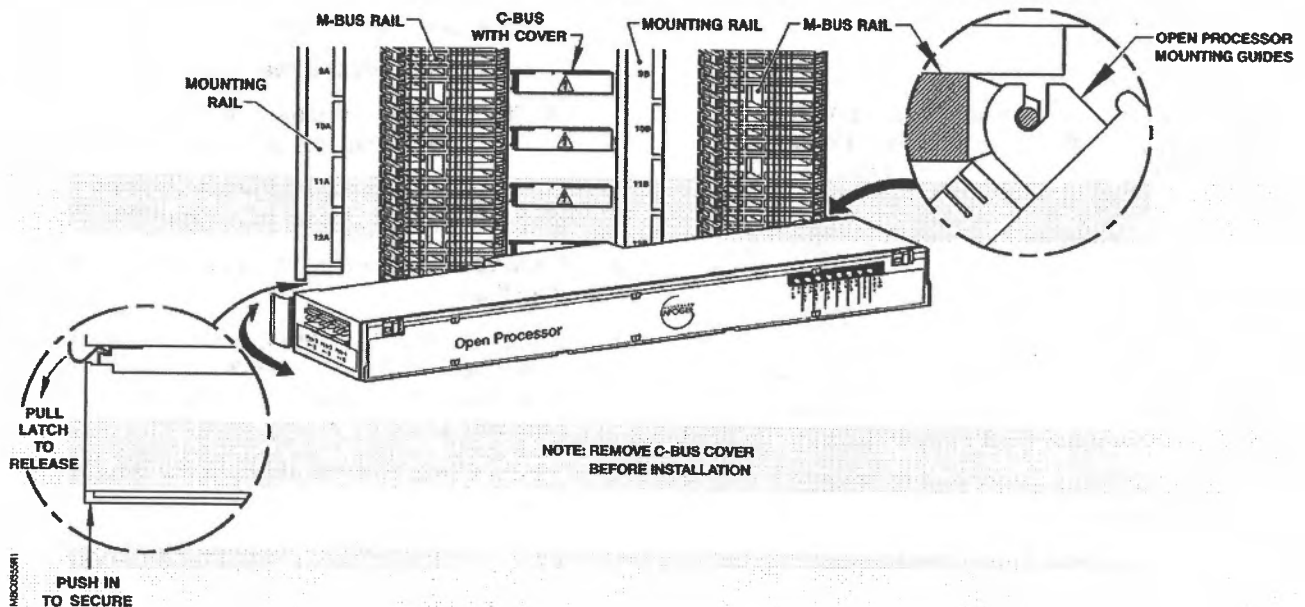


Figure 2. Installation of the Power Open Processor/Open Processor.

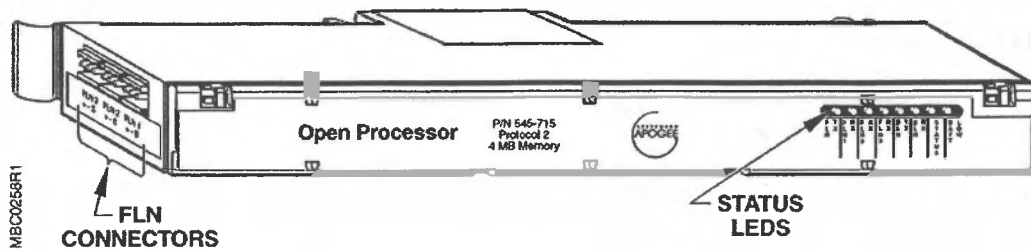


Figure 3. Front View of the Open Processor/Protocol 2.

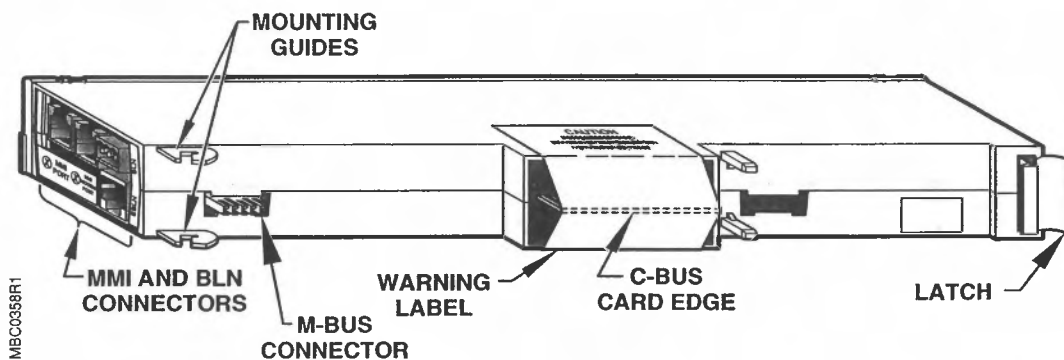


Figure 4. Rear View of the Power Open Processor.

### Installing an Additional Power Open Processor/Open Processor in an Existing MBC/RBC

**NOTE:** Power Open Processors can be installed or removed while the MBC/RBC is powered. If you are installing a Power Open Processor, perform Steps 5 through 16 of this procedure only.

1. Prepare the MBC/RBC and related equipment for shutdown.
2. Notify appropriate building personnel that the panel will be shut down and tell them which equipment is going to be affected. Follow the necessary shutdown procedures to prevent damage to any equipment or personnel.
3. Ensure that all previously installed Open Processors have a good battery to prevent data loss. The BATT LOW LED indicates a low battery. If the light is glowing red, replace the battery before proceeding.



**CAUTION:**

To avoid equipment damage, do not install an Open Processor while the MBC/RBC panel is powered up.

4. Switch the MBC/RBC power switch OFF.
 

**NOTE:** Insert or remove the Open Processor only when the power switch is OFF.
5. Remove the C-Bus cover from the lowest available slot and discard (see Figure 2).
6. Remove any remaining M-Bus protective tape from the M-Bus rails.
7. If there is a warning label over the C-Bus card on the back of the Power Open Processor/Open Processor, remove it (see Figure 4).
8. Remove the protective cap from the C-Bus card edge (see Figure 4).
9. Align the Power Open Processor/Open Processor with the slot number printed on the mounting rail (see Figure 2).
10. Align the Power Open Processor/Open Processor mounting guides with the right-hand edge of the M-Bus rail (see Figure 2).

11. Push firmly on the free end of the Power Open Processor/Open Processor so that its C-Bus card edge and M-Bus connector mate with the C-Bus connector and M-Bus rail (see Figure 2). You will hear a "click" when the Power Open Processor/Open Processor is properly attached to the mounting rail.
12. If the Power Open Processor/Open Processor needs repositioning, pull the metal latch. Pull the Power Open Processor/Open Processor forward from the C-Bus connector (see Figure 2) and repeat Steps 9 through 11.
13. Plug the pre-wired FLN connectors into the corresponding ports on the left side of the Power Open Processor/Open Processor. These ports are labeled FLN 1, FLN 2, and FLN 3 (see Figure 3). The screws for the connector should be pointing down.
14. Do one of the following. If you are installing:
  - a. An *Open Processor/Protocol 2*, plug the ALN/BLN connector into the corresponding port on the right side labeled BLN + – S (see Figure 4). The screws for the connector should be pointing down.
  - b. A *Power Open Processor/Protocol 2*, plug the ALN/BLN connector into the corresponding (right-hand) port labeled BLN. The screws for the connector should be pointing down.
- c. A *Power Open Processor/Ethernet* or *Power Open Processor/BACnet*, plug one end of the RJ-45 connector into the Ethernet jack box, and the other end into the corresponding (right-hand) Power Open Processor port labeled EBLN.

**NOTE: For smoke control applications over Ethernet:**

You must connect to the Ethernet ALN/BLN or BACnet/IP ALN/BLN through an Ethernet switch UL Listed for Fire Signaling. The panel and the switch must be installed in the same room.

15. Discard the temporary connector cover.



**WARNING: Open Processor/Protocol 2 or Controller Module - Lithium Battery**

Only qualified service personnel or an authorized Siemens Building Technologies, Inc. representative can enable the Open Processor/Protocol 2 or Controller Module lithium battery.

Improper installation of battery P/N 545-710 or use of a different battery may cause an explosion.

16. Enable the Power Open Processor/Open Processor battery by removing the piece of Mylar that separates the battery from its holder.
17. Switch the MBC/RBC power switch ON.

The installation is now complete.

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## Power Module

### Product Description

The Power Module (refer to Figure 1) mounts to the mounting rails, Module Bus (M-Bus) rails, and Communication Bus (C-Bus). It accepts 24 Vac power from the Modular Building Controller (MBC) or Remote Building Controller (RBC) transformer through the C-Bus. The Power Module supplies 24 Vdc and 24 Vac power to the Point Termination Modules (PTM) via the M-Bus rails.

### Product Number

545-714 Power Module

### Required Tools

None

### Prerequisites

- MBC or RBC mounted and AC power connected
- Termination blocks installed
- All wiring terminated

### Expected Installation Time

7 minutes

### Instructions

1. Switch MBC or RBC power switch OFF.  
 NOTE: Only insert/remove the Power Module with the power switch OFF.
2. Remove the temporary cover (refer to Figure 2), which is the card with attached pre-wired BLN or FLN trunk connectors, that is wrapped around the mounting rails, M-Bus rails, and C-Bus.

Do not remove the connectors at this time. These connectors are terminated during the installation of the Open Processor.

3. Remove the C-Bus cover from the lowest available slot and discard (refer to Figure 3).
4. Remove any remaining M-Bus protective tape from the M-Bus rails.
5. Remove warning label from the Power Module to expose the C-Bus card and the protective cap on the C-Bus edge connector.
6. Remove the protective cap from the C-Bus card edge.
7. Align the Power Module (refer to Figure 3) with the slot designation marked on the mounting rails (for example: 1A and 1B).
8. Align the edge of the right-hand M-Bus rail with the Power Module mounting guides positioned as shown in Figure 4.
9. Push on the free end of the Power Module so that its C-Bus card-edge and M-Bus connector mate with the C-Bus connector and M-Bus rail (refer to Figure 3). You will hear a "click" when the Power Module is properly attached to the mounting rail.
10. If the Power Module needs repositioning, pull the Power Module latch. Then pull the Power Module forward from the C-Bus connector (refer to Figure 3) and repeat Steps 7 through 9.
11. Switch the MBC or RBC power switch ON. The Power Module begins a power-up sequence that lasts approximately five to six seconds. After the power-up time has elapsed, the Power Module should begin operating normally.

The installation is now complete.

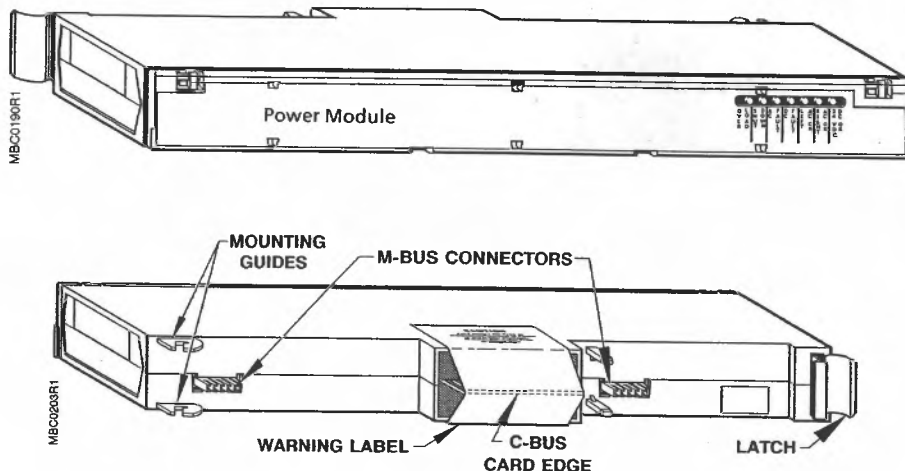


Figure 1. Front and Rear Views of the Power Module.

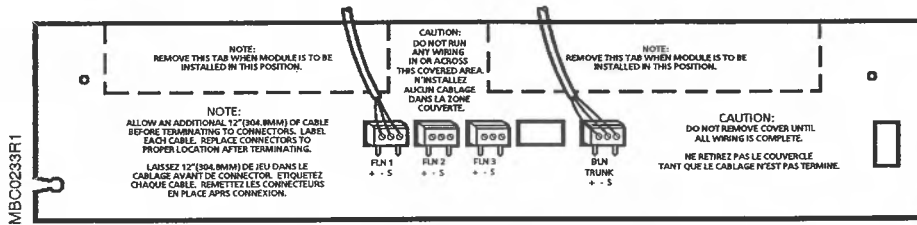


Figure 2. Temporary Cover with Pre-wired FLN and BLN Trunk Connectors Attached.

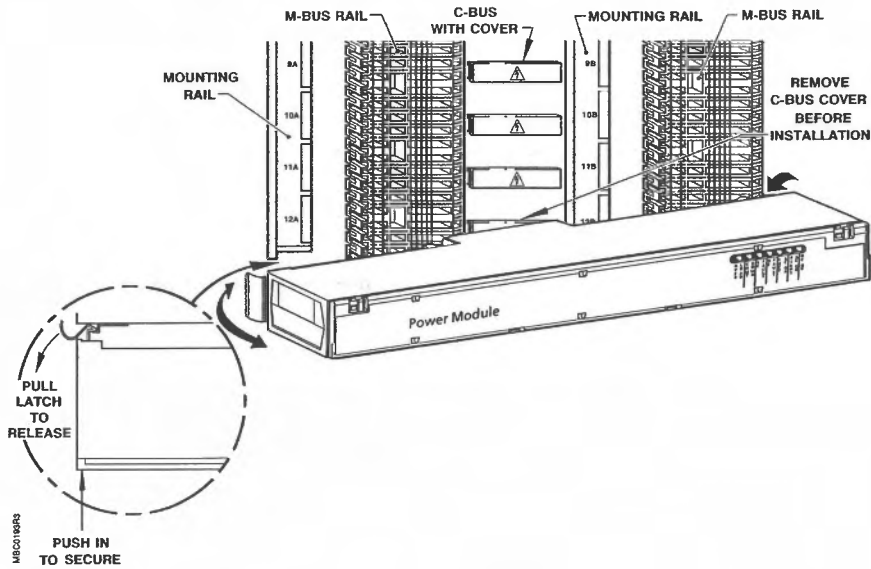


Figure 3. Installation.

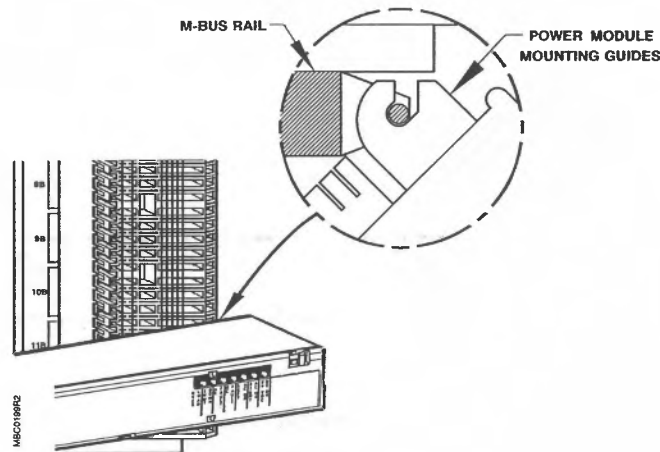


Figure 4. Positioning Mounting Guides.

## Point Expansion Modules

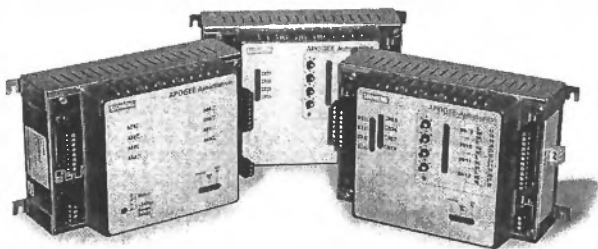


Figure 1. Point Expansion Modules.

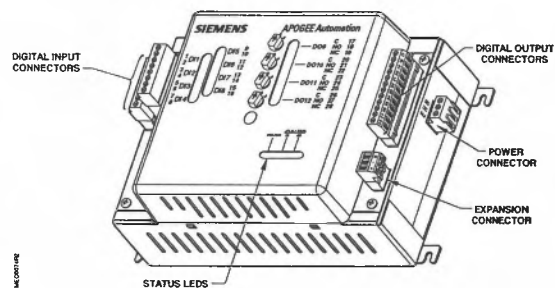


Figure 2. Digital Point Expansion Module (DPX).

### Description

The Point Expansion Modules provide cost-effective methods for controlling and monitoring remote points. As an extension of the field panel, this capability expands the point capacity of the APOGEE® Automation System and provides for efficient placement of the point terminations close to the sensors and loads.

### Features

- Compatible with the MEC Point Expansion Bus and any field panel Floor Level Network (FLN)
- Analog or digital points, which provide for point expansion capability to match the application requirements
- The terminal blocks are removable for easy termination and servicing of field wiring
- Optional Hand-Off-Auto (HOA) switches

### Analog Point eXpansion module (APX):

Available in 8AI and 4AI/4AO models. Analog inputs are user selectable to be 0-10V, 4-20mA, or 1K RTD. Analog outputs are selectable to be 0-10V or 4-20mA.

### Digital Point eXpansion module (DPX):

Available in 8DI/4DO and 4DI/4DO models. The digital inputs are dry contact with four of the inputs being pulse accumulator points. LEDs on the Digital Point Expansion modules indicate On/Off status for DI and DO points. The relayed digital output points support 110/220V Form C relays.

## Specifications

A/D Resolution (analog in)	12 bits
Network Communication Speed	4800 bps to 38.4K bps
Voltage Requirements	19.2 Vac to 26.4 Vac @ 50/60 Hz
Power Consumption	
Analog Point Expansion module 8AI	17 VA @ 24 Vac
Analog Point Expansion module 4AI/4AO	14 VA @ 24 Vac
Digital Point Expansion module 8DI/4DO	20 VA @ 24 Vac
Digital Point Expansion module 4DI/4DO	17 VA @ 24 Vac
Enclosure Type	NEMA 1
Ambient Operating Environment	+32°F to +120°F (0°C to +49°C) 93% RH (Non-condensing)
Agency Listings	UL 864 UUKL, UDTZ, QVAX ULC-C100 UUKL7 UL 916 PAZX
Agency Compliance	FCC Compliance Australian EMC Framework European EMC Directive (CE) European Low Voltage Directive (LVD)
Dimensions:	6" H x 9.5" W x 3.75" D (152 mm x 241mm x 95mm)
Mounting Surface	Building Wall or Structural Member

## Ordering Information

### Point Expansion Modules

Description	Product Number
Analog Point Expansion, 8AI	549-209
Digital Point Expansion, 8DI/4DO HOA-ready	549-210
Digital Point Expansion, 8DI/4DO with HOA	549-211
Digital Point Expansion, 4DI, 4DO HOA-ready	549-212
Digital Point Expansion, 4DI, 4DO with HOA	549-213 ←
Analog Point Expansion, 4AI, 4AO HOA-ready	549-214
Analog Point Expansion, 4AI, 4AO with HOA	549-215

### HOA Upgrade-Kits

Description	Product Number
HOA Upgrade Kit for the MEC 8DI, 8DO, 8AI, 8AO	549-517
HOA Upgrade Kit for the Digital Point Expansion module 4DI, 4DO	549-518
HOA Upgrade Kit for the Digital Point Expansion module 8DI/4DO	549-519
HOA Upgrade Kit for the Analog Point Expansion module 4AI, 4AO	549-520

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## Systems Integration

# APOGEE<sup>®</sup> Open Processor with Square D Modbus Driver

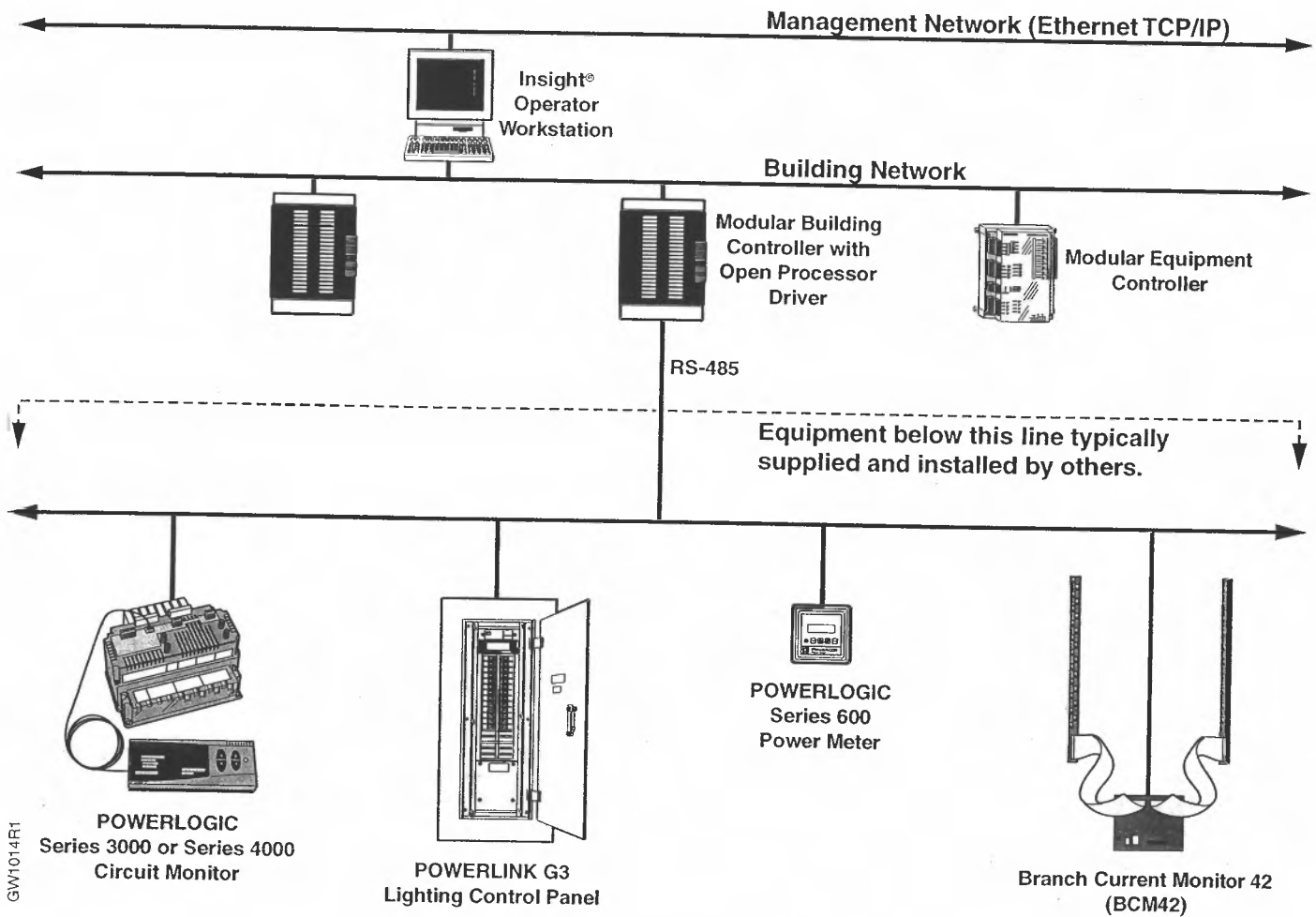


Figure 1. System Architecture.

## Notes on System Architecture

The APOGEE Open Processor with Square D Modbus Driver provides communication between the APOGEE Automation System and Square D® devices supporting Modbus RTU.

A maximum of 32 devices can be accessed with one driver.

The Open Processor with Square D Modbus Driver is intended to be connected directly to Square D devices that use the Modbus RTU protocol. If the Square D devices are networked through any type of network controller, server, or translator, contact the Integrated Systems department to determine connectivity.

## Functionality

The Open Processor with Square D Modbus Driver is a microprocessor-based, multitasking platform designed for multi-system communication and control. The Open Processor communicates with the APOGEE® Insight® software package, other APOGEE field panels and controllers, and the Square D system.

Through APOGEE Insight, the Square D points can be monitored and commanded. The Square D points integrated into the APOGEE Automation System can be accessed by system applications such as Powers Process Control Language, Equipment Scheduling, Trending, and Enhanced Alarming. The Open Processor also supports standard I/O point modules.

The Square D Modbus driver will not affect, in any way, the operating sequence or safeties as factory programmed into the Square D system.

## Keys to Success

Ensure that all Square D equipment to be integrated is supported by the APOGEE Open Processor with Square D Modbus Driver.

If legacy Square D devices using SY/MAX protocol are present with Square D devices using Modbus RTU, contact the Integrated Systems department to determine the best integration method.

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## Benefits

Systems integration brings the powerful facility control capabilities of the APOGEE Automation System together with the Square D system. Integrating the Square D points allows both systems to operate as a single system providing marked advantages in the following:

- Reduced operating and training costs.
- Increased employee productivity.
- Increased diagnostic capabilities to extend equipment life.
- Improved systems information and control.
- Maximized energy savings.

## Products Supported

Square D models supported by the Square D Modbus driver include:

- POWERLOGIC® Series 600 Power Meter (with Modbus RTU option or upgrade)
- POWERLOGIC Branch Current Monitor (BCM42)
- POWERLOGIC Series 3000 and Series 4000 Circuit Monitors (CM3000/CM4000)
- POWERLINK® G3 Lighting Control Panel

If there are any questions regarding the Square D system, contact your local Square D representative.

## Ordering Information

Description	Product Number
APOGEE Open Processor with Square D Modbus Driver	565-480

For more information, see [www.siemens.com](http://www.siemens.com).

## Power Modular Equipment Controller

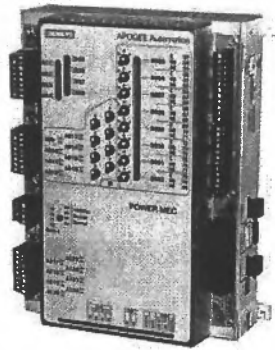


Figure 1. Power Modular Equipment Controller.

### Description

The Power Modular Equipment Controller family of field panel and point expansion products is an integral part of the APOGEE<sup>®</sup> Automation System. They are high performance, modular Direct Digital Control (DDC) supervisory equipment controllers. They operate stand-alone or networked to perform complex control, monitoring and energy management functions without relying on a higher-level processor. Power MECs communicate with other field panels or workstations on a peer-to-peer Building Level Network (BLN) or with an optional remote connection to a central console. The BLN may either be P2 or optional TCP/IP protocol. The Power MEC can optionally provide central monitoring and control for distributed Floor Level Network (FLN) devices. The FLN may either be P1 or LonTalk<sup>®</sup> protocol.

### Features

- Several levels of controllers to match application requirements
- Remote mounted external analog and digital point expansion modules for added point expansion which may be independently operated as FLN devices or directly controlled on an optional point expansion bus
- Proven program sequences to match equipment control applications
- Advanced Proportional Integral Derivative (PID) loop tuning algorithm for HVAC control minimize oscillations and guarantee precise control
- Built-in energy management applications and DDC programs for complete facility management
- Comprehensive alarm management, historical data trend collection, operator control and monitoring functions
- Message control for terminals, printers, pagers and workstations
- Option with Hands Off Auto (HOA) switches
- Option for compatibility with LonWorks<sup>®</sup> networks
- Option for peer-to-peer communications over industry standard 10/100 Base-T TCP/IP networks.

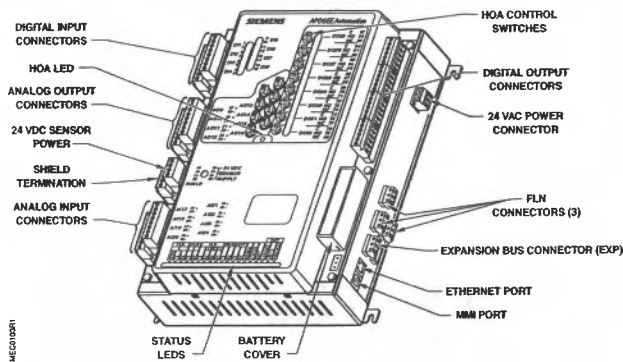


Figure 2. Power Modular Equipment Controller components and key features.

## Hardware

### Controllers

Several styles of controllers provide flexibility and expansion to meet application needs.

#### Power MEC Controller – 11xx

In addition to building and system management functions, this controller provides control of the 32 points contained on the input/output point board.

#### Power MEC Controller– 12xx

In addition to control of the 32 points on the input/output point board, this controller supports analog and digital point expansion modules, which can be mounted remote from the controller. This capability expands the point capacity of the Power MEC and provides for cost-effective placement of the point terminations close to the load.

#### Power MEC Controller – 13xx

In addition to building and system management functions and point expansion this controller supports connection to Insight using a dial-up modem or an APOGEE Ethernet Microserver. This allows use of the Power MEC in applications that are remote from the central console.

#### Power MEC Controller – 1xxxEx

The Power MEC “E” versions support industry standard TCP/IP networks through a direct connection to 10/100 BaseT for BLN communications.

#### Power MEC Controller – 12xxF, 13xxF

The Power MEC “F” version adds three connections to the Floor Level Network (FLN), for a total of 96 devices.

#### Power MEC Controller – 12xxL, 13xxL

The Power MEC “L” version adds LonWorks compatibility. It is equipped with a Neuron Microprocessor and FTT-10A Transceiver. Instead of three connections to the APOGEE P1 Floor Level Network, it has a single connection for a LonWorks network.

The “L” versions have a LonWorks network database server embedded. This database maintains a dynamic, real-time representation of the LonWorks network including connections/bindings, node status, and configuration parameters values.

The Power MEC consists of the following three major components:

- **Input/Output Point Board**

The input/output point board contains 32 points that perform A/D or D/A conversion, signal processing, point command output and communication with the controller board. The terminal blocks are removable for easy termination of field wiring. The analog input points are selectable to be 0-10V, 4-20mA, 1K RTD or optional 100K Thermistor. The analog output points are also selectable to be either 0-10V or 4-20mA. The digital inputs are dry contact, with four being pulse accumulator inputs. The digital outputs support 110/220V Form C rated relays.

- **Power Supply**

The power supply provides regulated power to the input/output point board and active sensors. The power supply is internal to the Power MEC housing, simplifying installation and troubleshooting.

The power supply works with the controller board to ensure smooth power up and down sequences for the equipment controlled by the I/O point board and analog and digital point blocks, even through brown-out conditions.



Status LEDs indicate 24 Vac supplied from the power supply and 24 Vdc supplied to the input/output point board.

- **Controller Board**

The controller board is a microprocessor-based multi-tasking platform for program execution and communications with the I/O point board and with other Power MECs and field panels over the BLN.

The 12xx and 13xx controllers can also support analog or digital point expansion modules, which provide for point expansion capability to match the application requirements. The controller board scans field data, optimizes control parameters and manages operator requests for data.

An RS-232 operator terminal port with a quick connect phone jack (RJ-11) is included with each controller board for operator devices such as a Local User Interface (LUI), simple CRT terminal, laptop PC, or printer. In addition, the MEC 13xx controller supports an RS-232 quick connect phone jack (RJ-45) for use with a phone modem for APOGEE autodial stand-alone network capability.

The 12xxF and 13xxF controllers support 3 FLN trunks for communications with a total of 96 FLN devices.

The program and database information stored in the Power MEC RAM memory is battery-backed. This eliminates the need for time-consuming program and database re-entry in the event of an extended power failure. When battery replacement is necessary, the controller board illuminates a "battery low" status LED and can send an alarm message to selected printers or terminals.

The firmware including the operating system is stored in non-volatile flash ROM memory. Flash ROM is easily upgradeable at the job site. This provides for ease of upgrade, as new firmware updates are made available.

Brownout protection and power recovery circuitry protect the controller board from power fluctuations.

### **Enclosure Assemblies**

The enclosure assembly houses both electronic and pneumatic components. The locking enclosure includes a perforated panel for mounting of the

Power MEC, Point Expansion Module and other electronic or pneumatic components. The enclosure is available in two sizes to allow the enclosure to match the requirements of the installation:

- Small - to house a controller or two point expansion modules
- Large - to house a controller and two point expansion modules or four point expansion modules

The enclosures are constructed of metal to accommodate secure conduit fittings and protect components against electrical transients. The enclosure allows space for easy wire routing and terminations.

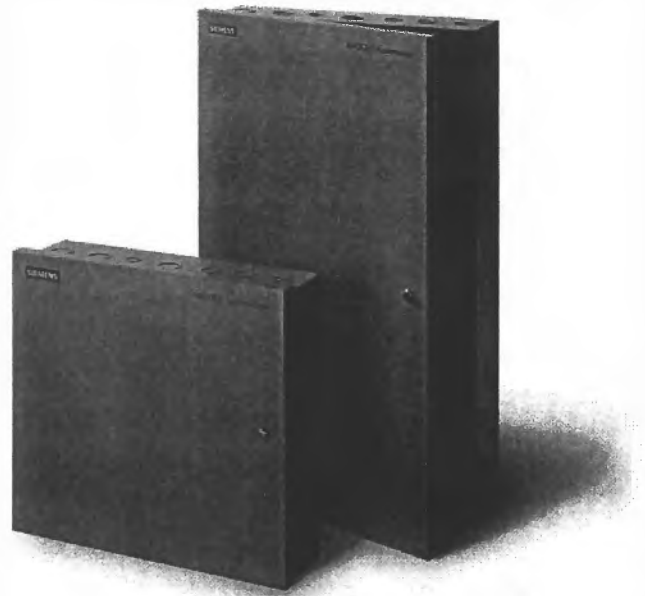


Figure 3. Two sizes of Power Modular Equipment Controller enclosures.

### **Service Box**

Two optional service boxes are available for mounting in the enclosure. One service box provides step down power from 115V to 24V, two Class 2 24 Vac power terminations (100 VA for Power MEC and Point Expansion Modules, and 60 VA for actuators), and two un-switched 115 Vac outlets to power accessory devices such as modems and Portable Operator's Terminals. A second service box provides step down power from 230V to 24V and Class 2 24 Vac power terminations.

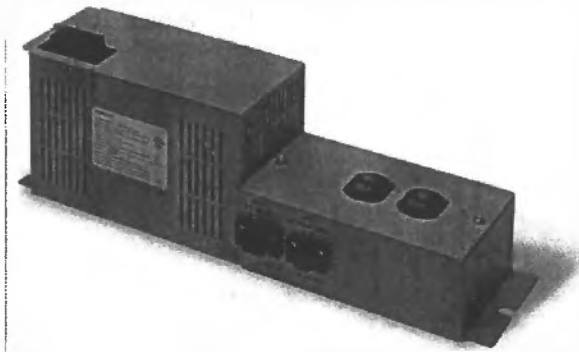


Figure 4. Power Modular Equipment Controller service box.

### Analog and Digital Point Expansion Modules

In addition to the points on the input/output board, the 12xx and 13xx Power MECs support analog and digital Point Expansion Modules. The controller can support a maximum of any combination of eight modules. They can be mounted next to or remote from the controller depending upon the job requirements. The total length of the wiring run for Point Expansion Modules is a maximum of 200 feet (61 meters) on the MEC expansion bus. Point Expansion Modules are also compatible with the APOGEE P1 FLN.

Point Expansion Module details are:

- Analog Point Expansion Module – 4AI, 4AO
- Analog Point Expansion Module – 8AI
- Digital Point Expansion Module – 4DI, 4DO
- Digital Point Expansion Module – 8DI, 4DO

The analog input points are user selectable to be 0-10V, 4-20mA, 1K RTD or optional 100K Thermistor input. The analog output points are also user configurable to be 0-10V or 0-20ma.

The digital inputs are dry contact with four of the inputs being pulse accumulator points. The relayed digital output points support 110/220V Form C relays.

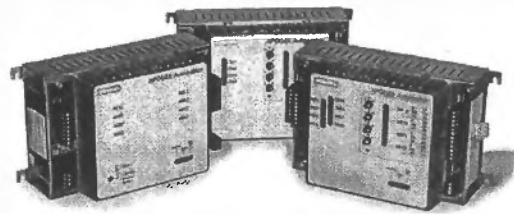


Figure 5. Analog and Digital Point Expansion Modules.

## Modular Equipment Control with Application Flexibility

The Power MECs are high performance controllers with complete flexibility to allow the owner to customize each controller with the exact program for the application. In addition, each controller can be sized to meet the hardware requirements for the application.

The control program for each panel is customized to exactly match the application. Proven Powers Process Control Language (PPCL), a BASIC type programming language provides direct digital control and energy management sequences to control equipment precisely and optimize energy usage.

In a stand-alone configuration, the MEC 13xx controller can fulfill all requirements of a Building Management System (BMS) supervisory system; managing operation schedules, alarms and dialing out to other building systems, printers and pagers.

## Global Information Access

Each Power MEC is equipped with one RS-232 operator terminal port. This port supports the connection of a Local User Interface (LUI), simple CRT terminal, laptop PC, or printer. Devices connected to the terminal port gain global information access. The MEC 13xx supports a second RS-232 port for use with a modem.

## Multiple Operator Access

Multiple operators can access the network simultaneously. Multiple operator access ensures that alarms are reported to an alarm printer while an operator accesses information from a local terminal. When using the Ethernet BLN option, multiple

operators may also access the controller through concurrent Telnet sessions and/or local operator terminal ports.

## Menu Prompted, English Language Operator Interface

The Power MEC has a simple, yet powerful menu driven English Language Operator Interface that provides, among other things:

- Point monitoring and display,
- Point commanding,
- Historical trend collection and display for multiple points,
- Event scheduling,
- Program editing and modification via Powers Process Control Language (PPCL),
- Alarm reporting and acknowledgment, and
- Continual display of dynamic information.

## Built-in Direct Digital Control Routines

The Power MEC provides stand-alone Direct Digital Control (DDC) to deliver precise HVAC control and comprehensive information about system operation. The controller receives information from sensors in the building, processes the information, and directly controls the equipment. The following functions are available:

- Closed Loop Proportional, Integral and Derivative (PID) control,
- Advanced loop tuning algorithm for (PID) parameters,
- Logical sequencing,
- Alarm detection and reporting, and
- Reset schedules.

## Built-in Energy Management Applications

The following applications are programmed in the Power MEC and require simple parameter input for implementation:

- Peak demand limiting,
- Start-Stop time optimization,
- Equipment scheduling, optimization and sequencing,
- Temperature compensated duty cycling,
- Economizer control,
- Night setback control,
- Automatic Daylight Savings Time switchover,
- Temporary schedule override,
- Holiday scheduling,
- Calendar-based scheduling, and
- Event scheduling.

## Specifications

Processor – Motorola MPC	1xxx, 1xxxE 1xxxF, 1xxxEF, 1xxxL, 1xxxEL	857T 860T
Processor Clock Speed		48 MHz
Memory	1xxx, 1xxxE, 1xxxF, 1xxxL 1xxxEF, 1xxxEL	32mb RAM / 8mb FLASH (40mb Total) 64mb RAM / 8mb FLASH (72mb Total)
Battery Backup of RAM (field Replaceable) AA Alkaline		14 days typical
Network Communication:		
Building Level Network		300 bps to 115.2K bps for RS-485 BLN 300 bps to 115.2K bps for Remote BLN 10/100 BaseT for Ethernet BLN
Floor Level Network		78K bps for LonWorks FLN 4800 bps to 38.4 bps for P1 FLN
Point Expansion Bus		38.4 bps
A/D Resolution (analog in)		12 bits
D/A Resolution (analog out)		8 bits
Local Communication Interface		RS-232 port
Voltage Requirements		
Service Box, 115V		115Vac +/- 15% @ 60 Hz +/- 5%
Service Box, 230V		230Vac +/- 15% @ 50/60 Hz +/- 5%
Controller or Expansion Module		20 Vac to 30 Vac @ 47 Hz to 63 Hz
Power Consumption		
Power Modular Equipment Controllers		50 VA
Analog Point Expansion module 8AI		17 VA @ 24 Vac
Analog Point Expansion module 4AI/4AO		14 VA @ 24 Vac
Digital Point Expansion module 8DI/4DO		20 VA @ 24 Vac
Digital Point Expansion module 4DI/4DO		17 VA @ 24 Vac
Enclosure Type		NEMA 1
Ambient Operating Environment		+32°F to +120°F (0°C to +49°C) 93% RH (Non-condensing)
Agency Listings		UL 864 UUKL ULC-C100 UUKL7 UL 916 PAZX
Agency Compliance		FCC Compliance Australian EMC Framework European EMC Directive (CE) European Low Voltage Directive (LVD)
Dimensions:		
Modular Equipment Controller		11.4" H x 9.5" W x 3.75" D (289 mm x 241 mm x 95 mm)
Analog Point Expansion Module		6" H x 9.5" W x 3.75" D (152 mm x 241mm x 95mm)
Digital Point Expansion Module		6" H x 9.5" W x 3.75" D (152 mm x 241mm x 95mm)
NEMA Type 1 Small Enclosure		18.75" H x 20" W x 5" D (475 mm x 508 mm x 127 mm)
NEMA Type 1 Large Enclosure		34" H x 20" W x 5" D (863.6 mm x 508 mm x 127 mm)
Mounting Surface		Building Wall or Structural Member

## Ordering Information

### Controller Range

Description	Product Number
Power MEC 1100, 8DI, 8DO, 8AI, 8AO, HOA-ready	549-610
Power MEC 1101, 16DI, 4DO, 8AI, 4AO	549-611
Power MEC 1110, 8DI, 8DO, 8AI, 8AO with HOA	549-612
Power MEC 1200, 8DI, 8DO, 8AI, 8AO, point expansion support, HOA-ready	549-613
Power MEC 1201, 16DI, 4DO, 8AI, 4AO	549-614
Power MEC 1210, 8DI, 8DO, 8AI, 8AO, point expansion support, with HOA	549-615
Power MEC 1300, 8DI, 8DO, 8AI, 8AO, point expansion support, modem, HOA-ready	549-616
Power MEC 1310, 8DI, 8DO, 8AI, 8AO, point expansion support, modem, with HOA	549-617
Power MEC 1200F, 8DI, 8DO, 8AI, 8AO, point expansion support, P1 FLN support, HOA-ready	549-620
Power MEC 1210F, 8DI, 8DO, 8AI, 8AO, point expansion support, P1 FLN support, with HOA	549-621
Power MEC 1300F, 8DI, 8DO, 8AI, 8AO, point expansion support, modem, P1 FLN support, HOA-ready	549-622
Power MEC 1310F, 8DI, 8DO, 8AI, 8AO, point expansion support, modem, P1 FLN support with HOA	549-623
Power MEC 1200L, 8DI, 8DO, 8AI, 8AO, point expansion support, LonWorks network, HOA-ready	549-640
Power MEC 1210L, 8DI, 8DO, 8AI, 8AO, point expansion support, LonWorks network, with HOA	549-641
Power MEC 1300L, 8DI, 8DO, 8AI, 8AO, point expansion support, modem, LonWorks network, HOA-ready	549-642
Power MEC 1310L, 8DI, 8DO, 8AI, 8AO, point expansion support, modem, LonWorks network with HOA	549-643
Power MEC 1200EL, 8DI, 8DO, 8AI, 8AO, point expansion support, LonWorks network, HOA-ready, Ethernet BLN	549-644
Power MEC 1210EL, 8DI, 8DO, 8AI, 8AO, point expansion support, LonWorks network, with HOA, Ethernet BLN	549-645
Power MEC 1100E, 8DI, 8DO, 8AI, 8AO, HOA-ready, Ethernet BLN	549-624
Power MEC 1110E, 8DI, 8DO, 8AI, 8AO, with HOA, Ethernet BLN	549-625
Power MEC 1200E, 8DI, 8DO, 8AI, 8AO, point expansion support, HOA-ready, Ethernet BLN	549-626
Power MEC 1210E, 8DI, 8DO, 8AI, 8AO, point expansion support, with HOA, Ethernet BLN	549-627
Power MEC 1200EF, 8DI, 8DO, 8AI, 8AO, point expansion support, P1 FLN support, HOA-ready, Ethernet BLN	549-628
Power MEC 1210EF, 8DI, 8DO, 8AI, 8AO, point expansion support, P1 FLN support, with HOA, Ethernet BLN	549-629
Analog Point Expansion Module, 4AI/4AO 24V HOA-ready - for MEC Expansion or FLN	549-214
Analog Point Expansion Module, 4AI/4AO 24V with HOA - for MEC Expansion or FLN	549-215
Digital Point Expansion Module, 4DI/4DO 24V HOA-ready - for MEC Expansion or FLN	549-212
Digital Point Expansion Module, 4DI/4DO 24V with HOA - for MEC Expansion or FLN	549-213
Analog Point Expansion Module, 8AI 24V - for MEC Expansion or FLN	549-209
Digital Point Expansion Module, 8DI/4DO 24V HOA-ready - for MEC Expansion or FLN	549-210
Digital Point Expansion Module, 8DI/4DO 24V with HOA - for MEC Expansion or FLN	549-211
MEC NEMA 1 Small Enclosure	549-504
MEC NEMA 1 Large Enclosure	549-505
MEC Service Box, 115V to 24 Vac	549-506
MEC Service Box, 230V to 24 Vac	549-507

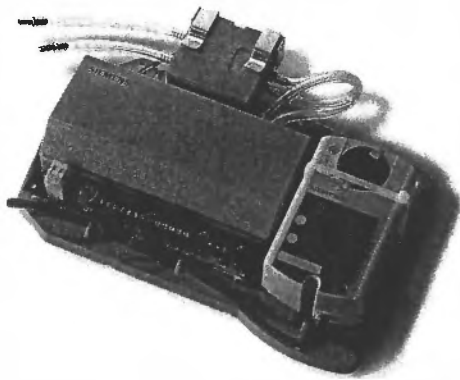
### HOA Upgrade-Kits

Description	Product Number
HOA Upgrade Kit for MEC 100, 200, 300 (68302 processor - non-Power)	549-517
HOA Upgrade Kit Analog Point Block 4AI/4AO	549-520
HOA Upgrade Kit Digital Point Block 4DI/4DO	549-518
HOA Upgrade Kit Digital Point Block 8DI/4DO	549-519

<b>Accessories</b>	
<b>Description</b>	<b>Product Number</b>
Modem Cable (DB25 male to RJ-45 8-pin) for hardware flow control of autodial (Dial-up) modem	549-510
MMI Extension Cable, (RJ-11 male to female) for printers or terminals outside of enclosure	545-712
Lithium Battery (10/pkg.) for Models 100, 101, 110, 200, 201, 210, 300, 310	545-710
MMI Cable (DB9 female to RJ-11 6-pin) for no flow control operator interface connections	540-143
U.S. Robotics Sportster 56K bps, Dial-up, Fax, V.92 modem with RJ-45 cable and telephone transient surge suppressor for Smoke Control Application	549-511
APOGEE Ethernet Microserver 200, 115V with two serial cables (DB9 female to RJ-11 6-pin) used with MEC 13xx Modem and MMI ports	538-920
APOGEE Ethernet Microserver 200, 100V to 240V with two serial cables (DB9 female to RJ-11 6-pin) used with MEC 13xx Modem and MMI ports	538-922
Ethernet transient surge suppressor for AEM200 Smoke Control Application	538-923
<b>Documentation</b>	
<b>Description</b>	<b>Document Number</b>
Power Modular Equipment Controller Owner's Manual	125-2183
Powers Process Control Language (PPCL) User's Manual	125-1896

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## TEC /Actuator Package



TEC/Actuator Package

### Description

This new offering pairs a terminal equipment controller (TEC) with a GDE131.1U Actuator on a common plate. The TEC/Actuator Package reduces installation time, and therefore cost, by providing the Field Installer a pre-assembled package that mounts in less time than what is required to separately mount the components. It is a low cost solution for field applications requiring VAV or CV applications with an electronic actuator.

### TEC Specifications

Dimensions – 6 DO board assembly (in.)	4-1/8 x 7-11/16 x 1-27/32 (105mm x 195mm x 47mm)
Dimensions – Auto zero module w/bracket (in.)	2-15/32 x 3-3/4 x 1-1/16 (63mm x 95mm x 27mm)

Dimensions – Plate (in.)	Without AZM: Approx. 10 x 6.5 With AZM: Approx. 10 x 7.5
Power Source	24 Vac 50/60 Hz +15%, -15% (limited by actuator)
Power Consumption @ 24 Vac (plus loads)	Nominal 3.5 V Peak 5 VA
Operating Temperature Range	32° to 122°F (0° to 50°C)
Storage Temperature Range	-22° to 140°F (-30° to 60°C) (limited by actuator)
Humidity Range	10% to 95% non-condensing
Agency Listings	UL 916, PAXZ; UDTZ; FCC Part 15, Class A CSA-Std. C22.2 No 205

### Actuator Specifications

Power Supply	
Operating Voltage	24 Vac +15%, -15%
Frequency	50/60 Hz
Power Consumption	2.3 VA
Equipment Rating	UL—Class 2, CSA Class III per EN60730
Function	
Torque	44 lb-in (5 Nm)
Runtime for 90° opening or closing	90 sec. At 60 Hz (108 sec. At 50 Hz)
Nominal angle of rotation	90°
Maximum angular rotation	95°

<b>Mounting</b>	
Shaft size	3/8 to 5/8 inch (8 to 16mm) diameter
Minimum shaft length	1-1/2 inch (38 mm)
<b>Housing</b>	
Material	Durable plastic
Gear lubrication	Silicone free
<b>Ambient Conditions</b>	
Ambient temperature – operation	32 to 122°F (0 to 50°C) (limited by TEC)
Storage and transport	-22 to 140°F (-30 to 60°C)
Ambient humidity (non-condensing)	95% R.H.
Agency Certification	UL listed to UL873; C-UL certified to Canadian Standard; C22.2 No. 24-93
<b>Miscellaneous</b>	
Pre-cabled connection	18 AWG
Life cycle	Designed for over 50,000 full stroke cycles at rated torque and temperature

## Ordering Information

Application Type	New	Includes these existing components		
	Combo	Existing TEC Part Number	Gap Actuator Number	AZM Part Number
Variable Air Volume	550-065 ←	540-100	GDE 131.1U	--
	550-066	540-200	GDE 131.1U	540-378
Constant Volume	550-067	540-103	GDE 131.1U	--
	550-068	540-104	GDE 131.1U	540-378

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## PXC Compact Series

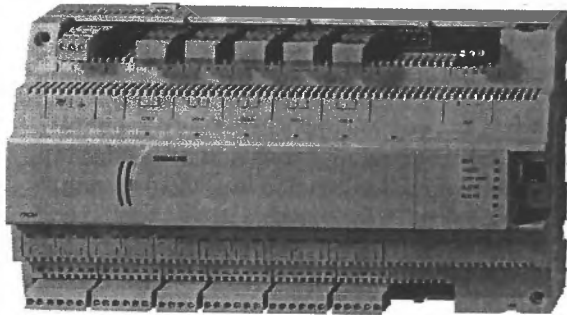


Figure 1. PXC24 Compact Controller

### Description

The compact series of the PXC (programmable controllers) is an integral part of the APOGEE<sup>®</sup> Automation System. They are high performance Direct Digital Control (DDC) supervisory equipment controllers. The controllers operate stand-alone or networked to perform complex control, monitoring and energy management functions without relying on a higher-level processor. PXC's communicate with other field panels or workstations on a peer-to-peer Automation Level Network (ALN). The ALN may be TCP/IP or RS485. Optional extended temperature range operation for the control of rooftop units is available.

### Features

- Several styles of controllers to match application requirements
- Proven program sequences to match equipment control applications
- Sophisticated Adaptive Control, a closed loop control algorithm that auto-adjusts to compensate for load/seasonal changes
- Built-in energy management applications and DDC programs for complete facility management
- Comprehensive alarm management, historical data trend collection, operator control and monitoring functions
- Message control for terminals, printers, pagers and workstations
- Utilizes Siemens new state-of-the-art TX-I/O<sup>™</sup> Technology providing highly configurable I/O for increased flexibility
- Option for either 16 or 24 inputs/outputs to cost-effectively match the needs of the application
- Extended temperature range for rooftop installation
- Option for peer-to-peer communications over industry standard 10 Base-T/100 Base-TX TCP/IP networks

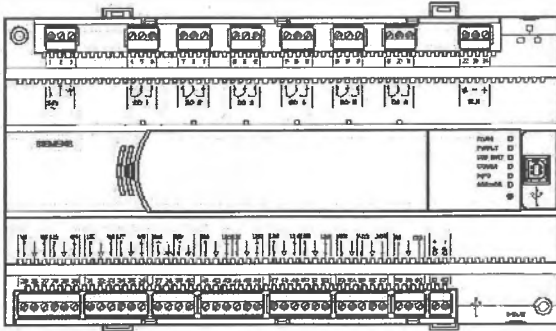


Figure 2. PXC24

## Hardware

### The compact series

Several styles of controllers provide flexibility to meet application needs.

#### PXC16

In addition to building and system management functions, this PXC16 provides control of 16 points, including 8 software-configurable universal points. Point count includes: 3UI; 5UI/O 2DI; 3AO; 3DO;

#### PXC24

In addition to building and system management functions, this PXC24 provides control of 24 points, including 16 software-configurable universal points. Point count includes: 3UI; 13UI/O, 3AO, 5DO

#### Options

Several options are available to match the application.

#### Ethernet or RS-485

Support for APOGEE P2 ALN via TCP/IP or RS-485 networks.

#### Extended Temperature Operation

The "R" versions of the compact series support extended temperature operation, allowing for rooftop installations.

The compact series consists of the following three major components, all included on a single board:

- **Input/Output Points**

The compact series contains 16 or 24 points that perform A/D or D/A conversion, signal processing, point command output and communication with the controller processor. The terminal blocks are removable for easy termination of field wiring.

The universal input points leverage TX-I/O™ Technology from Siemens Building Technologies and are software-selectable to be 0-10V, 4-20mA, Ni1000, 1K RTD, 10K or 100K Thermistor, digital input, or pulse accumulator inputs. The universal input/output points offer the same features as the universal input points as well as 0-10V analog outputs. Dedicated analog output points support 0-10V. The dedicated digital inputs are dry contact status sensing. The digital outputs are 110/220V 4 Amp (resistive) Form C relays.

Digital output points have status LEDs.

- **Power Supply**

The 24 volt DC power supply provides regulated power to the input/output points and active sensors. The power supply is internal to the PXC housing, eliminating the need for external power supply and simplifying installation and troubleshooting.

The power supply works with the processor to ensure smooth power up and power down sequences for the equipment controlled by the I/O points, even through brownout conditions.

- **Controller Processor**

The PXC Compact series include a microprocessor-based multi-tasking platform for program execution and communications with the I/O points and with other PXC and field panels over the ALN.

An RS-232 operator terminal port with a quick connect phone jack (RJ-45) with each controller. The RS-232 port supports operator devices (such as a local user interface or simple CRT terminal), and a phone modem for APOGEE dial-in service capability.

The program and database information stored in the PXC RAM memory is battery-backed. This eliminates the need for time-consuming program and database re-entry in the event of an extended power failure. When battery replacement is necessary, the controller board illuminates a "battery low" status LED.

The firmware, including the operating system, is stored in non-volatile flash ROM memory. Flash ROM is easily upgradeable at the job site. This provides for

ease of upgrade, as new firmware updates are made available.

Brownout protection and power recovery circuitry protect the controller board from power fluctuations.

LEDs indicate the operation status.

## Programmable Control with Application Flexibility

The compact series are high performance controllers with complete flexibility to allow the owner to customize each controller with the exact program for the application.

The control program for each PXC is customized to exactly match the application. Proven Powers Process Control Language (PPCL), a BASIC type programming language provides direct digital control and energy management sequences to control equipment precisely and optimize energy usage.

## Global Information Access

An RS-232 operator terminal port with a quick connect phone jack (RJ-45). The RS-232 port supports operator devices (such as a local user interface or simple CRT terminal), and a phone modem for APOGEE dial-in service capability. Devices connected to the terminal port gain global information access.

## Multiple Operator Access

Multiple operators can access the network simultaneously. Multiple operator access ensures that alarms are reported to an alarm printer while an operator accesses information from a local terminal. When using the Ethernet ALN option, multiple operators may also access the controller through concurrent Telnet sessions and/or local operator terminal ports.

## Menu Prompted, English Language Operator Interface

The PXC has a simple yet powerful menu-driven English Language Operator Interface that provides, among other things:

- Point monitoring and display
- Point commanding
- Historical trend collection and display for multiple points

- Event scheduling
- Program editing and modification via Powers Process Control Language (PPCL)
- Alarm reporting and acknowledgment
- Continual display of dynamic information

## Built-in Direct Digital Control Routines

The PXC provides stand-alone Direct Digital Control (DDC) to deliver precise HVAC control and comprehensive information about system operation. The controller receives information from sensors in the building, processes the information, and directly controls the equipment. The following functions are available:

- Adaptive Control, an auto-adjusting closed loop control algorithm. Provides more efficient, adaptive, robust, fast, and stable control than the traditional PID control algorithm. Superior in terms of response time, holding steady state, and minimizing error, oscillations and actuator repositioning
- Closed Loop Proportional, Integral and Derivative (PID) control
- Logical sequencing
- Alarm detection and reporting
- Reset schedules

## Built-in Energy Management Applications

The following applications are programmed in the PXC and require simple parameter input for implementation:

- Peak demand limiting
- Start-Stop time optimization
- Equipment scheduling, optimization and sequencing
- Temperature compensated duty cycling
- Economizer control
- Night setback control
- Automatic Daylight Savings Time switchover
- Temporary schedule override
- Holiday scheduling
- Calendar-based scheduling
- Event scheduling

## Specifications

Processor – Motorola Power PC	MPC852T
Processor Clock Speed	100 MHz
Memory	16MB RAM / 8MB FLASH (24MB Total)
Battery Backup of RAM (field Replaceable)	
AA Alkaline – non-rooftop models	2 Months typical
3.6 volt Lithium – Rooftop models	3 Months typical
Network Communication:	
Automation Level Network	1200 bps to 115.2K bps for RS-485 ALN 10 Base-T/100 Base-TX for TCP/IP
A/D Resolution (analog in)	16 bits
D/A Resolution (analog out)	10 bits
Analog Outputs	0-10v
Digital Inputs	Dry Contact, Status /Binary
Digital Outputs	Class I Relay
Universal Inputs	0-10v, 4-20mA, Nickel 1000, 1K RTD, 10k Thermistor, 100k Thermistor, digital - dry contact or pulse counter (20hz)
Universal Input/Output	Input: 0-10v, 4-20mA, Nickel 1000, 1K RTD, 10k Thermistor, 100k Thermistor, digital - dry contact or pulse counter (20hz) Output: 0-10v
Local Communication Interface	RS-232 port
Voltage Requirements	
Controller	20 Vac to 30 Vac @50/60 Hz +/- 5%
Power Consumption	20 VA @ 24Vac
Ambient Operating Environment	+32°F to +122°F (0°C to +50°C) 93% RH (Non-condensing)
Ambient Operating Environment <i>with Rooftop option</i>	-40°F to +158°F (-40°C to +70°C) 93% RH (Non-condensing)
Shipping and Storage Environment	-40°F to +185°F (-40°C to +85°C)
Agency Listings	UL 864 UUKL (except Rooftop) ULC-C100 UUKL7 (except Rooftop) UL 916 PAZX (All Units)
Agency Compliance	FCC Compliance Australian EMC Framework European EMC Directive (CE) European Low Voltage Directive (LVD)
Dimensions:	
Controller	10.7" L x 5.9" W x 2.45" D (272 mm x 150 mm x 62 mm)
Mounting Surface	Direct Equipment Mount, Building Wall or Structural Member

## Ordering Information

### PXC Compact Series

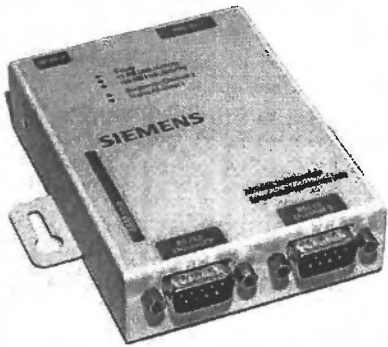
Description	Product Number
PXC Compact, 16 point, RS-485 ALN, APOGEE firmware	PXC16-P.A
PXC Compact, 16 point, RS-485 ALN, Rooftop, APOGEE firmware	PXC16-PR.A
PXC Compact, 16 point, P2 Ethernet ALN, APOGEE firmware	PXC16-PE.A
PXC Compact, 16 point, P2 Ethernet ALN, Rooftop, APOGEE firmware	PXC16-PER.A
PXC Compact, 24 point, RS-485 ALN, APOGEE firmware	PXC24-P.A
PXC Compact, 24 point, RS-485 ALN, Rooftop, APOGEE firmware	PXC24-PR.A
PXC Compact, 24 point, P2 Ethernet ALN, APOGEE firmware	PXC24-PE.A
PXC Compact, 24 point, P2 Ethernet ALN, Rooftop, APOGEE firmware	PXC24-PER.A
Lithium 3.6v Replacement Batteries 10 pk – Rooftop models	PXA-LITHP10

### Documentation

Description	Document Number
PXC Compact Series Owner's Manual	TBD
Powers Process Control Language (PPCL) User's Manual	125-1896

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## APOGEE Ethernet Microserver 200



### Description

The APOGEE® Ethernet Microserver 200 (AEM200) provides a convenient and cost-effective solution for connecting a Siemens Building Technologies, Inc. Building Level Network (BLN) or individual field panels to an Ethernet network. Used in conjunction with Insight® workstations, AEM200s more effectively leverage the Ethernet network, providing greater information accessibility.

The AEM200 reduces hardware costs and system network costs by reducing the number of Insight workstations. The AEM200 can also be used in place of a phone modem at the panel to avoid costly phone charges. The second port allows remote connection to the MMI prompt without interrupting Insight workstation operations.

Connecting BLNs to a TCP/IP Ethernet network is made easy by the AEM200. The AEM200 provides a reliable and low cost means for direct connection to shared or stand-alone LAN/WAN network environments.

BLN networks or individual field panels connected to the Ethernet via the AEM200 appear as remote BLNs at the Insight workstation. The remote BLN operates much like a BLN directly connected to the Insight workstation. Importantly, using AEM200 does not occupy any of the local BLN connections in the Insight workstation.

The Insight workstation can monitor, command, control and program the remote BLN's field panels and application specific controller information in the same manner it would if the BLN were directly connected to the workstation. If the Ethernet connection is interrupted from the remote network, the workstation displays an alarm message.

### Features

- Compatible with Ethernet version 2/IEEE 802.3.
- TCP/IP communications protocol used to transfer the BLN information back to the Insight workstation.
- Connects to the Ethernet via a 10/100BASE-T (RJ45) connection and to the APOGEE field panel via the RS232 Modem port.
- Second independent serial port connects to the MMI prompt via field panel RS232 MMI port.
- Compact size fits right inside the panel.
- Supports standard diagnostics such as SNMP.
- LED indicators for Good Link, Unit Ready and Operational Status.
- Under normal conditions the AEM200s and their associated BLNs use less than 1% of an Ethernet's capacity.

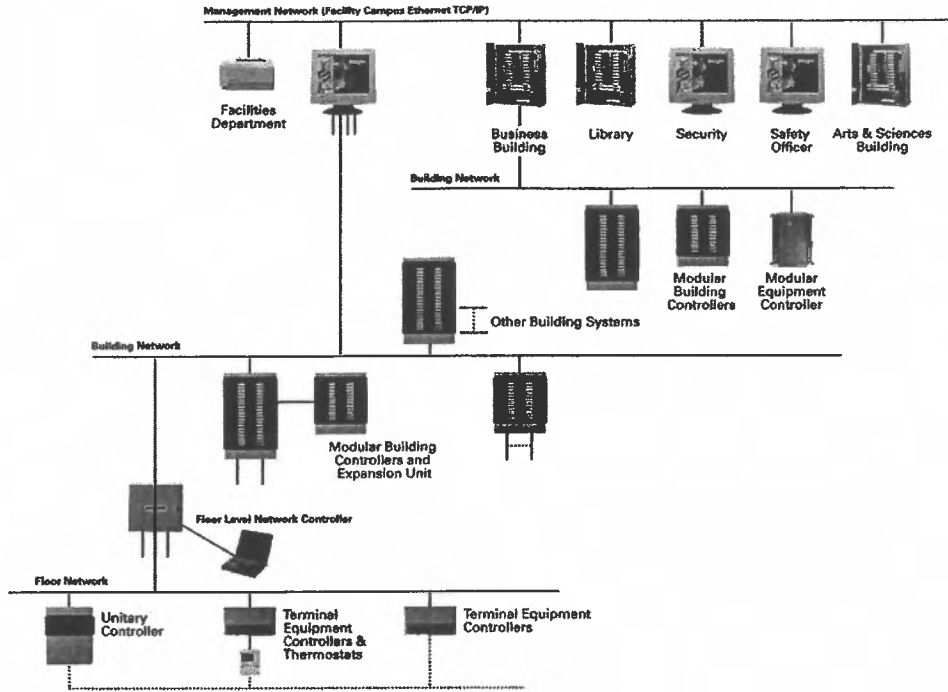


Figure 1. APOGEE Automation Architecture. Insight workstations, Building Level Networks and individual field panels sharing control information over shared or stand-alone Ethernet.

## Specifications

APOGEE Field Panel Compatibility:	Modular Building Controller (MBC), Remote Building Controller (RBC), Modular Equipment Controller (MEC) Series 300, Floor Level Network Controller (FLNC), and Stand-alone Control Unit with Version 5 controller board (SCU V5) (Firmware revision 2.2 or higher required)
Insight Workstation Compatibility:	Base or Advanced Insight Revision 3.1.2 or higher
Prerequisites:	Ethernet-based network running with TCP/IP environment
Ethernet Interface	Supports 10/100BASE-T (RJ45) connections
Serial Interface:	2 RS232C DB9-male connectors
Agency Listings:	FCC A, C/UL, TUV, CE B
Dimensions:	4.0" x 3.9" x 1" with tabs (10.3cm x 9.9cm x 2.6cm)
Power Requirements:	
120V	120VAC 60Hz 35 Watts max.
Universal	100-240VAC 60/50Hz 40 Watts max.

## Ordering Information

Description	Part Number
<b>Hardware</b>	
APOGEE Ethernet Microserver 200 with 120V Transformer and two serial cables.	538 920 ←
APOGEE Ethernet Microserver 200 with Universal Transformer, shielded Ethernet patch cable and two serial cables. Requires country Specific IEC 320 C13 line cord.	538 922
<b>Accessories</b>	
AEM Accessory Kit Includes:	538-900 ←
<ul style="list-style-type: none"> <li>25-pin to 9-pin configuration cable for AEM or AEM100</li> <li>25-pin to 9-pin adapter for AEM200</li> <li>Reset tool for AEM or AEM100</li> <li>Ethernet cross-over cable</li> </ul>	
Surge Suppressor 100BT/10BT	538-923
<ul style="list-style-type: none"> <li>required for smoke control</li> </ul>	
<b>Documentation</b>	
Life Safety Option	571-585

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## Analog Sensors—1000 Ohm Platinum RTD

### Description

1000 Ohm Platinum RTD sensors provide input for cost-effective, accurate temperature sensing (detecting) via a 20 AWG twisted, shielded cable pair. The sensor resistance varies according to the temperature being measured. Several models are available for specific mounting and sensing applications.

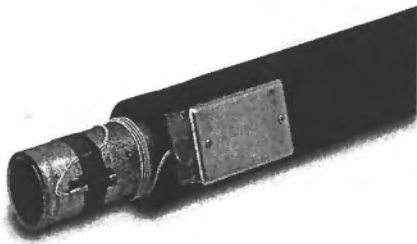


Figure 1. Surface Mounted Temperature Sensor.



Figure 2. Outside Air Temperature Sensor.

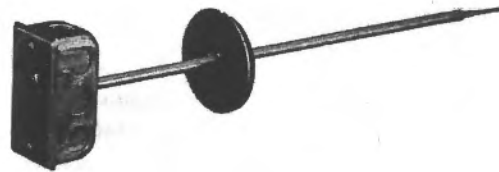


Figure 3. Duct (Single Point) Temperature Sensor.

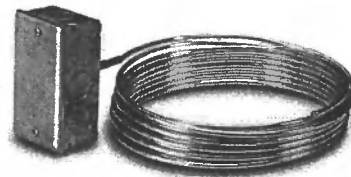


Figure 4. Duct (Averaging) Flexible Temperature Sensor.



Figure 5. Duct (Averaging) Rigid Temperature Sensor.



## Specification

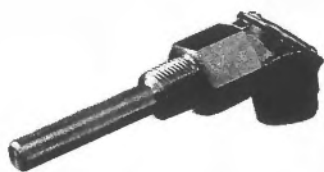


Figure 6. Liquid Immersion Temperature Sensor.

Temperature Mounting Range	See sensor specifications
Output Signal	Changing resistance
Elements	Platinum (or equivalent) wire resistance type
Accuracy	See Table 1
Reference Resistance at 32°F (0°C)	1000 Ohm

## Sensor Specifications

Sensor Specifications			
APPLICATION	TEMPERATURE RANGE/ MID-RANGE ACCURACY <sup>1</sup>	ELEMENT PACKAGE	PART NUMBER
Surface Mount - Pipe	-40°F to 240°F/±0.8°F (-40°C to 116°C/±0.5°C°)	2" x 4" metal box with clamps	544-089
Outdoor Air	-40°F to 240°F/±0.8°F (-40°C to 116°C/±0.5°C°)	Through the wall	544-578 ←
Duct - Single Point	-40°F to 240°F/±0.8°F (-40°C to 116°C/±0.5°C°)	Adjustable length probe with mounting bracket	544-339 ←
Duct - Averaging	-40°F to 240°F/±0.8°F (-40°C to 116°C/±0.5°C°)	25' (7.6 m) flexible	544-342 ←
		18" (46 cm) rigid	544-343 ←
		24" (60 cm) rigid	544-344
		48" (1.2 m) rigid	544-345
Liquid Immersion	-40°F to 240°F/±0.8°F (-40°C to 116°C/±0.5°C°)	Stainless Steel 2 - 1/2" (6.4 cm) Well	544-577 ←

<sup>1</sup> Application Sensing Range is determined by field panel to which the sensor is connected.

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## Room Temperature Sensors, Series 1000 and Series 2000 (Interactive)



**Figure 1. Room Temperature Sensor--Series 1000 shown with all available options.**

The **Series 1000** and **Series 2000** Room Temperature Sensors from Siemens Building Technologies, Inc., offer a wide range of features and functionality that work in concert with the APOGEE® Automation System to deliver exceptional occupant comfort in even the most demanding application environments. The product family range includes plain sensing only variants, and fully interactive types with a two line LCD that permits viewing and modification of controller points directly from the sensor's keypad and display. All sensors incorporate precision temperature sensing elements to accurately and reliably measure room temperature. Their compact, low profile design results in an attractive, inconspicuous installation. A styled ventilation ring optimizes airflow through the cover for fast measurement response and superior control.

### Series 1000

The **Series 1000** Room Temperature Sensor provides accurate, reliable sensing of room temperature Terminal Equipment Controllers (TECs), Modular Building Controllers (MBCs), Remote Building Controllers (RBCs), Unitary Controllers (UCs) and Modular Equipment Controllers (MECs).

#### TEC Applications

Room temperature sensors for TEC applications incorporate a thermistor element and plug-in Portable Operator's Terminal port located on the bottom of the cover. The plug-in Portable Operator's Terminal port provides a convenient means of communicating with the TEC to command or troubleshoot the system. These sensors connect to TECs via a six-wire cable terminated with a plug-in RJ-11 connector. The cable transmits the temperature, communication with the Portable Operator's Terminal, and the optional set point and override signals.

#### MBC, RBC, UC, MEC Applications

Room temperature sensors for MBC, RBC and UC applications incorporate a platinum RTD element. Connections to field panels are made via 18 to 22 AWG twisted pair cabling. A conveniently located unpluggable termination block simplifies both installation and service.

## Optional Features

- Digital temperature display: The digital temperature display provides an easy-to-read room temperature value in degrees Fahrenheit or Celsius.
- Set point adjustment: The high accuracy set point adjustment incorporates dual temperature scale indication and an access door that covers the set point adjustment switch.
- Override button: The flush mounted override button allows an occupant to change to an occupied control schedule during the unoccupied cycle for a predetermined time period.
- Maintenance free: These sensors draw a small amount of power directly from the controller and do not use batteries. This eliminates the cost of battery replacement and disposal. Specifications (Series 1000)

## Specifications (Series 1000)

Temperature Range	
Set point	55°F to 95°F (13°C to 35°C)
Operating	55°F to 95°F (13°C to 35°C)
Output Signals	Changing resistance
Accuracy	
10K Ohm Thermistor	
55 - 80.6°F (13 - 27°C)	±0.5°F (±0.3°C)
80.6 - 95°F (27 - 35°C)	±1.0°F (±0.5°C)
1,000 Ohm RTD MID-RANGE	
75°F (24°C)	±0.75°F (± 0.4°C) *
Calibration Adjustments	None required
Installation	
TEC	100 ft. Maximum Cable Length. 6C # 24 AWG, Belden 1228A or equal, NEC Class 2
MBC/RBC/UC/MEC	300 to 750 ft. Max. Cable Length 18 to 22 AWG twisted pair NEC Class 2
Installation Adjustments	None required
Cover	
Dimensions	3-11/32" H x 2-1/2" W x 1-1/2" D (85 mm x 63 mm x 38 mm)
Color	Desert Beige or White

\*For the accuracy at temperatures other than at the mid-range use the Sensor Accuracy Tool on Landscape



Figure 2. Room Temperature Sensor--Series 2000.

## Series 2000

The **Series 2000** Room Temperature Sensors provide an interactive digital link to Terminal Equipment Controllers (TECs) that allows viewing and adjustment of controller points directly from the sensor's liquid crystal display and keypad. These sensors incorporate a precision thermistor to accurately and reliably measure room temperature.

### Standard Features

**Programmable Liquid Crystal Display (LCD):** A two-line alphanumeric LCD allows simultaneous display of room temperature, a user-selected "critical" point, and day/night operation status. Users may configure the screen to:

- show English or metric units,
- turn the room temperature display on or off,
- select a critical point for display, or
- turn off the critical point display.
- Digital set point adjustment: The sensor's keypad allows error-free digital set point adjustments in one-degree increments. Set point values momentarily display as changes are made.
- Display of operating mode: Graphic symbols are displayed to indicate the controller's operating mode. A "sun" indicates occupied mode operation and a "moon" indicates night mode operation.
- Override button: A flush-mounted override button allows user to change to an occupied control schedule during the unoccupied cycle for a period of time determined by the system operator.

Passkey security: A special hardware passkey plugs into the sensor's MMI port to allow access to the display configuration menu and the controller's point database.

- **Backward compatibility:** These sensors are backward compatible with all TECs. The sensors are wired with six-conductor phone cables and standard RJ-11 connectors.
- **Maintenance free:** These sensors draw a small amount of power directly from the controller and do not use batteries. This eliminates the cost of battery replacement and disposal.

## Specifications (Series 2000)

### Effective Sensing and Set Point Range

(TEC)	55°F to 95°F (13°C to 35°C)
Output Signals	Changing resistance
Room temperature	Changing resistance
Set point	Digital
Thermistor Calibration Point (TEC)	77°F (25°C)
Accuracy	
10K Ohm Thermistor	
55 - 80.6°F (13 - 27°C)	±0.5°F (±0.3°C)
80.6 - 95°F (27 - 35°C)	±1.0°F (±0.55°C)
Resistance value	10K Ω ohms
Calibration	None required
Installation	
TEC	100 ft. Maximum Cable Length 6C # 24 AWG, NEC Class 2
Installation Adjustments	None required
Cover	
Dimensions	3-11/32" H x 2-1/2" W x 1-1/2" D (85 mm x 63 mm x 38 mm)
Color	Desert beige or white

## Product Ordering Information

TEC Description	Product Part Number
<b>Series 1000</b>	
Sensing only	540-660 <sup>1</sup>
Sensing with override	540-662 <sup>1</sup>
Sensing with set point	540-664 <sup>1</sup>
Sensing with temperature display	540-666 <sup>2</sup>
Sensing with override, set point	540-670 <sup>1</sup>
Sensing with override, temperature display	540-672 <sup>2</sup>
Sensing with set point, temperature display	540-676 <sup>2</sup>
Sensing with override, set point, temperature and critical point display, interactive	540-680 <sup>2</sup> ←
<b>Series 2000</b>	
TEC Sensor	540-650 <sup>1</sup>
<b>MBC/RBC/UC/MEC Description</b>	<b>Product Part Number</b>
<b>Series 1000</b>	
Sensing only	544-760 <sup>1</sup> ←
Sensing with override	544-762 <sup>1</sup>
Sensing with set point	544-764 <sup>1</sup>
Sensing with temperature display	544-766 <sup>2</sup>
Sensing with override, set point	544-770 <sup>1</sup>
Sensing with override, temperature display	544-772 <sup>2</sup>
Sensing with set point, temperature display	544-776 <sup>2</sup>
Sensing with override, set point, temperature display	544-780 <sup>2</sup> ←

<sup>1</sup> Add letter suffix to indicate desired color: A=Desert Beige, B=White (e.g., 540-660A).

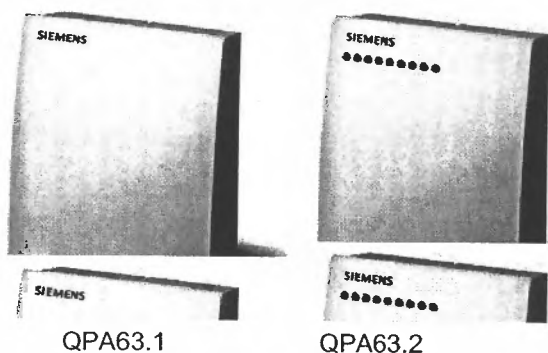
<sup>2</sup> Add letter suffix to indicate temperature display units and color: F=°F, C=°C, A=Desert Beige, B=White (e.g., 540-680FA).

## Accessories Ordering Information

Description	Product Part Number
Passkey for Series 2000 Room Temperature Sensors	544-643
Single Adapter Base Kit (White)	544-782B
Single Adapter Base Kit (Beige)	544-782A
Double Adapter Base Kit (White)	544-783B
Double Adapter Base Kit (Beige)	544-783A
Extender Ring Kit (White)	544-785B
Extender Ring Kit (Beige)	544-785A
Non-Conduit Rough-In Kit	544-784
Series 2000 (Interactive) Room Temperature Sensors, User Guide	129-363
Sensor Power Supply Module (for MBC applications with digital display option)	PTX6.4SPS
Available with vinyl or plenum jacket in 25', 50', and 100' lengths. Contact your local Siemens Building Technologies, Landis Division field office for more information.	TEC room sensor cables (6 conductor w/RJ-11 connectors on each end)

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## CO<sub>2</sub>/VOC Sensors (QPA63 Series)



QPA63.1

QPA63.2

### Description

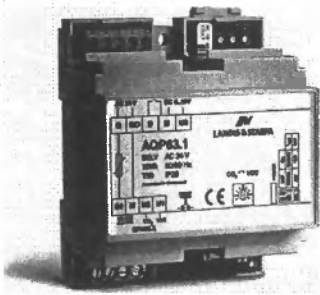
The QPA63 series CO<sub>2</sub>/VOC sensors are designed for sensing indoor air quality in rooms or air ducts. The microprocessor-based units consist of a photoacoustic CO<sub>2</sub> sensor and a VOC (Volatile Organic Compound) sensor with a heated stannic dioxide semiconductor. Because the photo acoustic CO<sub>2</sub> sensor experiences less than 1% drift per year for the first two years of operation and negligible drift thereafter, no calibration of the CO<sub>2</sub> sensor is necessary.

The units operate on 24 Vac and provide a 0-10 Vdc signal based on CO<sub>2</sub> only or provide two 0-10 Vdc inputs (CO<sub>2</sub> and VOC) to the Ventilation Demand Calculator (AQP63.1) which then combines the two signals into one 0-10 Vdc ventilation demand signal. Additionally, the AQP63.1 allows the weighting of each signal to be adjusted from a factory set 50/50 value. Because the AQP63.1 also performs an ongoing calibration of the VOC signal from the QPA63, the VOC signal cannot be used without the AQP63.1.

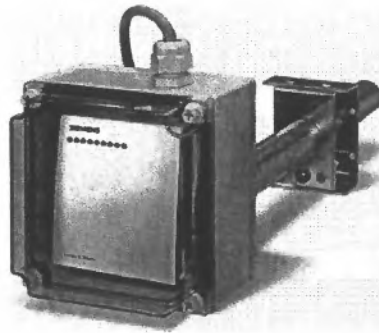
The sensors are suited for use with all systems and devices capable of acquiring and handling the 0—10 Vdc output signal based on only CO<sub>2</sub> (QPA63 alone) or based on both CO<sub>2</sub>/VOC (QPA63 and AQP63.1).

### Specifications

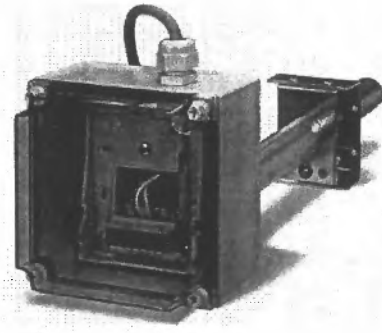
Power supply	Operating voltage (Class 2)	24 Vac ± 20 %
	Frequency	50/60 Hz
	Power consumption	max. 6 VA
Operating characteristics	CO <sub>2</sub> measuring range	0 — 2000 ppm
	Tolerance	±100 ppm
	Output	0 – 10 Vdc, linear
	Calibration	None required
	VOC measuring range	0 — 10 V <sub>voc</sub>
	Permissible air velocity in the duct	<16 ft/s
Electrical	Voltage	0 — 10 Vdc
	Current	±1 mA
	Permissible line lengths	
	Copper cable 20 AWG	190 feet
	Copper cable 16 AWG	720 feet
Copper cable 14 AWG	980 feet	
Copper cable 13 AWG	1,475 feet	
Connection terminals	Screw terminals for	2 x 16 AWG or 1 x 14 AWG



AQP63.1



ARG64 with CO<sub>2</sub> Sensor



ARG64 without CO<sub>2</sub> Sensor

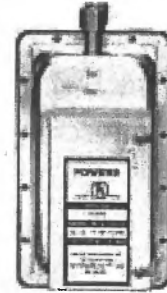
## Ordering Information

Product Number	Description
→ QPA63.1	CO <sub>2</sub> /VOC Sensor without LEDs
QPA63.2	CO <sub>2</sub> /VOC Sensor with LEDs
→ ARG64*	Duct Mounting Kit for QPA63
ARG70*	Wall Mounting Kit for QPA63
AQP63.1	Ventilation Demand Calculator

\*Either the ARG64 or the ARG70 is required for mounting, depending on the application.

## Powers™ Controls

### SW 141 Differential Static Airflow Switches



141-0518

#### Description

The SW 141 Airflow Switch senses static differential pressure and the diaphragm operated snap switches actuate electrical circuits.

#### Application

The manual reset switch (141-0575) should be used for applications requiring safety lock out (shut down) of the fan. The switch can be used on the fan discharge (positive pressure), fan inlet (negative pressure), or across the fan (differential pressure) to detect excessively high positive pressures or low negative pressures and turn off the fan before damage occurs to ducts or dampers.

The auto reset switch should be used for applications requiring positive proof of airflow (or fan operation) or to detect high differential pressures associated with dirty air filters or similar maintenance alarms not requiring safety lock (shut down) of the fan.

#### Product Numbers

Table 1.

Product Number	Setpoint Range (Field Adjustable)	Factory Setpoint Accuracy	Differential	Switching Action
141-0518	1" W.C. to 12" W.C. (250 Pa to 3000 Pa)	1" ± 0.1" W.C. (250 Pa ± 25 Pa) to 12" ± 1.2" W.C. (3000 Pa ± 300 Pa)	0.25" W.C. (62.5 Pa) maximum at 1" W.C. (25 Pa) setpoint to 1.2" W.C. (300 Pa) maximum at 12" W.C. (3000 Pa) setpoint	SPDT/ Auto Reset
141-0575	1" W.C. to 12" W.C. (250 Pa to 3000 Pa)	1" ± 0.1" W.C. (250 Pa ± 25 Pa) to 12" ± 1.2" W.C. (3000 Pa ± 300 Pa)	Not Applicable	SPST/ Manual Reset
141-0574	0.05" W.C. to 1.0" W.C. (12.5 Pa to 250 Pa)	0.05" ± 0.02" W.C. (12.5 Pa ± 5 Pa) to 1" ± 0.1" W.C. (250 Pa ± 25 Pa)	0.02" W.C. (5 Pa) at minimum setpoint 0.1" W.C. (25 Pa) at maximum setpoint	SPDT/ Auto Reset



<b>Specifications</b>	Measured media	Air
	Switch action	See Table 1
	Auto reset	Switch is Normally Closed (N.C.) and only opens on increasing pressure signal.
	Manual reset	Switch must be manually reset by operator
<b>Operating</b>	Ambient temperature range	-40 to 180°F (-40 to 82°C)
	Maximum overpressure	0.5 psi (3.4 kPa)
	Mounting position	Diaphragm in any vertical plane
	<b>Physical</b>	Electrical ratings
	Conduit opening	One 1/2-inch conduit size
	Sample line connectors	Two connectors, complete with nuts and ferrules, which accept 1/4-inch OD (6.4 mm) copper or poly tubing
	Material	Aluminized steel
	Agency certification	MFHX File MH9888 1811M25
	U.L.	
	CSA	
	Weight	1 lb (0.45 kg)
	Dimensions	See Figure 8
<b>Accessories</b>	High accuracy static pressure sensor	269-062
	Static pressure sensing kit	189-142

**Operation** The diaphragm operates a spring lever to actuate the snap switch. The manual reset switch keeps the electrical contact open until pushed to reset. Turning the adjustment knob clockwise increases the setpoint.

**Installation** Mount the unit with the diaphragm in any vertical plane. Connect the static pressure line(s) as shown in Figure 1.

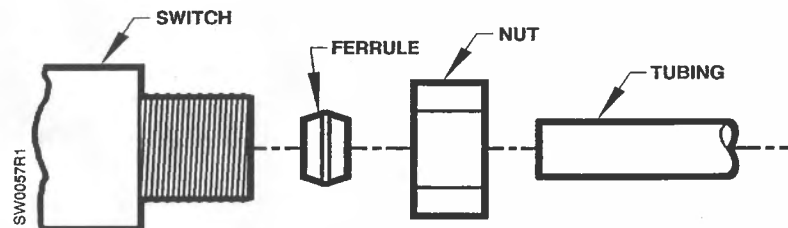


Figure 1. Connecting the Static Pressure Line.

**Installation,  
 Continued**

For use as a negative pressure switch:

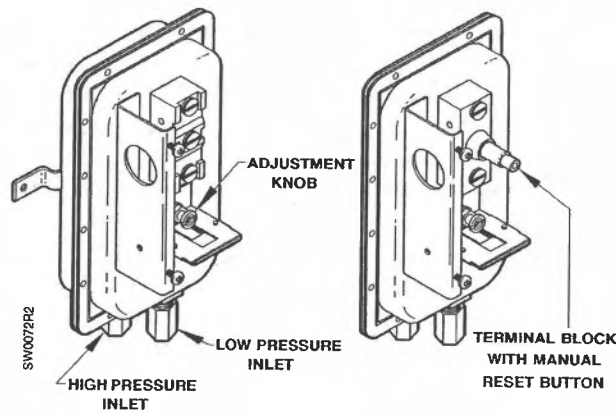
Connect the static pressure line to the low inlet (marked on the case and Figure 2) and leave the high inlet open to the atmosphere.

For use as a positive pressure switch:

Connect the static pressure line to the high inlet (marked on the case and Figure 2) and leave the low inlet open to the atmosphere.

For use as a differential pressure switch:

Connect the highest static pressure line to the high inlet and the lowest static pressure line to the low inlet (marked on the case and Figure 2.)



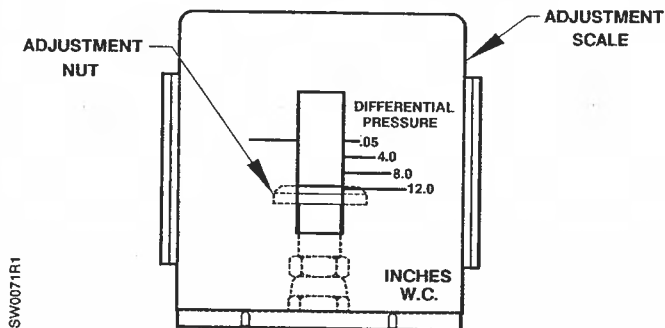
141-0518 and 141-0574

141-0575

**Figure 2. Switches with Covers Removed.**

**Setpoint  
 Adjustment**

- The setpoint is factory set at the minimum position.
1. To increase the setpoint, turn the adjustment knob clockwise as shown in Figure 2 and Figure 3. From the lowest setpoint, several turns are necessary to engage the adjusting mechanism.
  2. Adjust the setpoint until switching occurs at the proper point.
  3. Check the setpoint for accuracy with a magnahelic gauge.



**Figure 3. Adjusting the Setpoint.**

- The top of the screw is the setpoint location on the printed scale.

## Wiring Diagrams

Before setpoint pressure is applied to the diaphragm, the switch contact is in a normally closed position as shown in Figures 5 and 6.

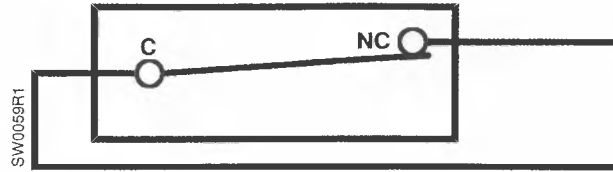


Figure 4. Manual Reset Switch 141-0575.

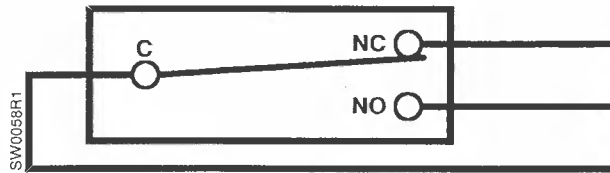


Figure 5. Auto Reset Switches 141-0518 and 141-0574.

SPDT terminals are marked Common (C), Normally Open (NO), and Normally Closed (NC).

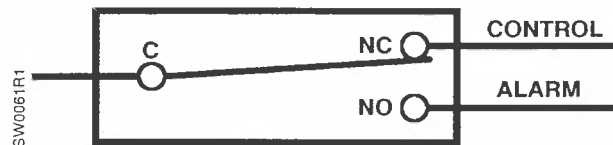


Figure 6. Auto Reset Switches to Prove Excessive Airflow or Pressure.

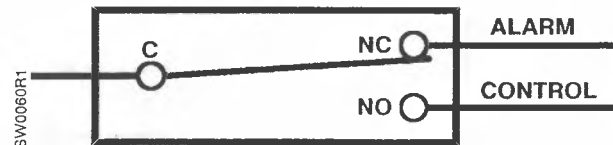
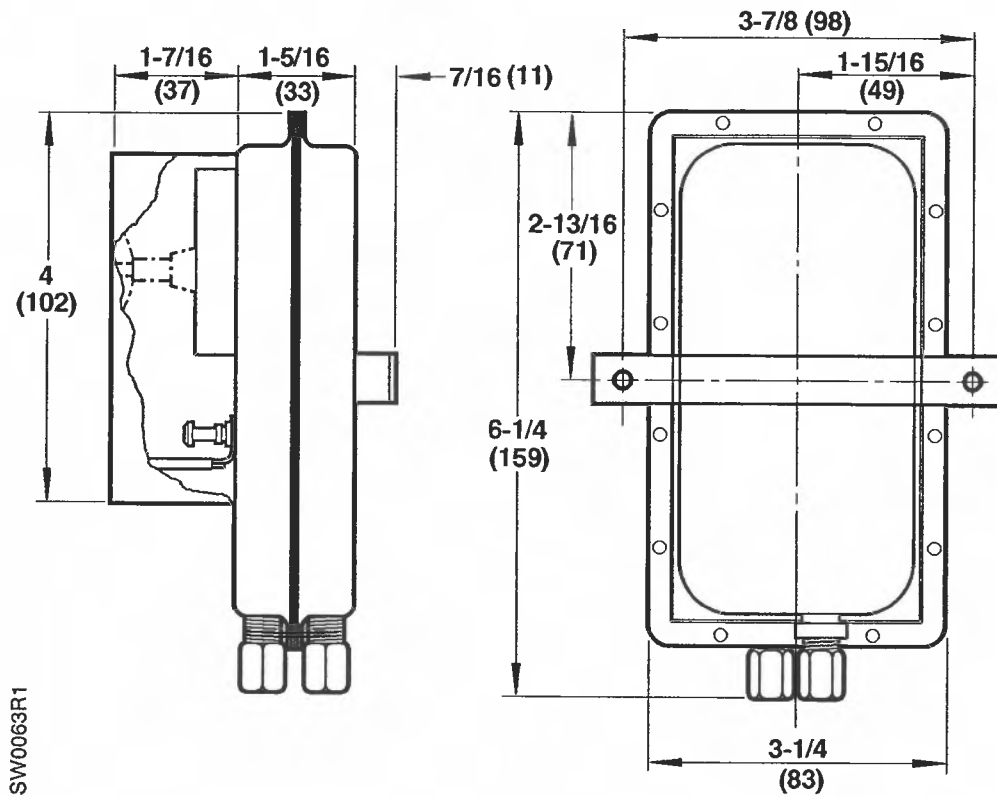


Figure 7. Auto Reset Switches to Prove Insufficient Airflow or Pressure.

**Dimensions**



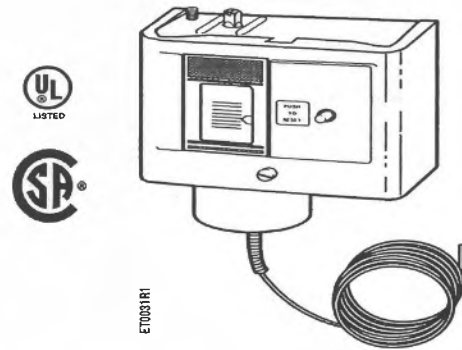
**Figure 8. Dimensions in Inches (Millimeters).**

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## Powers™ Controls

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### Low Temperature Detection Thermostat



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#### Description

The electric Low Temperature Detection Cut-out and Alarm Thermostat is a remote bulb instrument which opens an electrical circuit to stop the supply fan motor and/or closes an outside air damper when the temperature at the sensing element falls below the setting of the instrument. Simultaneously, it closes a circuit to indicate an alarm condition.

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#### Features

- Manual reset
- Easy temperature setting with adjusting screw on top of enclosure
- Mounting bracket and two screws included
- Main and separate reverse-acting auxiliary contacts

---

#### Product Number

134-1504 ←

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#### Warning/Caution Notations

<b>WARNING</b>		Personal injury/loss of life may occur if a procedure is not performed as specified.
<b>CAUTION</b>		Equipment damage, or loss of data may occur if the user does not follow a procedure as specified.

---

#### Application

This instrument should only be used on those applications where the ambient temperature to which the instrument case and bellows are exposed remains above the temperature setting of the thermostat. This thermostat should be used in areas protected from the weather.



**WARNING:**

This low temperature detection thermostat is designed for use only as an operating control. Where an operating control failure would result in personal injury and/or loss of property, it is the installer's responsibility to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of control failure.

---

**Specifications**

Switch Action	Main (LINE-M2) contacts open on temperature drop, simultaneously auxiliary contacts close
Range	15 to 55°F (-9 to 13°C)
Maximum bulb temperature	400°F (204°C)
Minimum differential	5°F (2.8°C) Non-adjustable
Sensing element	Vapor filled
Bulb length	1/8-inch OD x 20 feet (6 m)
Reset action	Manual
Electrical rating	See <i>Table 1</i>
Weight	2.4 lbs. (1.1 kg)
Dimensions	See <i>Figures 2 and 5</i>
Approvals	UL file SA 3863 CSA file LR948

---

**Operation**

This thermostat incorporates a temperature sensing element of the vapor-filled type which actuates a heavy duty contact through a rugged link mechanism.

Any one-foot length of the element subjected to temperatures below the temperature setting of the thermostat will actuate the thermostat switch mechanism regardless of the temperature being sensed by the remainder of the element. This makes the thermostats ideal for protecting large coils where air stratification could cause freezing conditions in a localized area.

The thermostat has a main and auxiliary contact unit. The main load circuit (LINE-M2) opens on temperature drop and simultaneously, an auxiliary or alarm circuit (LINE-MI) closes on temperature drop.

**NOTE:** The reset button must be manually pressed down and released to resume normal fan system operation.

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## Electrical Ratings

Table 1.

Pole Number	Line-M2 (Main)				Line-M1 (Auxiliary)			
	120 V	208 V	240 V	277 V	120 V	208 V	240 V	277 V
Motor Rating								
AC Full Load Amps	16.0	9.2	8.0	—	6.0	3.3	3.0	—
AC Locked Rotor Amps	96.0	55.2	48.0	—	36.0	19.8	18.0	—
AC Non-Ind Amps	16.0	9.2	8.0	7.2	6.0	6.0	6.0	6.0
Pilot Duty-Both Poles	125 VA, 24 to 600 Vac 57.5 VA, 120 to 300 Vdc							

## Mounting and Installation

### General Guidelines

- Locate the sensing element in the downstream side of the coil.
- Locate the case and bellows where the ambient temperature is always warmer than the set point.
- Install the thermostat so that the reset button is readily accessible and the element bellows points down.
- Install as much of the bulb as possible in a horizontal plane. If too much of the bulb is vertical, it will not operate properly.
- Avoid sharp bends or kinks in the sensing element.

### Large walk-in Ducts (Figure 1)

1. Attach the mounting bracket to the thermostat with the two round head screws provided.
2. Mount the two perforated steel strap hangers inside the duct with the wide part of the hanger strap parallel to the air flow.
3. Drill a hole in the side of the duct. With the bulb still coiled, thread the bulb through the hole using a rotary movement.
4. Mount the thermostat on the outside of the duct.
5. Carefully uncoil the bulb avoiding sharp bends or kinks in the sensing element.
6. Mount the bulb in a horizontal, serpentine manner, attaching the bulb to the strap as shown in detail in *Figure 1*.

The installation is complete.

**NOTE:** For an alternate method of mounting, use coil clips (Part Number 356-115) in the fins to hold the bulb in a horizontal, serpentine pattern.

## Mounting and Installation, Continued

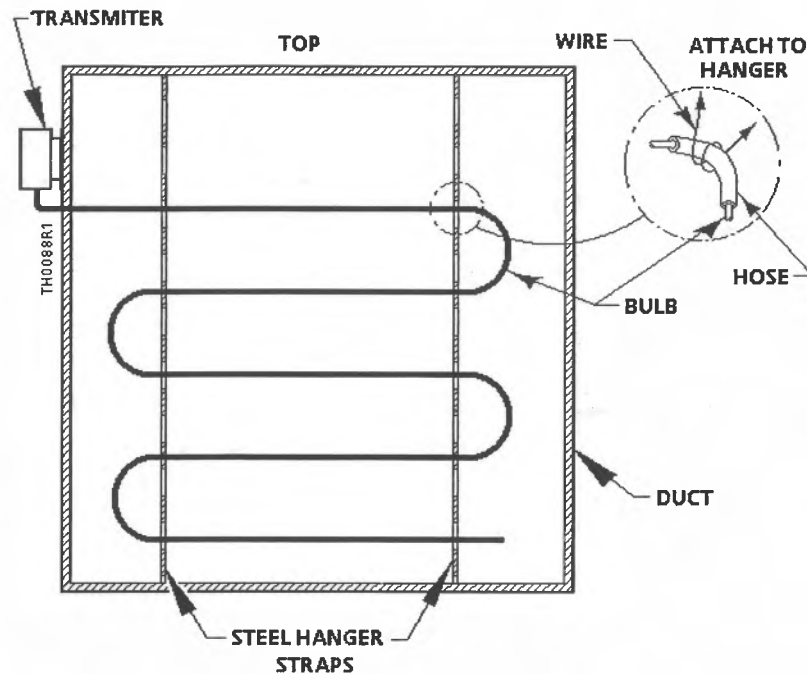


Figure 1. Typical Mounting in Walk-in Duct.

### Limited Access Ducts (Figure 2)

1. Attach the mounting bracket to the thermostat with the two round head screws provided.
2. Attach a mounting flange (part number 808-412) on the opposite side of the duct (near the bottom) from where the thermostat will be mounted.
3. Mount a second flange on a 8-inch by 4-inch sheet metal plate. Cut an access opening for the bulb on the duct diagonally across from the duct-mounted flange. Drill mounting screw holes for the sheet metal plate.
4. Cut a length of copper tubing to fit diagonally across the duct. Stretch out the bulb and wrap it around the tubing. See *Figure 2*.
5. Insert the tubing and bulb through the access hole and into the duct-mounted flange. Fasten the 8-inch by 4-inch sheet metal plate to the duct.
6. Mount the thermostat on the outside of duct.



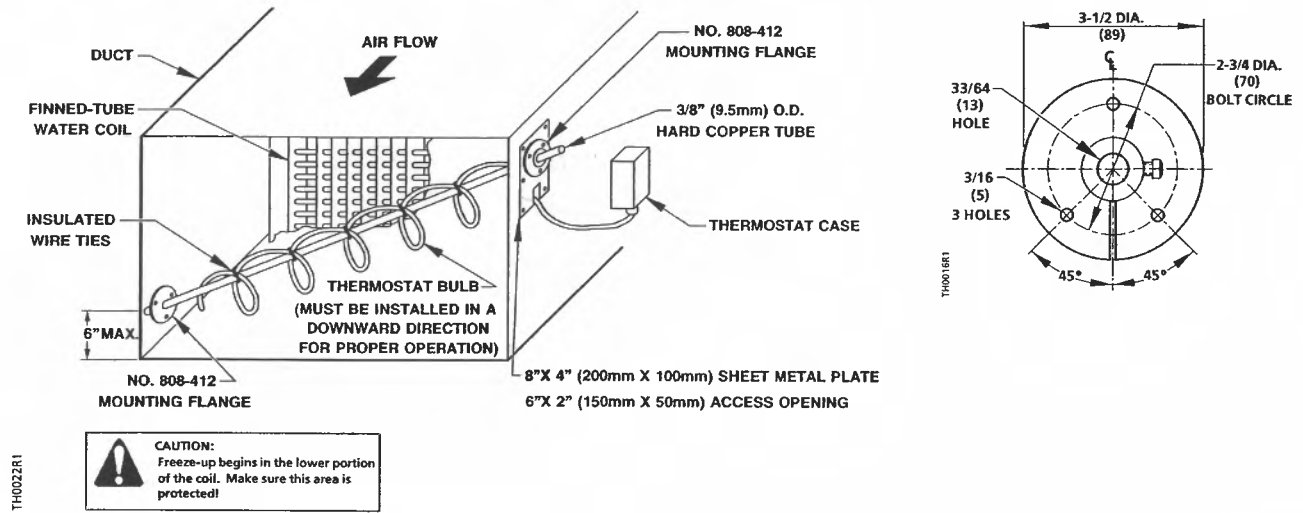


Figure 2. Bulb Mounting for Limited Access Ducts with 808-412 Mounting Flange.

**Wiring**



**WARNING:**

Disconnect the power supply before wiring connections are made to avoid possible electrical shock or damage to the equipment.

Make all wiring connections using copper conductors only and in accordance with the National Electrical Code and local regulations. Loads exceeding the rating of the thermostat should be handled by means of a relay or motor starter.

An opening for 1/2-inch conduit is provided in the bottom of the thermostat enclosure.

See Figure 3 for a typical wiring diagram.

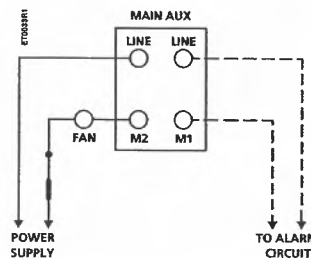


Figure 3. Typical Wiring Diagram.



**CAUTION:**

Use terminal screws furnished (#8-32 x 1/4-inch binder head screw). Longer terminal screws can interfere with switch mechanism and damage the switch.

---

**Adjustment**

After mounting the thermostat, adjust the temperature setting using the set point adjusting screw on the top of the enclosure. See *Figure 4*.

Observe a complete operating cycle to be sure that all components function correctly.



**Figure 4. Set Point Adjustment Screw.**

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**Calibration**

There is no field calibration required for the thermostat.

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**Troubleshooting**

Observe a complete operating cycle to be sure that all components function correctly.

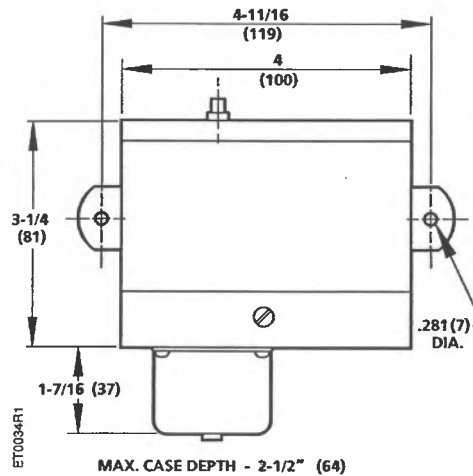
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**Service**

There is no servicing of the thermostat. Replace if inoperative.

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**Dimensions**



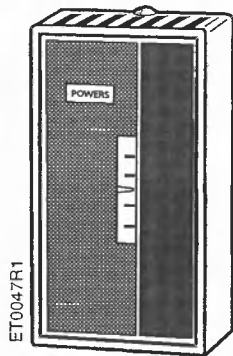
**Figure 5. Dimensions in Inches (Millimeters).**

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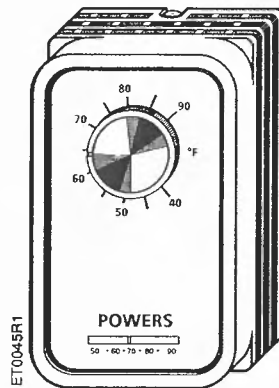
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# Powers™ Controls

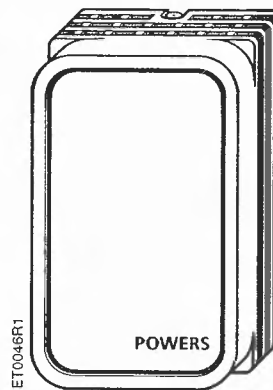
## ET 134 Line Voltage Room Thermostats



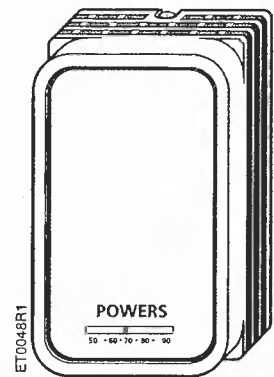
134-1083



134-1084 & 134-1085  
Exposed Knobs



134-1084 & 134-1085  
Concealed Adjustment



134-1086

### Description

The ET 134 line voltage room thermostat is a wall mounted instrument available with exposed or concealed set point adjustment. Models are available with Single-Pole, Single-Throw (SPST) or Single-Pole, Double-Throw (SPDT) contact action and for standard-duty (nominal 1/4 hp; 10 amps, non-inductive) or heavy-duty (nominal 1 hp; 22 amps, non-inductive) applications.

### Features

134-1083

- Locking cover with allen screws
- Concealed auto-off-fan selector switch
- Adjustable high range stop

134-1084, -1085, -1086

- Separable mounting plate for mounting and wiring without removing cover
- Locking cover with allen screws
- Concealed, adjustable low and high range stops
- Internal, dual Celsius and Fahrenheit scale

### Warning/Caution Notations

<b>WARNING</b>		Personal injury/loss of life may occur if a procedure is not performed as specified.
<b>CAUTION</b>		Equipment damage, or loss of data may occur if the user does not follow procedure as specified.

## Application

These line voltage thermostats control heating, cooling or year round air conditioning units in commercial, industrial or residential installations. Typical uses are for unit heaters, fan coils, blast coils, refrigerated storage room, electric heat, duct furnaces, greenhouses, etc.



### WARNING:

These thermostats are designed for use only as an operating control. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the Installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

## Product Numbers

Table 1. Product Numbers and Specifications.

Product Number	Set Point Adjustment	Set Point Range °F (°C)	Diff °F (°C)	Switch Action	Motor Rating (Full Load Amps)		Resistive Rating (Am s)		Weight lbs. (kg)
					120 Vac	240 Vac	120 Vac	277 Vac	
134-1083	Concealed	40 to 90 (5 to 30)	1.8 (1)	SPST with "AUTO-OFF FAN" Switch	6.0	3.0	—	—	1.3 (0.6)
134-1084	*Exposed Knob, or Concealed		1.8 (1) Htg. 2.3 (1.3) Clg.	SPDT Heating/Cooling	6.0	3.0	10.0	10.0	1.0 (0.45)
134-1085			3 (1.7) Htg. 3.5 (2) Clg.		16.0 Htg. 8.0 Clg.	8.0 Htg. 8.0 Clg.	22.0 Htg.	22.0 Htg.	
134-1086	Concealed		1.8 (1)	SPST open on Temperature rise Heating only	6.0	3.0	—	—	1.0 (0.45)
134-117	Aluminum Thermostat Guard and Baseplate								1.3 (0.6)
134-034	Concealed Adjustment Faceplate								0.03 (0.02)

**NOTE:** Approval UL File E35198

\*Each thermostat is shipped with a blank faceplate for use when concealed adjustment is desired.

## Mounting

The proper location of a heavy-duty room thermostat is very important to ensure good performance.

- Make sure the thermostat is in a place where air circulates around it freely.
- Never install the thermostat on or near an outside wall.
- Keep the thermostat away from windows and doors.
- Do not locate the thermostat too close to a strong light or any other false source of heat such as direct sunlight, steam lines, etc.
- Mount the thermostat on a post or partitioning wall, but make sure that there are no pipes or duct work in that wall or in the other side of the wall.
- Mount in a vertical position.

---

**Wiring****WARNING:**

Disconnect the power supply before wiring connections are made to avoid possible electrical shock or equipment damage.

---

Make all wiring connections using copper conductors only and in accordance with the National Electrical Code and local regulations. Loads exceeding the rating of the thermostat should be handled by means of a relay or motor starter.

- Install an electrical conduit box for the thermostat.
- Pull the required wires to this box.

**CAUTION:**

Use terminal screws furnished (#8-32 x 1/4-inch binder head screw). Substitution of other screws can cause problems in making proper connections.

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**Service**

There is no servicing of the thermostat. Replace if inoperative.

---

**Installation of  
134-1083**

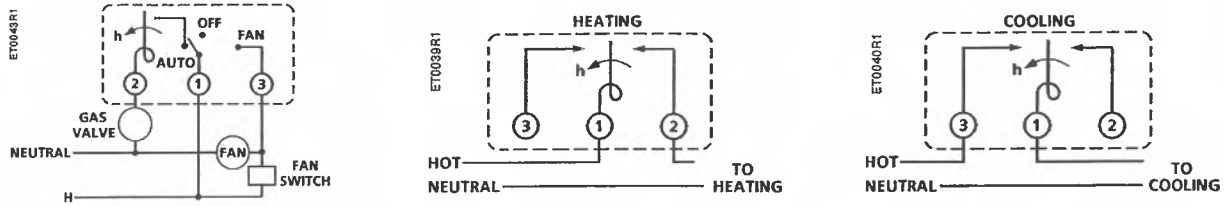
Read previous sections on Mounting and Wiring.

1. Make the wiring connections to the numbered terminals on the back of the thermostat. *Figure 1* shows a typical wiring diagram.
2. Remove the thermostat cover by loosening the allen screws at the top and bottom of the thermostat. The allen wrench is included with the thermostat.
3. Mount the thermostat to the box using the two keyhole openings in the thermostat base.
4. Set the high temperature cut-out stop.
  - a. Turn the thermostat dial so the desired high temperature setting minus one degree is at the pointer. See *Figure 2*.
  - b. Loosen the stop screw and slide the screw toward the back of the dial against the step behind the dial.
  - c. Tighten the stop screw.
5. Set the desired temperature. Turn the dial to the pointer located at the nine o'clock position. See *Figure 2*.
6. Turn the selector switch so that desired AUTO, OFF, or FAN reads vertically. *Figure 2*.
7. Replace the thermostat cover. Tighten the screws on the bottom and top of the thermostat.

The installation is now complete.

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**Installation of 134-1083, continued**

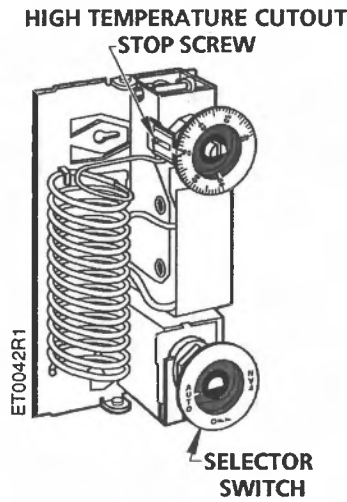


Typical Auto-Off-Fan application for 134-1083 thermostat.

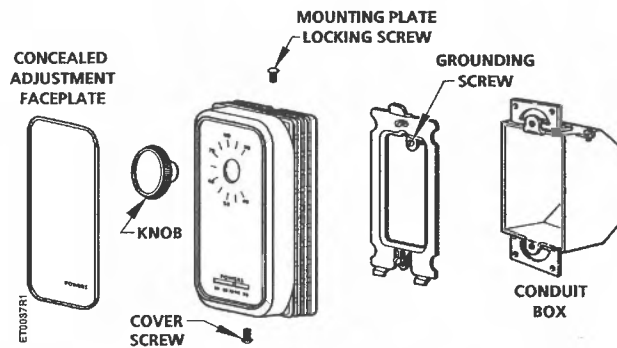
Typical heating application for 134-1084, -1085,-1086 thermostats.

Typical cooling application for 134-1084, and -1085 thermostats.

**Figure 1. Wiring Diagrams.**



**Figure 2. Interior View of 134-1083.**



**Figure 3. Mounting a 134-1084, -1085, and -1086 Thermostat to a Conduit Box.**

**Installation of  
 134-1084, -1085,  
 -1086**

Read previous section on Mounting and Wiring.

1. Do not remove the thermostat cover to install.
2. Remove the mounting plate from back of the thermostat by unscrewing the mounting plate locking screw (see *Figure 3*) with the allen wrench provided.
3. Fasten the plate to the conduit box with the screws provided on the mounting plate.
4. Make the wiring connections to the terminals on the back of the thermostat. Terminal number 1 identification is stamped on the terminal block. See *Figure 1* for typical wiring diagrams.
5. Hook the two slots in the back of the thermostat over the prongs of the mounting plate. Swing the thermostat into position on the plate.
6. Tighten the mounting plate locking screw.

The installation is now complete.

**Adjustments  
 To remove the  
 thermostat cover**

1. Pull off the knob.
2. Loosen the thermostat cover screw with the allen wrench provided.

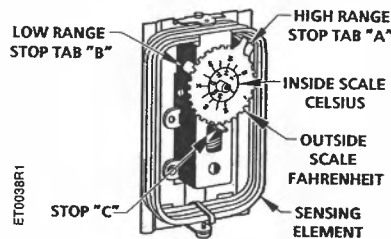
**To convert to concealed  
 adjustment**

1. Remove the thermostat cover following instructions above.
2. Peel off the backing from the enclosed faceplate.
3. Position the new faceplate over the factory -installed faceplate.
4. Press firmly onto the cover.
5. Set the thermostat dial by lining up the desired set point at the nine o'clock position.
6. Replace the cover and tighten the thermostat cover screw.

**To set high and low  
 range stops**

See *Figure 4*

1. Before the cover is removed, set the dial to the maximum stop setting.
2. Remove the knob as described above.
3. Hold the dial firmly, press tab "A", and rotate the tab clockwise until it stops against stop "C".
4. Release the tab and be sure it snaps into the desired notch.
5. Set the dial at the lowest temperature stop setting desired.
6. Hold the dial firmly, press tab "B" and rotate it counter clockwise until it stops against stop "C".
7. Release the tab and be sure it snaps into the desired notch.
8. Replace the cover, tighten the cover screw, and push on the knob.
9. Rotate the knob to the desired setting.



**Figure 4. Interior of 134-1084, -1085, and, -1086 Thermostats with High and Low Adjustment Stops.**

**Dimensions**

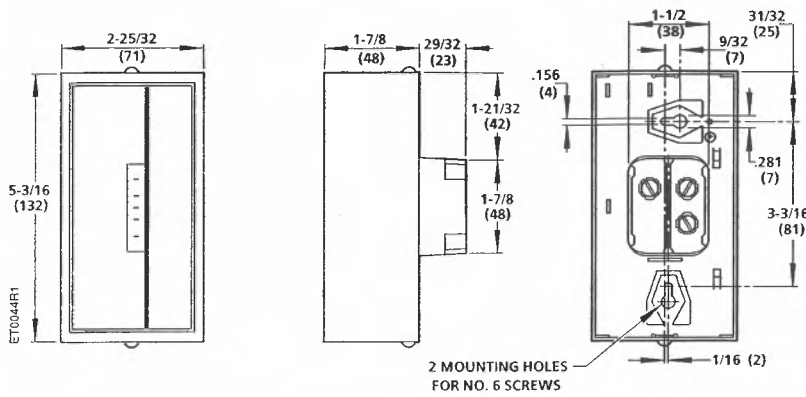


Figure 5. Dimensions of the 134-1083 Thermostat.

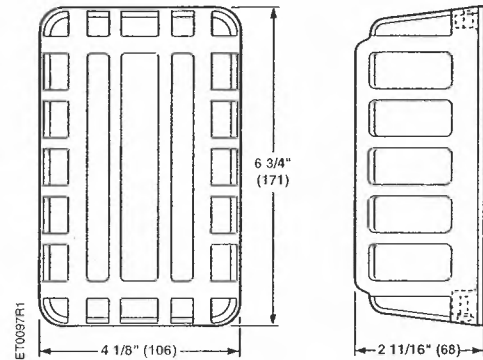


Figure 6. Dimensions of 134-117 Thermostat Guard.

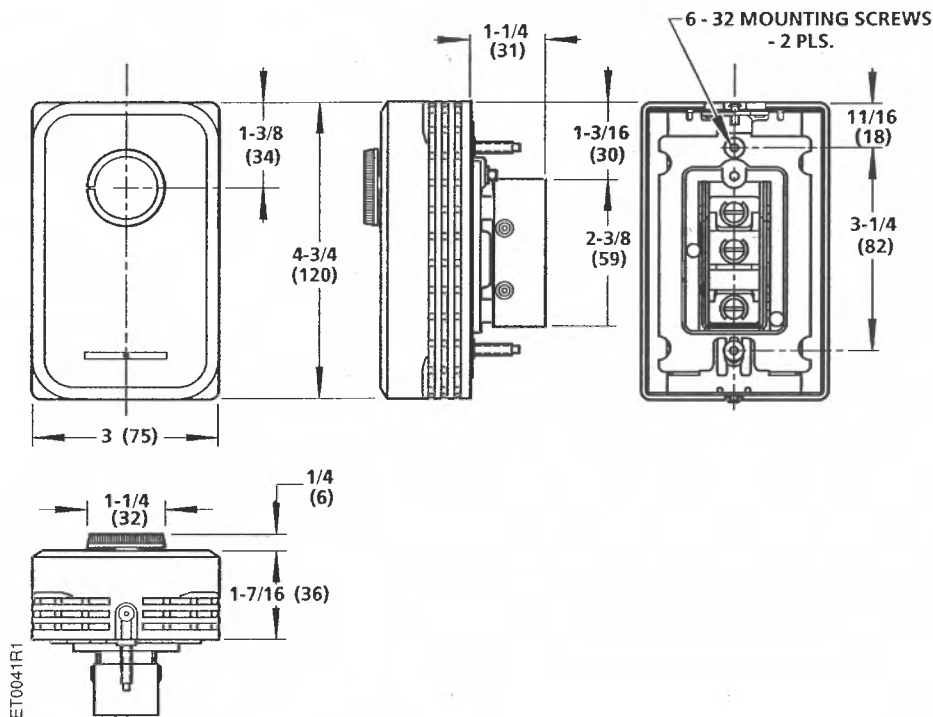


Figure 7. Dimensions of the 134-1084, -1085, and -1086 Thermostats.

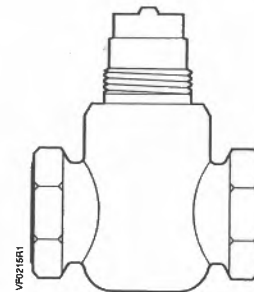
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## Powermite 599 Series

### MT Series Terminal Unit

### Two-way Valves

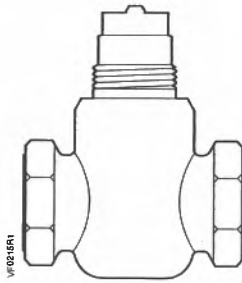


<b>Description</b>	The Powermite 599 Series ANSI Class 250 MT Series two-way valve bodies work with any MT Series pneumatic or electronic* actuator with a 7/32-inch (5.5 mm) stroke.														
	* 1-1/4 and 1-1/2 inch valves use only electronic actuators.														
<b>Features</b>	<ul style="list-style-type: none"> <li>• Direct coupled universal bonnet</li> <li>• Choice of brass or stainless steel trim</li> <li>• ANSI Leakage Class IV (0.01% of Cv)</li> </ul>														
<b>Application</b>	A typical application for the Powermite two-way valve is the control of hot or chilled water or steam for convectors, fan coil units, unit conditioners, radiation, reheat coils, and similar terminal units requiring an actuator that delivers a minimum of 67 pounds force (300 N). Ninety (90) pounds (400N) are required on 1-1/2 inch valve.														
<b>Product Numbers</b>	See Table 2.														
<b>Ordering a Valve Plus Actuator Assembly</b>	To order a complete valve plus actuator assembly from the factory, combine the actuator prefix code with the suffix of the valve assembly product number. See <i>Technical Bulletin TB251</i> (155-306P25) for selection procedure and ordering codes.														
	Valve assemblies can be ordered using the numbers in Table 2.														
<b>Specifications</b>	<table border="0"> <tr> <td>Line size</td> <td>1/2-in to 1-1/2 in (15 mm to 40 mm)</td> </tr> <tr> <td>Capacity</td> <td>See Tables 3 through 6 and Figure 1</td> </tr> <tr> <td>Body style</td> <td>Globe</td> </tr> <tr> <td>Seat style</td> <td>Metal-to-metal</td> </tr> <tr> <td>Action</td> <td>Normally open/normally closed</td> </tr> <tr> <td>Valve body rating</td> <td>ANSI Class 250; See Table 1</td> </tr> <tr> <td>Stem travel (Stroke)</td> <td>7/32-inch (5.5 mm)</td> </tr> </table>	Line size	1/2-in to 1-1/2 in (15 mm to 40 mm)	Capacity	See Tables 3 through 6 and Figure 1	Body style	Globe	Seat style	Metal-to-metal	Action	Normally open/normally closed	Valve body rating	ANSI Class 250; See Table 1	Stem travel (Stroke)	7/32-inch (5.5 mm)
Line size	1/2-in to 1-1/2 in (15 mm to 40 mm)														
Capacity	See Tables 3 through 6 and Figure 1														
Body style	Globe														
Seat style	Metal-to-metal														
Action	Normally open/normally closed														
Valve body rating	ANSI Class 250; See Table 1														
Stem travel (Stroke)	7/32-inch (5.5 mm)														

<b>Specifications</b>	Body	UNS CA 844 bronze or forged brass C37700									
	<b>Material</b>	Body trim Stem Packing	See Table 2 Stainless steel ASTM A582 Type 303 Ethylene propylene O-ring								
<b>Operating</b>	Spring Range (1/2 to 1-inch valve only)										
	Normally closed	10 to 15 psi (69 to 102 kPa)									
	Normally open	3 to 8 psi (21 to 55 kPa)									
	Controlled medium	Water, steam, glycol solutions to 50%									
	Medium temperature range	35°F to 250°F (2°C to 120°C)									
	Maximum inlet pressure	See Table 1									
	Maximum recommended differential pressure for modulating service										
			<table border="1"> <thead> <tr> <th>Brass trim</th> <th>Stainless steel trim*</th> </tr> <tr> <td></td> <td>* 1/2 – 1 inch only</td> </tr> </thead> <tbody> <tr> <td>Liquid 25 psi (173 kPa)</td> <td>50 psi (345 kPa)</td> </tr> <tr> <td>Steam 15 psi (103 kPa)</td> <td>15 psi (103 kPa)</td> </tr> </tbody> </table>	Brass trim	Stainless steel trim*		* 1/2 – 1 inch only	Liquid 25 psi (173 kPa)	50 psi (345 kPa)	Steam 15 psi (103 kPa)	15 psi (103 kPa)
	Brass trim	Stainless steel trim*									
		* 1/2 – 1 inch only									
Liquid 25 psi (173 kPa)	50 psi (345 kPa)										
Steam 15 psi (103 kPa)	15 psi (103 kPa)										
Rangeability Cv <1 Cv >1	>50:1 >100:1										
Close-off pressures Close-off ratings Leakage rate Flow characteristics	See Tables 7 and 8 and Figure 2 According to ANSI/FCI 70-2 Class IV (0.01% of Cv) Modified equal percentage										
<b>Miscellaneous</b>	Canadian Registration Numbers	0H7645.5 0C0838.9									
	Mounting location	NEMA 1 (interior only)									
	Dimensions	See Tables 10 and 11 and Figure 4									
	Valve Weight	See Table 11									
<b>Service Kit</b>	Sealing rings for union valves (package of 25)										
	1/2-inch (15 mm)	698-088									
	3/4-inch (20 mm)	599-03394									
	Union connection kit										
	1/2-inch (15 mm)	599-02941									
	3/4-inch (20 mm)	599-02942									
Protective black knob to cover the bonnet and threads/manual override.		4 268 8895 0									

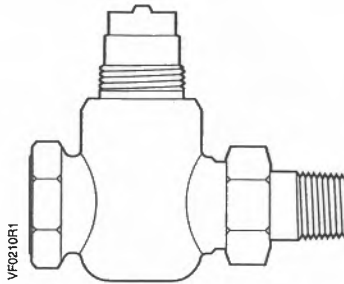
**Table 1. Body Temperature-Pressure Rating.**

Valve Body	Temperature		Pressure	
	°F	°C	psig	(kPa)
Bronze/ Forged Brass	-20 to 150	(-30 to 66)	400	(2758)
	200	(93)	385	(2655)
	250	(121)	365	(2586)
	300	(149)	335	(2300)
	350	(177)	300	(2068)



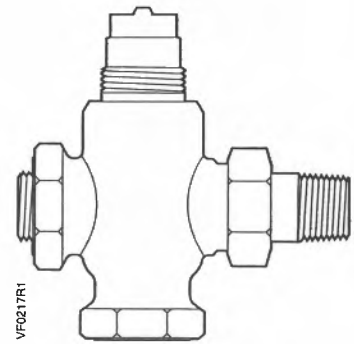
Female NPT x Female NPT

FxF



Female NPT x Union Male

FxUM



Angle Female x Union Male

AFxUM

Table 2. Product Part Numbers.

Action	Flow Rate		Nominal Line Size		Trim and Connection					
	Cv	(Kvs)	Inch	(mm)	Stainless Steel			Brass		
					FxF	FxUM	AFxUM	FxF	FxUM	AFxUM
Normally Closed	0.4	(0.34)	1/2	(15)	599-02015	599-02016	—	599-02000	599-02001	—
	0.63	(0.54)	1/2	(15)	599-02017	599-02018	—	599-02002	599-02003	—
	1.0	(0.85)	1/2	(15)	599-02019	599-02020	—	599-02004	599-02005	—
	1.6	(1.37)	1/2	(15)	599-02021	599-02022	—	599-02006	599-02007	—
	2.5	(2.15)	1/2	(15)	599-02023	599-02024	—	599-02008	599-02009	—
	4.0	(3.44)	1/2	(15)	599-02025	599-02026	—	599-02010	599-02011	—
	6.3	(5.43)	3/4	(20)	599-02047	599-02028	—	599-02012	599-02013	—
	10	(8.6)	1	(25)	599-02029	—	—	599-02014	—	—
	16	(13.8)	1-1/4	(32)	—	—	—	599-02085	—	—
25	(21.5)	1-1/2	(40)	—	—	—	599-02088	—	—	
Normally Open	0.4	(0.34)	1/2	(15)	599-02047	599-02048	—	599-02030	599-02031	—
	0.63	(0.54)	1/2	(15)	599-02049	599-02050	—	599-02032	599-02033	—
	1.0	(0.85)	1/2	(15)	599-02051	599-02052	—	599-02034	599-02035	—
	1.6	(1.37)	1/2	(15)	599-02053	599-02054	—	599-02036	599-02037	—
	2.5	(2.15)	1/2	(15)	599-02055	599-02056	599-02057	599-02038	599-02039	599-02040
	4.0	(3.44)	1/2	(15)	599-02058	599-02059	599-02060	599-02041	599-02042	599-02043
	6.3	(5.43)	3/4	(20)	599-02061	599-02062	—	599-02044	599-02045	—
	10	(8.6)	1	(25)	599-02063	—	—	599-02046	—	—
	16	(13.8)	1-1/4	(32)	—	—	—	599-02084	—	—
	25	(21.5)	1-1/2	(40)	—	—	—	599-02087	—	—

**Table 3. Maximum Water Capacity - U.S. Gallons per Minute.**

Valve Size In inches	Pressure Differential - psi															
	Cv1	2	3	4	5	6	8	10	15	20	25	30	40	50	60	75
1/2	0.4	0.6	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.8	2.0	2.2	2.5	2.8	3.1	3.5
	0.63	0.9	1.1	1.3	1.4	1.5	1.8	2.0	2.4	2.8	3.2	3.5	4.0	4.5	4.9	5.5
	1.0	1.4	1.7	2.0	2.2	2.5	2.8	3.2	3.9	4.5	5.0	5.5	6.3	7.1	7.8	8.7
	1.6	2.3	2.8	3.2	3.6	3.9	4.5	5.1	6.2	7.2	8.0	8.8	10.1	11.3	12.4	13.9
	2.5	3.5	4.3	5.0	5.6	6.1	7.1	7.9	9.7	11.2	12.5	13.7	15.8	17.7	19.4	22
	4	5.7	7	8.0	8.9	10	11.3	12.6	15.5	17.9	20.0	21.9	25	28	31	35
3/4	6.3	8.9	10.9	12.6	14.1	15.4	17.8	20	24	28	32	35	40	45	49	55
1	10	14.1	17.3	20	22	24	28	32	39	45	50	55	63	71	77	87
1-1/4	16	23	28	32	36	39	45	51	62	72	80	88	101	113	124	139
1-1/2	25	35	43	50	56	61	71	79	97	112	125	137	158	177	194	217

**Table 4. Maximum Water Capacity - Cubic Meters per Hour (m<sup>3</sup>/hr).**

In mm	Valve Size								Pressure Differential - kPa						
	1	10	20	30	40	50	60	80	Kvs/100	150	200	300	400	500	
15	0.03	0.11	0.15	0.19	0.22	0.24	0.26	0.30	0.34	0.42	0.48	0.59	0.68	0.76	
	0.05	0.17	0.24	0.30	0.34	0.38	0.42	0.48	0.54	0.66	0.76	0.94	1.08	1.21	
	0.09	0.27	0.38	0.47	0.54	0.60	0.66	0.76	0.85	1.0	1.2	1.5	1.7	1.9	
	0.14	0.43	0.61	0.75	0.87	0.97	1.06	1.23	1.37	1.7	1.9	2.4	2.7	3.1	
	0.21	0.68	0.96	1.17	1.35	1.51	1.66	1.91	2.15	2.6	3.0	3.7	4.3	4.8	
	0.34	1.1	1.5	1.9	2.2	2.4	2.7	3.1	3.4	4.2	4.9	6.0	6.9	7.7	
20	0.54	1.7	2.4	3.0	3.4	3.8	4.2	4.9	5.4	6.7	7.7	9.4	10.9	12.1	
25	0.86	2.7	3.8	4.7	5.4	6.1	6.7	7.7	8.6	10.5	12.2	14.9	17.2	19.2	
32	1.4	4.4	6.2	7.6	8.7	9.8	10.7	12.3	13.8	16.9	19.5	23.9	27.6	30.9	
40	2.2	6.8	9.6	11.8	13.6	15.2	16.7	19.2	22	26	30	37	43	48	

**Table 5. Maximum Steam Capacity - Pounds per Hour.**

Valve Size In inches	Inlet Pressure - psig																
		2		5				10				15					
		Pressure Differential - psi															
Cv/1	1	2	1	2	3	4	5	2	4	6	8	10	6	9	12	15	
<b>0.50</b>	0.4	4.8	6.7	5.2	7.3	8.8	10.0	11.0	8.2	11.3	13.6	15.3	16.7	15.0	17.9	20.0	21.6
	0.63	7.5	10.5	8.2	11.4	13.8	15.7	17.4	12.9	17.8	21.3	24.1	26	23.7	28.2	32	34
	1.0	12.0	16.6	13.0	18.2	22	25	28	20	28	34	38	42	38	45	50	54
	1.6	19.1	27	21	29	35	40	44	33	45	54	61	67	60	72	80	86
	2.5	30	42	33	45	55	62	69	51	71	85	96	104	94	112	125	135
	4	48	67	52	73	88	100	110	82	113	136	153	167	150	179	200	216
<b>0.75</b>	6.3	75	105	82	114	138	157	174	129	178	213	241	263	237	282	316	341
<b>1.0</b>	10	120	166	130	182	219	250	275	204	283	339	382	417	376	447	501	541
<b>1.25</b>	16	191	266	208	291	351	400	441	327	453	542	611	667	601	716	801	865
<b>1.50</b>	25	299	416	325	454	549	625	689	511	707	847	955	1042	940	1118	1252	1351

**Table 6. Steam Capacity - Kilograms per Hour.**

Valve Size In mm	Inlet Pressure - kPa					
		50		100		
		Pressure Differential - kPa				
Kvs	10	25	10	20	50	
<b>15</b>	0.34	1.7	2.7	2.4	3.4	5.4
	0.54	2.7	4.3	3.8	5.4	8.5
	0.85	4.3	6.8	6	8.5	14
	1.37	6.9	10.8	10	14	22
	2.15	10.7	17	15	21	34
	3.4	17	27	24	34	54
<b>20</b>	5.4	27	43	38	54	85
<b>25</b>	8.6	43	68	60	85	135
<b>32</b>	13.8	69	108	97	137	216
<b>40</b>	22	107	170	151	214	338

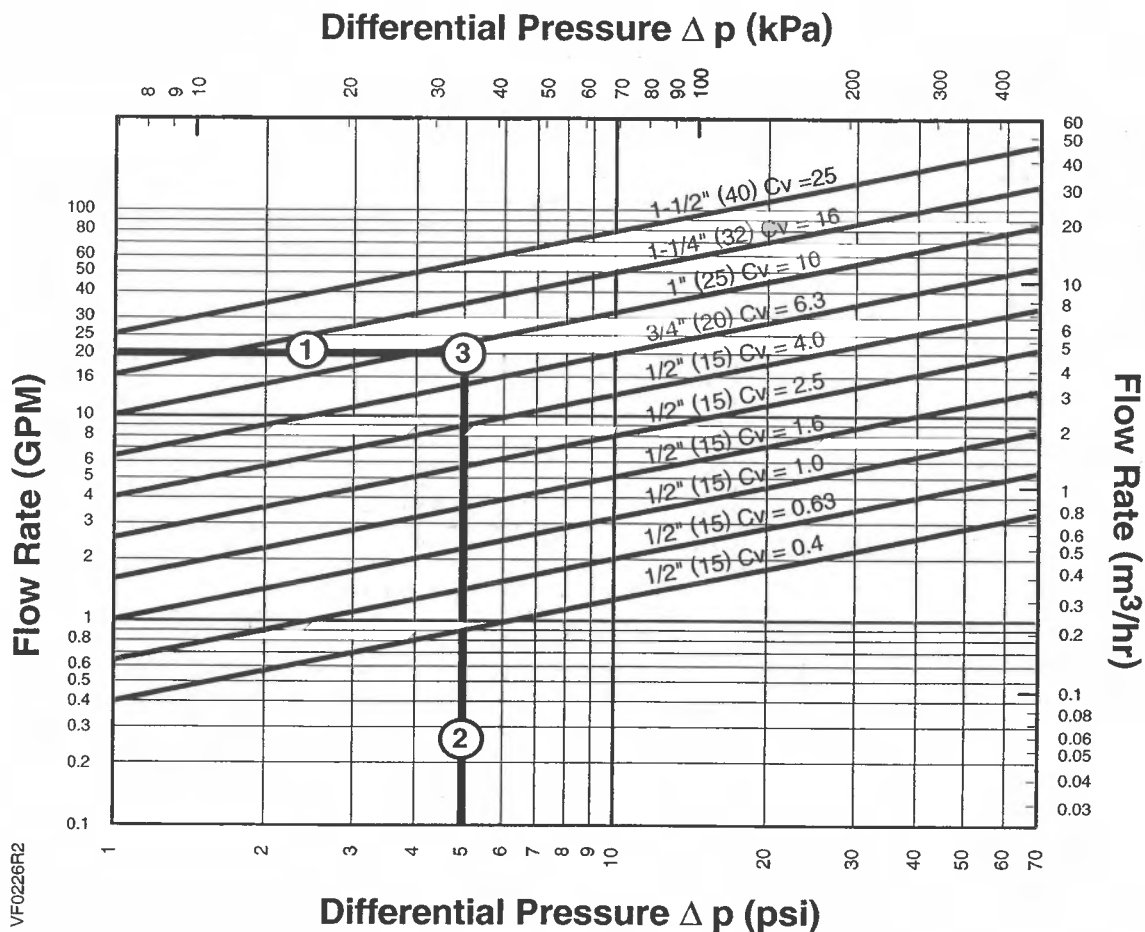


Figure 1. Water Capacity Graph

**Selection Example**

Select a valve given:

See Figure 1.

- ① Required flow = 20 gpm.
- ② Desired pressure drop = 5 psi.
- ③ Choose a 1-inch (25-mm) valve, Cv 10.

**Table 7. Close-off Pressures for Electronic Actuators.**

Action	Valve Size In. (mm)	SQS psi (kPa)	SSC psi (kPa)
NC	1/2 0.4 < Cv < 1.6 (15) (0.34 < Kvs < 1.37)	95 (655)	95 (655)
	1/2 2.5 < Cv < 4 (15) (2.15 < Kvs < 3.44)	50 (345)	50 (345)
	3/4 (20) and 1 (25)	40 (276)	40 (276)
	1-1/4 (32)	21 (145)	21 (145)
	1-1/2 (40)	13 (90)	-
NO	1/2 0.4 < Cv < 1.6 (15) (0.34 < Kvs < 1.37)	160 (1103)	120 (828)
	1/2 2.5 < Cv < 4 (15) (2.15 < Kvs < 3.44)	85 (586)	65 (448)
	3/4 (20) and 1 (25)	70 (482)	55 (379)
	1-1/4 (32)	28 (193)	20 (138)
	1-1/2 (40)	14 (96)	10 (68)

**Table 8. Maximum Available Close-off Pressures for Pneumatic Actuators.**

Action	Valve Size In. (mm)	2-inch Actuator @ 0 psi (0 kPa) (with 10 to 15 psi valve)
NC	1/2 0.4 < Cv < 1.6 (15) (0.34 < Kvs < 1.37)	95 (655)
	1/2 2.5 < Cv < 4 (15) (2.15 < Kvs < 3.44)	50 (345)
	3/4 (20) and 1 (25)	40 (276)
		<b>@ 15 psi (103 kPa) (with 3 to 8 psi valve)</b>
NO	1/2 0.4 < Cv < 1.6 (15) (0.34 < Kvs < 1.37)	95 (655)
	1/2 2.5 < Cv < 4 (15) (2.15 < Kvs < 3.44)	45 (310)
	3/4 (20) and 1 (25)	35 (241)

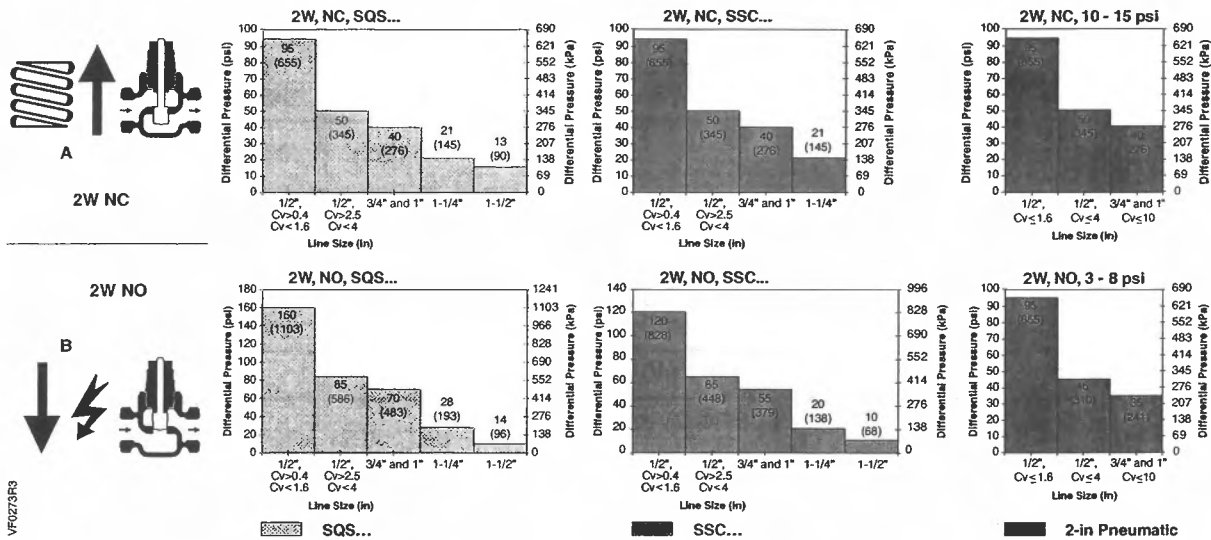


Figure 2. Close-off Pressures.

**Operation**

Figure 3 shows the normally open valve in the open or full flow position and the normally closed valve in the closed or zero flow position. The valve spring provides the necessary force to hold the stem in the raised or normal position.

In the event of power failure, a fail-safe actuator returns the valve to its normal position. Fail-in-place actuators will hold the last commanded position. See the Technical Instructions of the various actuators for additional information.

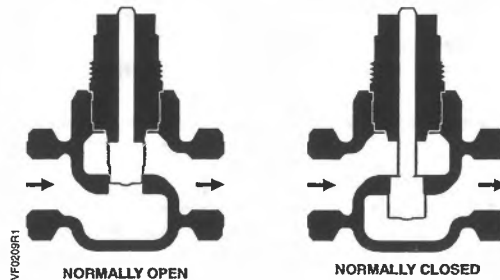


Figure 3.

**Sizing**

The sizing of a valve is important for correct system operation. An undersized valve will not have sufficient capacity at maximum load. An oversized valve can initiate cycling, and the seat and throttling plug can be damaged because of the restricted opening. Correct sizing of the control valve for actual expected conditions is considered essential for good control.

See Tables 3 through 6 for valve capacities.



**Sizing, continued**

The following variables must be determined:

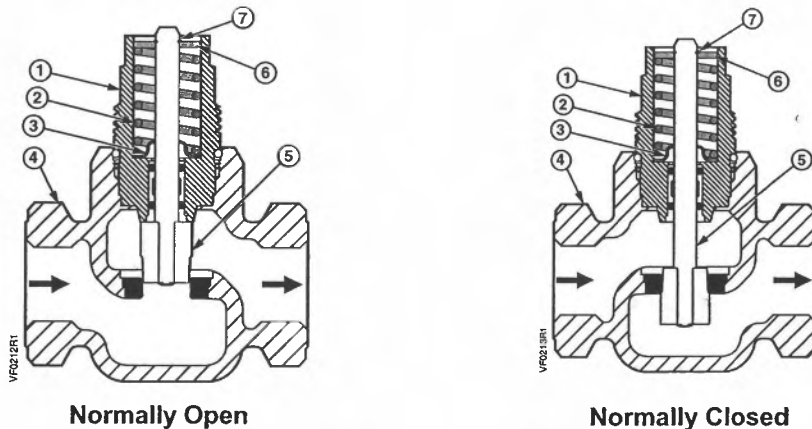
- The medium to be controlled: water, etc.
- The maximum inlet temperature and pressure of the medium at the valve.
- The pressure differential that will exist across the valve under maximum load demand.
- The maximum capacity the valve must deliver.
- The maximum line pressure differential the valve actuator must close against.
- See *Application Bulletin (AB)-1 Control Valve Selection and Sizing (155-285)* for further recommendations.

**Mounting and Installation**

- Install the valve so that the flow follows the direction of the arrow indicated on the valve body.
- For best performance, install the valve assembly with the actuator above the valve body. The valve and actuator can be installed in any position between vertical and horizontal. It is not recommended to install the valve assembly so that the actuator is below horizontal or upside-down.
- Allow sufficient space for servicing the valve and actuator. See Table 11 for valve body dimensions. See Figure 4 and Table 10 for dimensions of the service envelope recommended around the actuator.

**NOTE:** Instructions for field mounting an actuator, wiring diagrams, and start-up are covered in the Technical Instructions and Installation Instructions for each actuator.

**Parts of the Valve**



**Table 9. 2-way Bronze/Forged Brass Valves.**

Item	Part Name	Qty	Material	Item	Part Name	Qty	Material
1	Bonnet assembly	1		5	Stem and plug assembly	1	Stainless steel or brass
2	Spring	1	Stainless steel	6	Upper guide disc	1	Brass
3	Wiper	1	Nylon	7	Retaining ring	1	Stainless steel
4	Valve body	1	Bronze/Forged brass				

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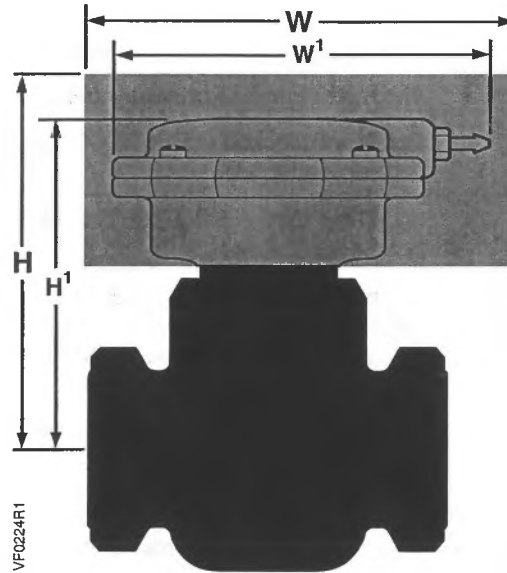
**Service**

Replace the valve if inoperable.

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**Dimensions**

The letters in Figure 4 refer to the valve centerline to top of actuator, the width of the actuator, and service envelope dimensions in Table 10. See Table 11 for valve body dimensions.

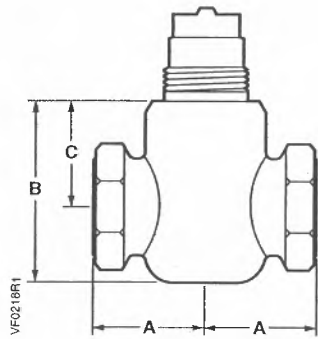


**Figure 4.**

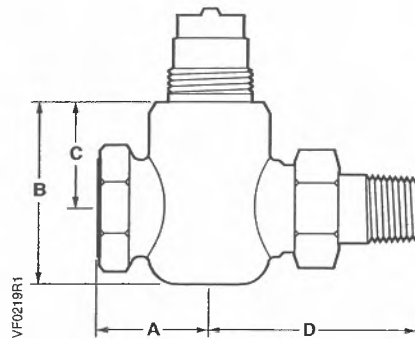
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**Table 10. Actuator Dimensions and Recommended Service Envelope. Dimensions in inches (millimeters).**

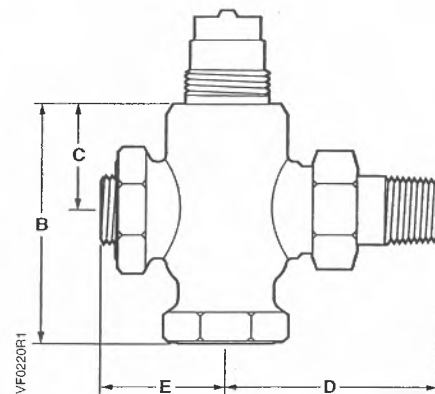
Actuator	Actuator Prefix Code	Valve Line Size	Center line to Top of Actuator, H1		Service Height, H		Width or Diameter Of Actuator, W1	Service Width W
			NO	NC	NO	NC		
599-01088 2-Inch Pneumatic	256, 257, 258	1/2 (15)	3-1/16 (78)		11 (280)		4 (100)	10 (250)
		3/4 (20)	3-1/16 (78)		11 (280)		4 (100)	10 (250)
		1 (25)	3-5/16 (84)		11-1/4 (285)		4 (100)	10 (250)
SQS65U 0 – 10V Fail-in-Place	264	1/2 (15)	6-5/8 (167)		14-1/2 (370)		5-1/16 (128)	9 (225)
		3/4 (20)	6-5/8 (167)		14-1/2 (370)		5-1/16 (128)	9 (225)
		1 (25)	6-7/8 (173)		15 (380)		5-1/16 (128)	9 (225)
		1-1/4 (32)	8-1/4 (210)	7-3/4 (195)	16 (406)	9 (225)	5-1/16 (128)	13 (225)
		1-1/2 (38)	8-5/16 (211)	7-11/16 (195)	16 (406)	9 (225)	5-1/16 (128)	13 (225)
SQS65.5U 0 – 10V Fail-Safe	265	1/2 (15)	6-1/16 (153)		14 (355)		5-1/16 (128)	9 (225)
		3/4 (20)	6-1/16 (153)		14 (355)		5-1/16 (128)	9 (225)
		1 (25)	6-5/16 (159)		14-1/2 (370)		5-1/16 (128)	9 (225)
		1-1/4 (32)	7-11/16 (195)	7-3/16 (183)	15-1/2 (394)	9 (225)	5-1/16 (128)	13 (225)
		1-1/2 (38)	7-3/4 (197)	7-1/8 (181)	16 (406)	9 (225)	5-1/16 (128)	13 (225)
SQS85.53U 3-Position Fail-Safe	266	1/2 (15)	6-1/16 (153)		14 (355)		5-1/16 (128)	9 (225)
		3/4 (20)	6-1/16 (153)		14 (355)		5-1/16 (128)	9 (225)
		1 (25)	6-5/16 (159)		14-1/2 (370)		5-1/16 (128)	9 (225)
		1-1/4 (32)	7-11/16 (195)	7-3/16 (183)	15-1/2 (394)	9 (225)	5-1/16 (128)	9 (225)
		1-1/2 (38)	7-3/4 (197)	7-1/8 (181)	15-1/2 (394)	9 (225)	5-1/16 (128)	9 (225)
SSC61U 0 – 10V Fail-in-Place	261	1/2 (15)	5-1/2 (140)		13-1/2 (343)		4-3/4 (121)	12-3/4 (324)
		3/4 (20)	5-1/2 (140)		13-1/2 (343)		4-3/4 (121)	12-3/4 (324)
		1 (25)	5-3/4 (146)		13-3/4 (349)		4-3/4 (121)	12-3/4 (324)
		1-1/4 (32)	7-1/4 (184)	6-3/4 (171)	15-3/8 (390)	14-7/8(377)	4-3/4 (121)	12-3/4 (324)
		1-1/2 (38)	7-5/16 (186)	-	15-3/8 (390)	-	4-3/4 (121)	12-3/4 (324)
SSC61.5U 0 – 10V Fail-Safe	262	1/2 (15)	5-1/2 (140)		13-1/2 (343)		4-3/4 (121)	12-3/4 (324)
		3/4 (20)	5-1/2 (140)		13-1/2 (343)		4-3/4 (121)	12-3/4 (324)
		1 (25)	5-3/4 (146)		13-3/4 (349)		4-3/4 (121)	12-3/4 (324)
		1-1/4 (32)	7-1/4 (184)	6-3/4 (171)	15-3/8 (390)	14-7/8(377)	4-3/4 (121)	12-3/4 (324)
		1-1/2 (38)	7-5/16 (186)	-	15-3/8 (390)	-	4-3/4 (121)	12-3/4 (324)
SSC81U 3-Position Fail-in-Place	259	1/2 (15)	5-1/2 (140)		13-1/2 (343)		4-3/4 (121)	12-3/4 (324)
		3/4 (20)	5-1/2 (140)		13-1/2 (343)		4-3/4 (121)	12-3/4 (324)
		1 (25)	5-3/4 (146)		13-3/4 (349)		4-3/4 (121)	12-3/4 (324)
		1-1/4 (32)	7-1/4 (184)	6-3/4 (171)	15-3/8 (390)	14-7/8(377)	4-3/4 (121)	12-3/4 (324)
		1-1/2 (38)	7-5/16 (186)	-	15-3/8 (390)	-	4-3/4 (121)	12-3/4 (324)
SSC81.5U 3-Position Fail-Safe	260	1/2 (15)	5-1/2 (140)		13-1/2 (343)		4-3/4 (121)	12-3/4 (324)
		3/4 (20)	5-1/2 (140)		13-1/2 (343)		4-3/4 (121)	12-3/4 (324)
		1 (25)	5-3/4 (146)		13-3/4 (349)		4-3/4 (121)	12-3/4 (324)
		1-1/4 (32)	7-1/4 (184)	6-3/4 (171)	15-3/8 (390)	14-7/8(377)	4-3/4 (121)	12-3/4 (324)
		1-1/2 (38)	7-5/16 (186)	-	15-3/8 (390)	-	4-3/4 (121)	12-3/4 (324)



Female NPT x Female NPT  
**FxF**



Female NPT x Union Male  
**FxUM**



Angle Female x Union Male  
**AFxUM**

Table 11. 2-way Valve Dimensions.

Valve Size inch (mm)	A	B		C	D	E	Weight lb (kg)			
		FxF & FxUM					AFxUM	FxF	FxUM	AFxUM
		NO	NC							
1/2 (15)	1-3/8 (35)	2-1/4 (57)		2-15/16 (74) NO Only	1-5/16 (33)	2-5/8 (67)	1-1/2 (38) NO only	.96 (0.4)	1.14 (0.5)	1.4 (0.6)
3/4 (20)	1-5/8 (41)	2-3/8 (59)		—	1-5/16 (33)	3-1/8 (79)	—	1.8 (0.8)	2.2 (1)	—
1 (25)	1-15/16 (49)	2-3/4 (69)		—	1-9/16 (39)	—	—	2.6 (1.2)	—	—
1-1/4 (32)	2-1/2 (63.5)	4-1/4 (108)	—	—	—	—	—	—	—	—
1-1/2 (40)	2-9/16 (65)	4-1/4 (108)	—	—	—	—	—	—	—	—

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## Powermite™ 599 Series, MT Series Terminal Unit 2-Way Valves



### Description

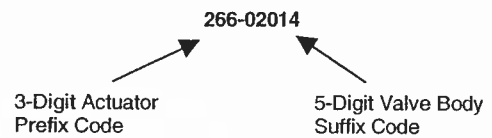
The Powermite 599 Series ANSI Class 250 MT Series 2-Way Valve bodies work with any MT Series pneumatic or electronic actuator with a 7/32-inch (5.5-mm) stroke. They are suitable for normally open or normally closed control. Typical applications include control of hot or chilled water, glycol solutions up to 50%, or steam up to 15 psi (103 kPa). Compatible actuators deliver a minimum of 67 lbs. (300 N) of force.

### Features

- Direct-coupled universal bonnet
- Female NPT end connections and brass trim
- ANSI Leakage Class IV (0.01% of Cv)

### Product Numbers

Use the product numbers in the tables to order the valve and the actuator assembled together. The product number consists of a 3-digit prefix code, a hyphen, and a 5-digit suffix code. The prefix specifies an actuator. The suffix specifies the valve body.



2-Way Valve & Actuator Assemblies with Brass Trim and Female NPT Connections													
Valve Body	Line Size, In. (mm)	Cv (Kvs)	2-Inch Pneumatic Actuators, fail-safe *			Electro-mechanical, 24V							
			10-15 psi (69-103 kPa)	3-8 psi (21-55 kPa)	8-13 psi (55-90 kPa)	SSC81U 3 pos., fail-in-place	SSC81.5U 3 pos., fail-safe	SSC61U 0-10V, fail-in-place	SSC61.5U 0-10V, fail-safe	SQS65U 0-10V, fail-in-place	SQS65.5U 0-10V, fail-safe	SQS85.53U 3 pos., fail-safe	
			Actuator Prefix Code										264
			256	257	258	259	260	261	262	264	265	266	
Normally Closed	599-02000	1/2 (15)	0.4 (0.34)	256-02000	257-02000B	258-02000C	259-02000	260-02000	261-02000	262-02000	264-02000	265-02000	266-02000
	599-02002	1/2 (15)	0.63 (0.54)	256-02002	257-02002B	258-02002C	259-02002	260-02002	261-02002	262-02002	264-02002	265-02002	266-02002
	599-02004	1/2 (15)	1 (0.85)	256-02004	257-02004B	258-02004C	259-02004	260-02004	261-02004	262-02004	264-02004	265-02004	266-02004
	599-02006	1/2 (15)	1.6 (1.37)	256-02006	257-02006B	258-02006C	259-02006	260-02006	261-02006	262-02006	264-02006	265-02006	266-02006
	599-02008	1/2 (15)	2.5 (2.14)	256-02008	257-02008B	258-02008C	259-02008	260-02008	261-02008	262-02008	264-02008	265-02008	266-02008
	599-02010	1/2 (15)	4 (3.42)	256-02010	257-02010B	258-02010C	259-02010	260-02010	261-02010	262-02010	264-02010	265-02010	266-02010
	599-02012	3/4 (20)	6.3 (5.38)	256-02012	257-02012B	258-02012C	259-02012	260-02012	261-02012	262-02012	264-02012	265-02012	266-02012
	599-02014	1 (25)	10 (8.55)	256-02014	257-02014B	258-02014C	259-02014	260-02014	261-02014	262-02014	264-02014	265-02014	266-02014
	599-02085	1-1/4 (32)	16 (13.8)	-	-	-	259-02085	260-02085	261-02085	262-02085	264-02085	265-02085	266-02085
	599-02088	1-1/2 (40)	25 (21.5)	-	-	-	-	-	-	-	264-02088	265-02088	266-02088
Normally Open	599-02030	1/2 (15)	0.4 (0.34)	256-02030A	257-02030	258-02030C	259-02030	260-02030	261-02030	262-02030	264-02030	265-02030	266-02030
	599-02032	1/2 (15)	0.63 (0.54)	256-02032A	257-02032	258-02032C	259-02032	260-02032	261-02032	262-02032	264-02032	265-02032	266-02032
	599-02034	1/2 (15)	1 (0.85)	256-02034A	257-02034	258-02034C	259-02034	260-02034	261-02034	262-02034	264-02034	265-02034	266-02034
	599-02036	1/2 (15)	1.6 (1.37)	256-02036A	257-02036	258-02036C	259-02036	260-02036	261-02036	262-02036	264-02036	265-02036	266-02036
	599-02038	1/2 (15)	2.5 (2.14)	256-02038A	257-02038	258-02038C	259-02038	260-02038	261-02038	262-02038	264-02038	265-02038	266-02038
	599-02041	1/2 (15)	4 (3.42)	256-02041A	257-02041	258-02041C	259-02041	260-02041	261-02041	262-02041	264-02041	265-02041	266-02041
	599-02044	3/4 (20)	6.3 (5.38)	256-02044A	257-02044	258-02044C	259-02044	260-02044	261-02044	262-02044	264-02044	265-02044	266-02044
	599-02046	1 (25)	10 (8.55)	256-02046A	257-02046	258-02046C	259-02046	260-02046	261-02046	262-02046	264-02046	265-02046	266-02046
	599-02084	1-1/4 (32)	16 (13.8)	-	-	-	259-02084	260-02084	261-02084	262-02084	264-02084	265-02084	266-02084
	599-02087	1-1/2 (40)	25 (21.5)	-	-	-	259-02087	260-02087	261-02087	262-02087	264-02087	265-02087	266-02087

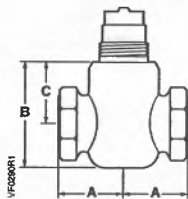
\* Product numbers in gray shading are available as assemblies only.

**Technical Data**

<b>Line Size</b>	1/2 to 1-1/2 inch (15 to 40 mm)	<b>Controlled Medium</b>	Water, steam, glycol solutions to 50%
<b>Body</b>	Globe style, UNS CA 844 bronze, ANSI Class 250	<b>Medium Temperature</b>	35 to 250°F (2 to 120°C)
<b>Trim</b>	Brass	<b>Max. Differential Pressure for Modulating Service:</b>	
<b>Stem</b>	Stainless steel ASTM A582 Type 303, 7/32-inch (5.5-mm) stroke	<b>Liquid</b>	25 psi (173 kPa)
<b>Seat</b>	Metal-to-metal	<b>Steam</b>	15 psi (103 kPa)
<b>Packing</b>	Ethylene propylene O-ring	<b>Rangeability</b>	Cv <1 = >50:1, Cv >1 = >100:1
<b>Close-off Ratings</b>	According to ANSI/FCI 70-2 See Table 1.	<b>Leakage Rate</b>	Class IV (0.01% of Cv)
		<b>Flow Characteristics</b>	Modified equal percentage
		<b>Mounting</b>	NEMA 1 (interior only)

**Table 1. Close-Off Ratings in psi (kPa).**

Action	Line Size Inches (mm)	Flow Rate, Cv (Kvs)	Close-Off Ratings @ 20 psi (138 kPa)				
			Electronic Actuator		2-Inch Pneumatic Actuator		
			SQS...	SSC...	3-8 psi (69-103 kPa)	8-13 psi (21-55 kPa)	10-15 psi (55-90 kPa)
NC	1/2 (15)	0.4 to 1.6 (0.34 to 1.37)	95 (655)	95 (655)	40 (276)	95 (655)	95 (655)
	1/2 (15)	2.5 to 4 (2.15 to 3.44)	50 (345)	50 (345)	28 (193)	50 (345)	50 (345)
	3/4 (20) and 1 (25)	6.3 to 10 (5.43 to 8.6)	40 (276)	40 (276)	18 (124)	40 (276)	40 (276)
	1-1/4 (32)	—	21 (145)	21 (145)	—	—	—
	1-1/2 (40)	—	13 (90)	—	—	—	—
NO	1/2 (15)	0.4 to 1.6 (0.34 to 1.37)	160 (1103)	120 (828)	95 (655)	45 (310)	20 (138)
	1/2 (15)	2.5 to 4 (2.15 to 3.44)	85 (586)	65 (448)	45 (310)	25 (172)	15 (103)
	3/4 (20) and 1 (25)	6.3 to 10 (5.43 to 8.6)	70 (482)	55 (379)	35 (241)	10 (69)	—
	1-1/4 (32)	—	28 (193)	20 (138)	—	—	—
	1-1/2 (40)	—	14 (96)	10 (68)	—	—	—



**Female NPT x Female NPT**

Valve Size In. (mm)	A	B		C		Weight lbs. (kg)
		NO	NC	NO	NC	
1/2 (15)	1-3/8 (35)	2-1/4 (57)		1-5/16 (33)		1.3 (0.6)
3/4 (20)	1-5/8 (41)	2-3/8 (59)		1-5/16 (33)		1.8 (0.8)
1 (25)	1-15/16 (49)	2-3/4 (69)		1-9/16 (39)		2.6 (1.2)
1-1/4 (32)	2-1/2 (63.5)	4-1/4 (108)	3-7/8 (98.4)	2-3/16 (55.6)	1-11/16 (42.9)	4 (1.8)
1-1/2 (40)	2-9/16 (65)	4-1/4 (108)	3-7/8 (98.4)	2-1/4 (57.2)	1-5/8 (41.3)	5 (3.2)

**Figure 1. Two-way Valve Dimensions in Inches (mm).**

**Typical Specifications**

Automatic control valves shall have NPT threaded type fittings, 1/2 through 1-1/2 inch (15 through 40mm) sizes, and shall be ANSI rated to withstand the pressures and temperatures encountered.

Valves shall have metal-to-metal seats, stainless steel stems, and Ethylene propylene O-ring packing.

Valve shall be ANSI Leakage Class IV (0.01% of Cv). Valves shall have a 50:1 rangeability (Cv <1) or better.

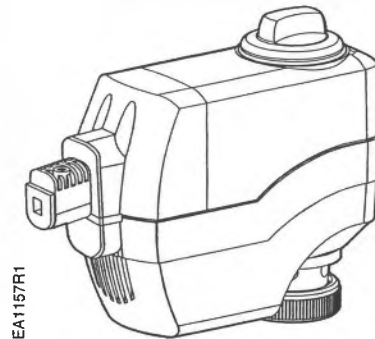
All two-way valves shall be provided with equal-percentage contoured throttling plugs.

For complete technical details on valves with stainless steel trim, or union female, angle female, or union male end connections, see *Powermite™ 599 Series, MT Series Terminal Unit Two-way Valves Technical Instructions*, Document No. 155-196P25.

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## Powermite 599 Series

### MT Series SSC Electronic Valve Actuator, 24 Vac 3-Position (Floating) Control



#### Description

The Powermite 599 Series MT Series SSC81U and SSC81.5U electronic valve actuators require a 24 Vac supply to provide a 3-position (floating) control signal. These actuators control Powermite 599 MT Series valves with a 7/32-inch (5.5 mm) stroke and a threaded valve bonnet that fits the actuators.

#### Features

- UL listed for plenum installations
- Direct coupled installation without special tools
- Manual override
- Visual position indication

#### Application

The Powermite 599 Series MT Series SSC81... electronic actuators and MT Series valves are used in heating and cooling applications. They are used in liquid and steam applications that require an actuator that delivers a minimum of 67 lbs (300 N) nominal force. The SSC81 series accepts plenum cable or 3/8-inch flex conduit connection.

#### Product Numbers

Table 1. Product Numbers.

Actuator	Operating Mode	Actuator Prefix Code
SSC81U	Fail-in-Place	259
SSC81.5U	Fail-Safe	260

#### Ordering a Valve Plus Actuator Assembly

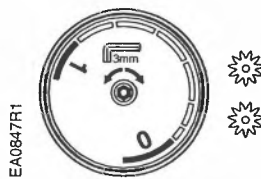
To order a complete valve plus actuator assembly from the factory, combine the actuator prefix code with the suffix of the valve product number. See *Technical Bulletin TB251, Powermite 599 Series MT Series Terminal Unit Valve and Actuator Assembly Selection* (155-306P25) for selection procedures.

To order an actuator only, use the product number.

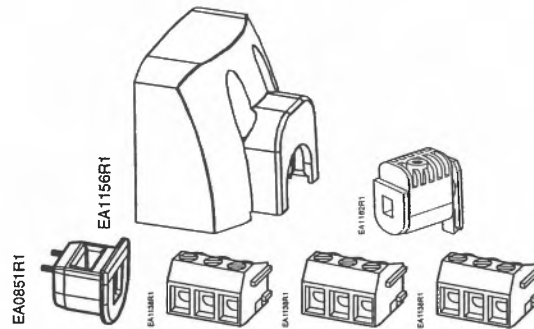
<b>Specifications</b>		
<b>Power requirements</b>	Operating voltage	24 Vac $\pm 20\%$
	Frequency	50/60 Hz $\pm 2$ Hz
	Power supply	Earth ground isolating Class 2, 24 Vac transformer
		<b>NOTE:</b> Do not power more than 10 actuators with one transformer.
	SSC81U power consumption	0.8 VA
	SSC81.5U power consumption	3 VA at ultra cap load, 2 VA at normal drift
<b>Control characteristic</b>	Control Signal	
	Y2	Retracts actuator shaft
	Y1	Extends actuator shaft
	G	System potential
	G0 (SSC81.5U only)	System neutral
<b>Functional operation</b>	Running time	
	SSC81U	150 s $\pm 2\%$ at 50 Hz 125 s $\pm 2\%$ at 60 Hz
	SSC81.5U	125 s $\pm 2\%$ at 50/60 Hz
	Fail-safe, SSC81.5U only (Figure 1, )	$\approx 30$ s
	Nominal stroke	7/32-inch (5.5 mm)
	Nominal force	67 lb (300N), +20%, -0%
	Stroke/signal relationship	Linear
	Capacitor charge time (Figure 1 )	max. 180 sec
Fail-safe (SSC81.5U only) to stem up (0 position)	Non-mechanical, electronic return fails	
<b>Agency certification</b>	UL	UL873 Listed
	cUL	Certified to Canadian Standard C22.2 No. 24-93
<b>Ambient conditions</b>	Ambient temperature	
	Operation	41°F to 122°F (5°C to 50°C) with 15 psi steam media
	Transport and storage	-13°F to 158°F (-25°C to +70°C)
	Ambient humidity	0 to 90% rh (non-condensing)
	Medium temperature	41°F to 248°F (5°C to 120°C)
<b>Physical characteristics</b>	Wiring Connection	Plenum cable or 3/8-inch flex conduit
	Weight	
	SSC81U	1.1 lb (0.5 kg)
	SSC81.5U	1.3 lb (0.6 kg)
	Dimensions	See Figure 8



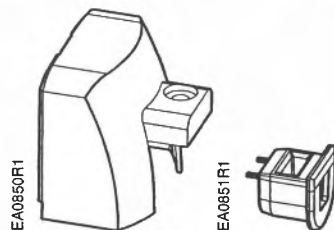
**Service Kits**



**4 224 5618 8** Visual Position Kit to replace one indicator and two gears. (Previous version.)



**4-115-5564-8:** Kit contains:  
 - Terminal cover  
 - Cover screws-2 (not shown)  
 - Tailpiece  
 - Tailpiece screw-1 (not shown)  
 - Cable lock  
 - Terminal block-3



**4-116-5608-8:** Kit contains:  
 - Terminal Cover  
 - Cable lock  
 - Cover screw- 1 (not shown)

**Operation**

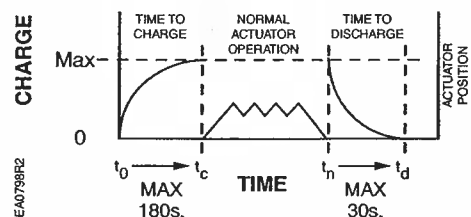
A 24 Vac control signal to terminal Y1 extends the actuator shaft proportionately to the length of time the signal is applied.

A 24 Vac control signal to terminal Y2 retracts the actuator shaft proportionately to the length of time the signal is applied.

In the event of a power failure with no control voltage, the SSC81U fails-in-place and holds its last position.

In the event of a power failure, the SSC81.5U returns to its normal fail-safe position. The SSC81.5U includes an electronic return mechanism that functions as follows. See Figure 1.

- At power-up ( $t_0$ ), a capacitor must charge to its maximum capacity (Max,  $t_c$ ). This will take a maximum of 180 sec, during which time no actuator movement occurs.
- Once the capacitor is fully charged ( $t_c$ ), normal actuator operation occurs.
- If a subsequent power failure occurs ( $t_n$ ) of greater than 5 sec, the capacitor discharges ( $t_d$ ) and the actuator returns to its normal fail-safe position.



**Figure 1. SSC81.5U Electronic Fail-Safe Mechanism.**

## Operation, Continued



### CAUTION:

Before applying power, make certain a valve is connected to the actuator.

If applying power to the actuator when a valve is not connected, the actuator will respond to a control signal and the shaft will extend until it reaches its maximum end stop. Thereafter, it will not respond to any signal.

If this occurs, turn the manual position indicator (See Figure 6 and Figure 7) on the top of the actuator to the 0 position and verify the actuator shaft retracts completely. Disconnect power. Connect a valve to the actuator, reapply power, and the actuator will return to normal operation.

## Calibration Stroke

The SSC81.5U writes its calibration stroke parameters to nonvolatile memory on the first startup of the actuator. Successive startups bypass the calibration stroke unless the memory is manually cleared. If installing the actuator on a different valve (such as on a replacement valve), manually clear the calibration stroke from memory as follows:

1. Remove the terminal cover using a Phillips head screwdriver.
2. Locate hole on the circuit board shorting bars.
3. Insert and gently twist a flat-blade screwdriver to electrically connect the shorting bars (Figure 2). The SSC81... then performs a new calibration stroke.
4. Secure the terminal cover back in place.

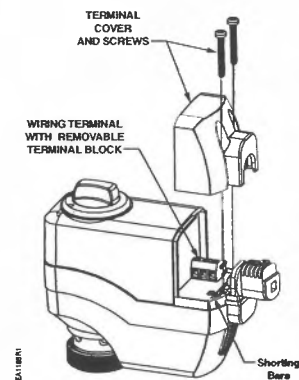


Figure 2. Manually Clearing Calibration Stroke from Memory.

## Mounting and Installation

Mount the actuator in one of the allowable positions shown in Figure 3.



Figure 3. Mounting Position.

When mounting the actuator in a plenum, the proper cable must be attached to meet local codes. Allow 8 inches (200 mm) above the actuator and 8 inches (200 mm) behind the cable for service.

**Wiring**

Use earth ground isolating step-down Class 2 transformers. Do not use autotransformers.

Determine supply transformer rating by summing total VA of all actuators used. The maximum rating for a Class 2 step-down transformer is 100 VA.

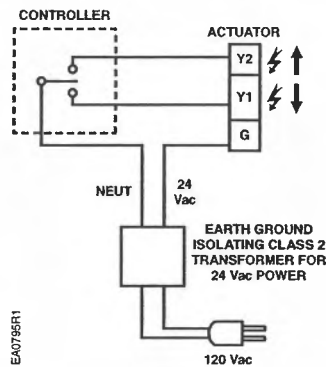
Do not power more than 10 actuators by one transformer.



**CAUTION:**

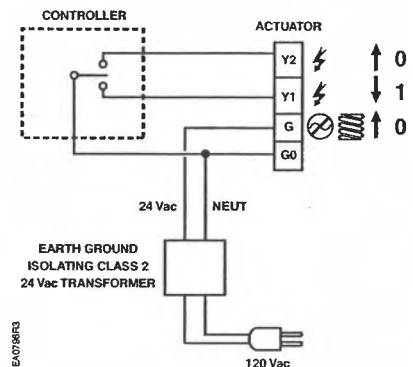
Terminals must be properly wired for correct function and full life of the actuator.

**Wiring Diagrams**



Y2...Retracts actuator shaft  
 Y1...Extends actuator shaft  
 G...System potential

**Figure 4. SSC81U (Fail-in-Place) Wiring.**

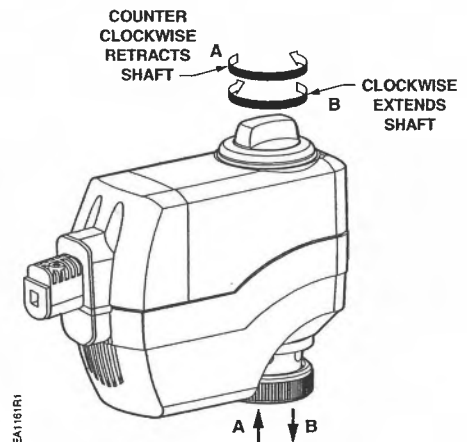


Y2...Retracts actuator shaft  
 Y1...Extends actuator shaft  
 G... System potential  
 G0...System neutral

**Figure 5. SSC81.5U (Fail-Safe) Wiring.**

**Manual Override**

For manual positioning, the manual override knob in the center of the position indicator per Figure 6.

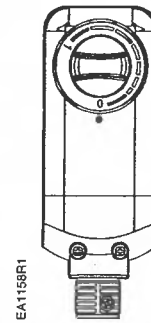


**Figure 6. Manual Override.**

**Start-up**

Check the wiring and the position indicator (Figure 7).

Position Indicator	Output Shaft
0	Retracted
1	Extended



**Figure 7. Position Indicator (Shown in 0 Position).**

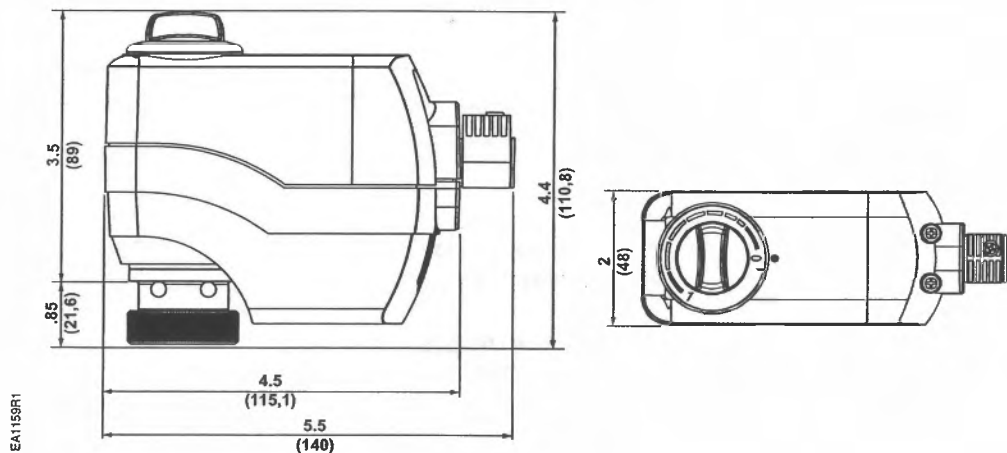
**Troubleshooting**

Check the wiring for proper connections.

**Service Kits**

If the actuator is inoperative, replace the unit.

**Dimensions**



**Figure 8. SSC Actuator Dimensions in Inches (Millimeters).**

**Service envelope**

Minimum access space recommended:

8 inches (200 mm) above the actuator and beside the terminal cover.

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## Powermite 599 Series

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### MT Series Terminal Unit Valve and Actuator Assembly Selection

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#### Description

This Technical Bulletin aids in selecting a Powermite 599 Series MT Series terminal unit valve and actuator assembly. Figure 1 provides a graph of water capacity for selecting the proper valve size. Figures 2 through 5 show close-off pressures for selecting an actuator according to specifications.

Tables 2 through 10 identify the product numbers. Table 1 provides a guide to these tables. The tables show all possible combinations of Powermite 599 Series valves and compatible actuators that can be ordered as complete valve assemblies from the factory.

Tables 11 through 13 provide the dimensions of all valves and the service envelope required for each actuator.

---

#### Using the Valve and Actuator Selection Graphs

Use Figure 1, the water capacity graph, to select a valve size as follows:

1. Locate the specified flow rate on the vertical axis.
2. Follow across on the horizontal axis to the point of intersection with the specified pressure drop.
3. Choose the valve size from the heavy diagonal lines across the graph.

---

Use Figures 2 through 5, the close-off pressure graphs, to select an actuator as follows:

1. Choose the graph for the valve action (normally open or closed) and actuator power source (electronic or pneumatic) specified.
2. Locate the bar that represents the valve line size. The top of the bar indicates the maximum close-off pressure for tight close off.

Use the legend at the bottom of the graph to identify the actuator.

---

#### Using the Valve and Actuator Assembly Tables

Use Tables 2 through 10 to select a valve and actuator assembly as follows:

1. Locate the appropriate table based on the required valve type, valve action, and actuator type per Table 1.
  2. Read Table 2 through 10 from left to right and select the appropriate valve specifications to identify the row with the required valve body.
  3. Read across the top of the table and select the appropriate actuator specifications to identify the column with the required actuator.
  4. Read down the actuator column and read across the valve body row. The column/row intersection determines the appropriate valve and actuator assembly. The valve and actuator assembly product number is the actuator prefix code added to the valve body suffix.
-

---

## Selection Example

### Specifications

In an ANSI 250 piping system, a two-way, normally closed, female-by-female NPT threaded valve is to deliver 20 gpm (4.5 m<sup>3</sup>/h) chilled water with no more than 5 psi (35 kPa) pressure drop across the fully open valve.

The actuator is to receive 24 Vac power, supply a three-position control signal, and provide fail-in-place operation. The actuator is to close off tightly against a pump head pressure of 15 psi (103 kPa, 1 bar).

---

### Valve Sizing

Use Figure 1, the water capacity graph, to select the valve size as follows:

1. Locate the required flow rate by finding 20 gpm (4.5 m<sup>3</sup>/h) on the vertical axis.
2. Follow across the horizontal axis to find the 5 psi (35 kPa) maximum allowable pressure drop across the open valve.
3. Since the point of intersection is near a 1-inch (25-mm), 10 Cv (8.5 Kvs) valve line size, select that valve line size to ensure proper flow.

---

### Actuator Selection

Use Figure 2, the maximum close-off pressure graph for actuators on two-way valves, to select an actuator as follows:

1. For NC valves with electronic actuators, choose the upper left graph.
2. Locate the 3/4-inch to 1-inch bar to correspond to the 1-inch (25-mm) valve size. Note that the top of the bar or the maximum close-off pressure is 40 psi (276 kPa).
3. The 40 psi (276 kPa) close-off rating of the SQS... actuator will close-off tightly against a pump head pressure of 15 psi (103 kPa, 1 bar).

---

### Assembly (Product Number) Selection

Use Table 3, two-way normally closed valve assemblies, to select a valve and actuator assembly as follows:

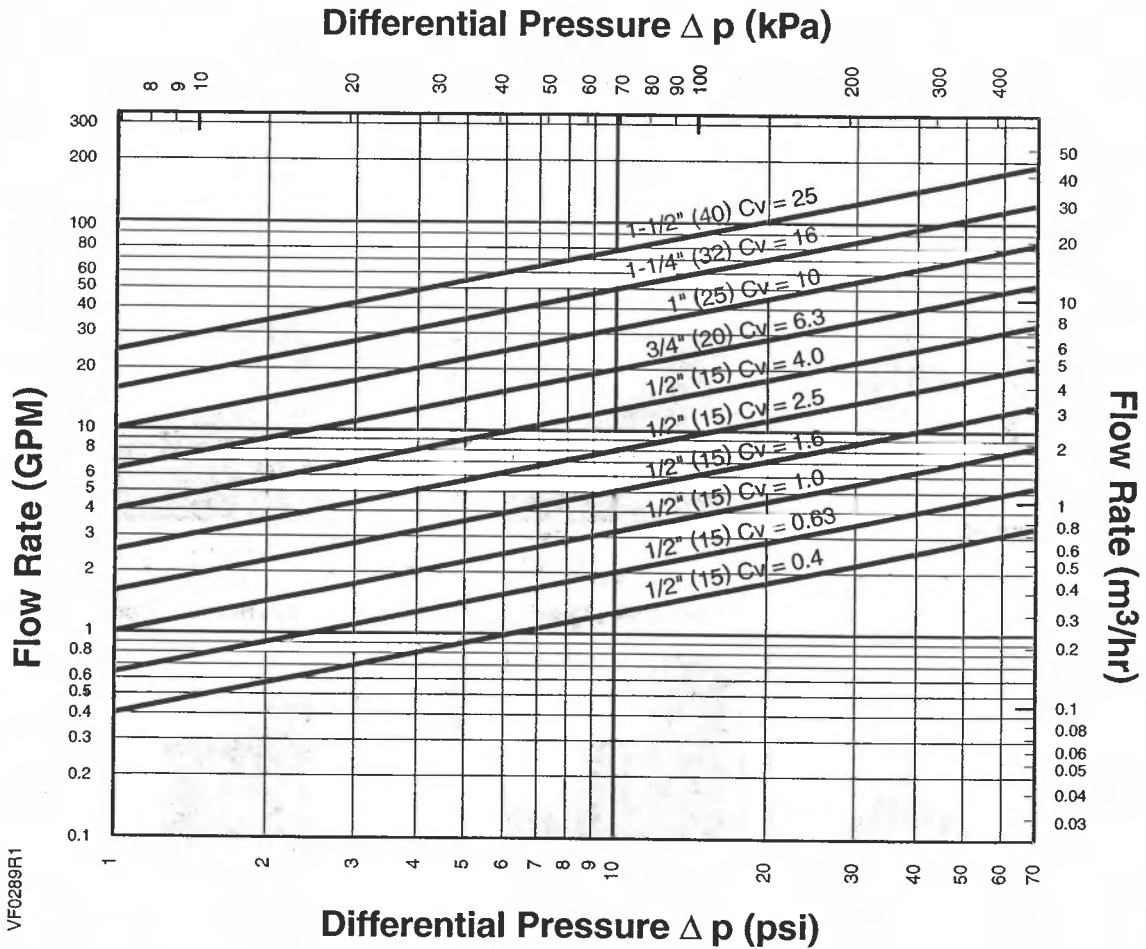
1. Read the table from left to right and select bronze trim for the low pressure, chilled water application and FxF for the female-by-female NPT valve threads. Select a 10 Cv (8.5 Kvs), 1-inch (25-mm) valve line size, determined from the preceding valve sizing example. The valve body part number is 599-02014.
2. Read across the top of the table and select a 24 Vac actuator with three-position control signal and fail-safe operation. The actuator part number is SQS85.53U. The actuator prefix code number is 266.
3. Read down the SQS85.53U actuator column and across the 599-02014 valve body row. The column/row intersection determines the appropriate valve and actuator assembly, which is 266-02014.

The valve and actuator can be ordered separately by using the part numbers from steps 2 and 3.

---

**Table 1. Guide to Valve/Actuator Tables.**

Table No.	Valve Type and Action	Actuator Type
2	2-way, Normally Closed	Pneumatic
3		SQS... Electronic
4		SSC... Electronic
5	2-way, Normally Open	Pneumatic
6		SQS... Electronic
7		SSC... Electronic
8	3-Way, Mixing	Pneumatic
9		SQS... Electronic
10		SSC... Electronic



**Figure 1. Water Capacity Graph.**

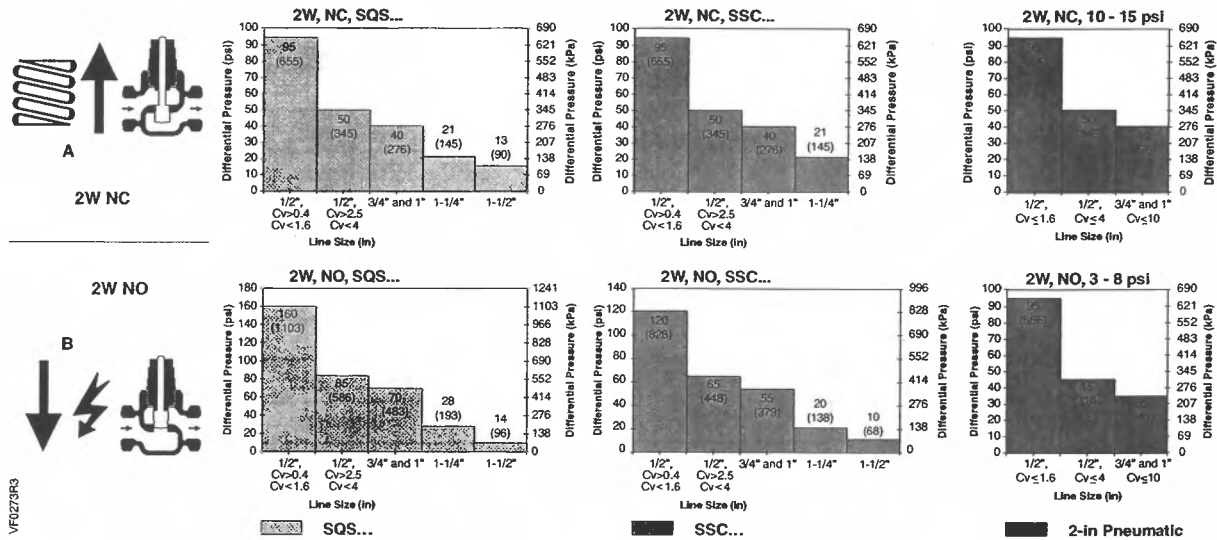


Figure 2. Maximum close-off pressure of actuators on standard 2-way valves. (Close-off pressures at 20 psi actuator pressure.)

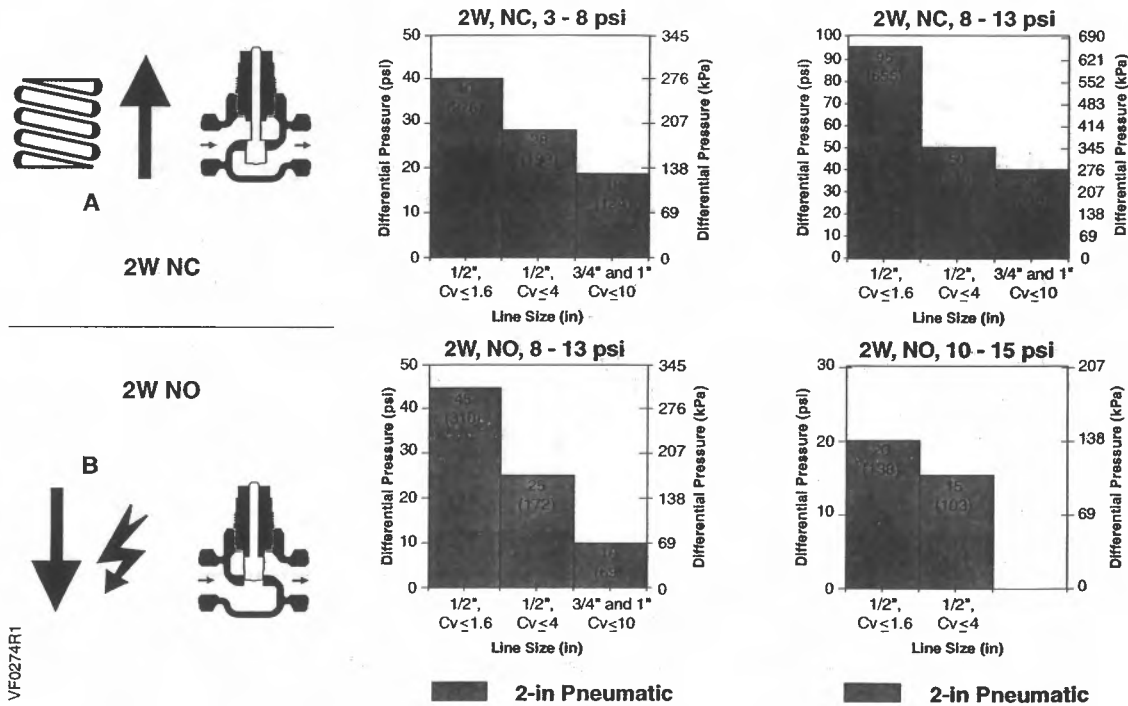


Figure 3. Maximum close-off pressure of 2-Inch pneumatic actuator on 2-way valve with alternate spring ranges. (Close-off pressures at 20 psi actuator pressure.)



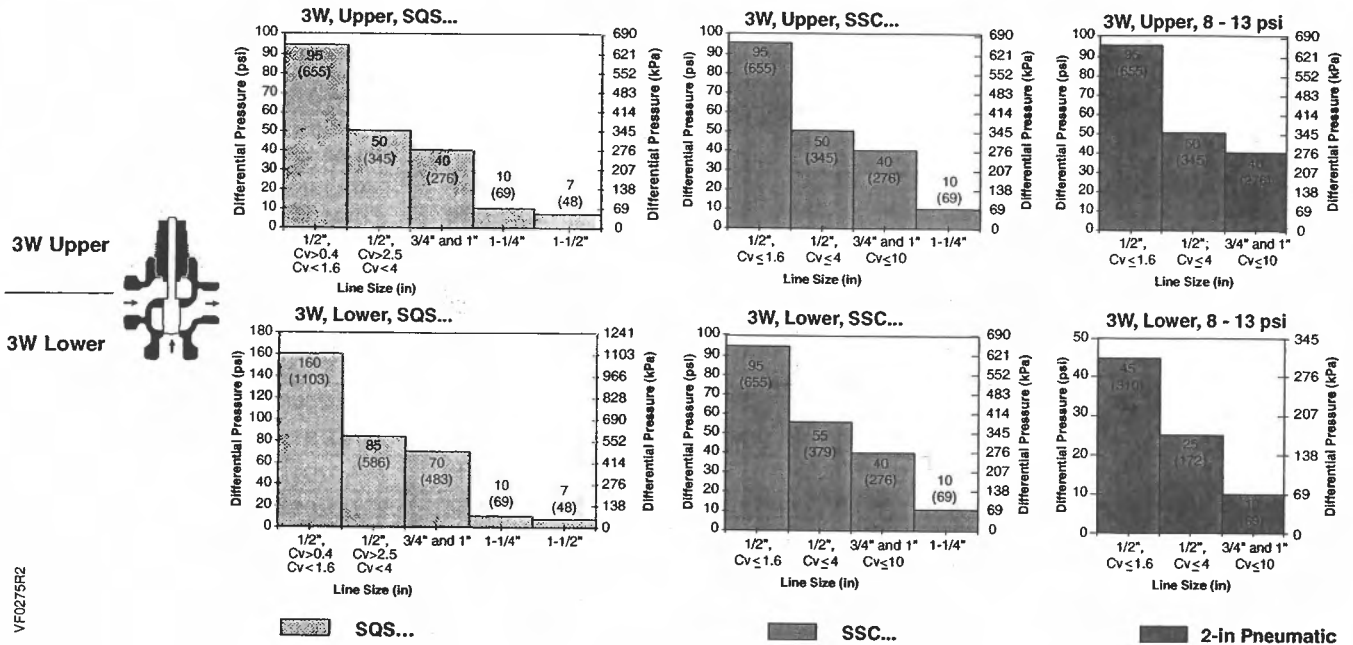


Figure 4. Maximum close-off pressure of actuators on standard 3-way valves. (Close-off pressures at 20 psi actuator pressure.)

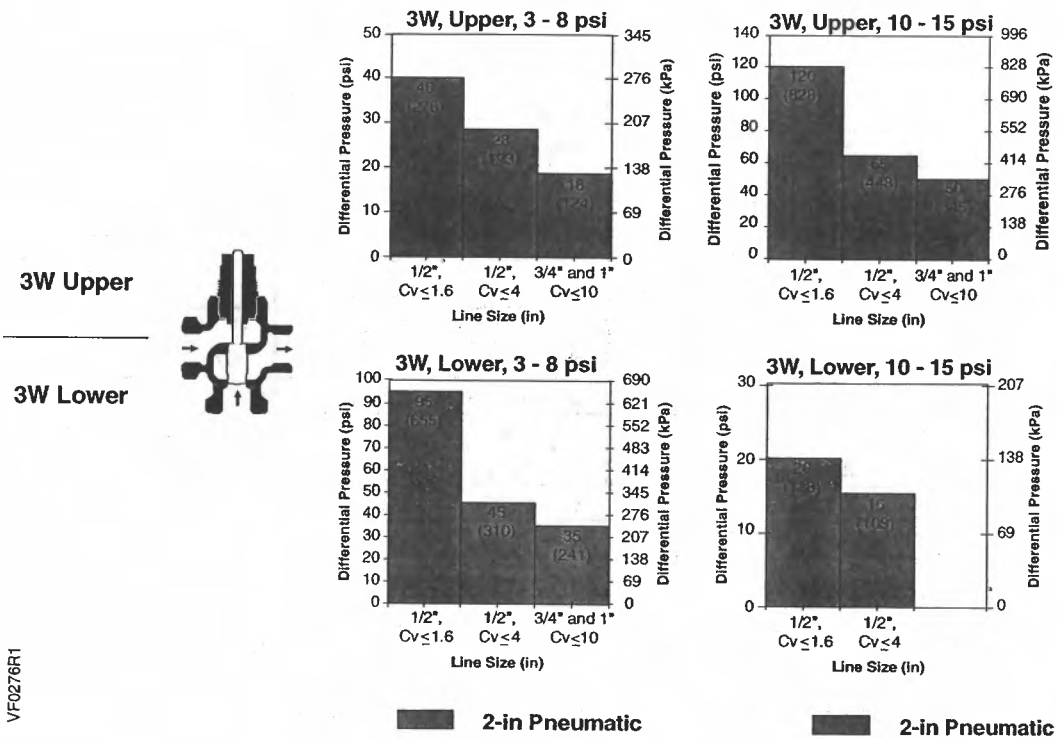


Figure 5. Maximum close-off pressure of 2-Inch pneumatic actuator on 3-way valve with alternate spring ranges. (Close-off pressures at 20 psi actuator pressure.)

**Table 2. 1/2 to 1-Inch, MT Series 2-Way, Normally Closed Valves with Powermite 599 Series MT Series 2-Inch Pneumatic Valve Actuator (599-01088).**

Port, Action, and Characteristic	Trim	Connection	Flow Rate		Line Size		Valve Body Assembly	Actuator Assembly		
			C <sub>v</sub>	K <sub>vs</sub>	In.	mm		Spring Range *		
								10-15 psi (69-103 kPa)	3-8 psi (21-55 kPa)	8-13 psi (55-90 kPa)
					Actuator Code 256	Actuator Code 257		Actuator Code 258		
2-Way, Normally Closed, Modified Equal Percentage, Technical Instructions 155-196P25	Brass	FxF	0.4	0.34	0.5	15	599-02000	256-02000	257-02000B	258-02000C
			0.63	0.54	0.5	15	599-02002	256-02002	257-02002B	258-02002C
			1	0.85	0.5	15	599-02004	256-02004	257-02004B	258-02004C
			1.6	1.37	0.5	15	599-02006	256-02006	257-02006B	258-02006C
			2.5	2.14	0.5	15	599-02008	256-02008	257-02008B	258-02008C
			4	3.42	0.5	15	599-02010	256-02010	257-02010B	258-02010C
			6.3	5.38	0.75	20	599-02012	256-02012	257-02012B	258-02012C
		10	8.55	1	25	599-02014	256-02014	257-02014B	258-02014C	
		FxUM	0.4	0.34	0.5	15	599-02001	256-02001	257-02001B	258-02001C
			0.63	0.54	0.5	15	599-02003	256-02003	257-02003B	258-02003C
			1	0.85	0.5	15	599-02005	256-02005	257-02005B	258-02005C
			1.6	1.37	0.5	15	599-02007	256-02007	257-02007B	258-02007C
			2.5	2.14	0.5	15	599-02009	256-02009	257-02009B	258-02009C
			4	3.42	0.5	15	599-02011	256-02011	257-02011B	258-02011C
	6.3		5.38	0.75	20	599-02013	256-02013	257-02013B	258-02013C	
	Stainless Steel	FxF	0.4	0.34	0.5	15	599-02015	256-02015	257-02015B	258-02015C
			0.63	0.54	0.5	15	599-02017	256-02017	257-02017B	258-02017C
			1	0.85	0.5	15	599-02019	256-02019	257-02019B	258-02019C
			1.6	1.37	0.5	15	599-02021	256-02021	257-02021B	258-02021C
			2.5	2.14	0.5	15	599-02023	256-02023	257-02023B	258-02023C
			4	3.42	0.5	15	599-02025	256-02025	257-02025B	258-02025C
			6.3	5.38	0.75	20	599-02027	256-02027	257-02027B	258-02027C
		10	8.55	1	25	599-02029	256-02029	257-02029B	258-02029C	
		FxUM	0.4	0.34	0.5	15	599-02016	256-02016	257-02016B	258-02016C
			0.63	0.54	0.5	15	599-02018	256-02018	257-02018B	258-02018C
			1	0.85	0.5	15	599-02020	256-02020	257-02020B	258-02020C
			1.6	1.37	0.5	15	599-02022	256-02022	257-02022B	258-02022C
			2.5	2.14	0.5	15	599-02024	256-02024	257-02024B	258-02024C
4			3.42	0.5	15	599-02026	256-02026	257-02026B	258-02026C	
6.3	5.38		0.75	20	599-02028	256-02028	257-02028B	258-02028C		

- The standard Normally Closed valves contain a 10 to 15 psi (69 to 103 kPa) spring range.
  - For an alternate spring range of 3 to 8 psi (21 to 55 kPa), add a "B" to the end of the part number.
  - For an alternate spring range of 8 to 13 psi (55 to 90 kPa), add a "C" to the end of the part number.
- See Powermite 599 Series MT Series 2-Inch Pneumatic Valve Actuator Technical Instructions (155-189P25) for details on the valve actuator.

**Table 3. 1/2 to 1-1/2 Inch, MT Series 2-Way, Normally Closed Valves with Powermite 599 Series MT Series SQS Electronic Valve Actuators.**

Port, Action, and Characteristic	Trim	Connection	Flow Rate		Line Size		Valve Body Assembly	Actuator Assembly		
			C <sub>v</sub>	K <sub>vs</sub>	In.	mm		SQS65U	SQS65.5U	SQS85.53U
								24V, 0-10V, Fail-in-Place	24V, 0-10V, Fail-Safe	24V, 3-Pos., Fail-Safe
								Actuator Code 264	Actuator Code 265	Actuator Code 266
2-Way, Normally Closed, Modified Equal Percentage, Technical Instructions 155-196P25	Brass	FxF	0.4	0.34	0.5	15	599-02000	264-02000	265-02000	266-02000
			0.63	0.54	0.5	15	599-02002	264-02002	265-02002	266-02002
			1	0.85	0.5	15	599-02004	264-02004	265-02004	266-02004
			1.6	1.37	0.5	15	599-02006	264-02006	265-02006	266-02006
			2.5	2.14	0.5	15	599-02008	264-02008	265-02008	266-02008
			4	3.42	0.5	15	599-02010	264-02010	265-02010	266-02010
			6.3	5.38	0.75	20	599-02012	264-02012	265-02012	266-02012
		10	8.55	1	25	599-02014	264-02014	265-02014	266-02014	
		16	13.8	1.25	32	599-02085	264-02085	265-02085	266-02085	
		25	21.5	1.50	40	599-02088	264-02088	265-02088	266-02088	
		FxUM	0.4	0.34	0.5	15	599-02001	264-02001	265-02001	266-02001
			0.63	0.54	0.5	15	599-02003	264-02003	265-02003	266-02003
			1	0.85	0.5	15	599-02005	264-02005	265-02005	266-02005
			1.6	1.37	0.5	15	599-02007	264-02007	265-02007	266-02007
	2.5		2.14	0.5	15	599-02009	264-02009	265-02009	266-02009	
	4		3.42	0.5	15	599-02011	264-02011	265-02011	266-02011	
	6.3		5.38	0.75	20	599-02013	264-02013	265-02013	266-02013	
	Stainless Steel	FxF	0.4	0.34	0.5	15	599-02015	264-02015	265-02015	266-02015
			0.63	0.54	0.5	15	599-02017	264-02017	265-02017	266-02017
			1	0.85	0.5	15	599-02019	264-02019	265-02019	266-02019
			1.6	1.37	0.5	15	599-02021	264-02021	265-02021	266-02021
			2.5	2.14	0.5	15	599-02023	264-02023	265-02023	266-02023
			4	3.42	0.5	15	599-02025	264-02025	265-02025	266-02025
			6.3	5.38	0.75	20	599-02027	264-02027	265-02027	266-02027
		10	8.55	1	25	599-02029	264-02029	265-02029	266-02029	
		FxUM	0.4	0.34	0.5	15	599-02016	264-02016	265-02016	266-02016
			0.63	0.54	0.5	15	599-02018	264-02018	265-02018	266-02018
			1	0.85	0.5	15	599-02020	264-02020	265-02020	266-02020
1.6			1.37	0.5	15	599-02022	264-02022	265-02022	266-02022	
2.5			2.14	0.5	15	599-02024	264-02024	265-02024	266-02024	
4			3.42	0.5	15	599-02026	264-02026	265-02026	266-02026	
6.3	5.38		0.75	20	599-02028	264-02028	265-02028	266-02028		

- For details on the SQS65U and SQS65.5U Actuator, see Powermite 599 Series MT Series SQS... Electronic Valve Actuator Technical Instructions (155-190P25).
- For details on the SQS85.53U Actuator, see Powermite 599 Series MT Series SQS... Electronic Valve Actuator Technical Instructions (155-308P25).

**Table 4. 1/2 to 1-1/4 Inch, MT Series 2-Way, Normally Closed Valves with Powermite 599 Series MT Series SSC... Electronic Valve Actuators.**

Port, Action, and Characteristic	Trim	Connection	Flow Rate		Line Size		Spring Range	Valve Body Assembly	Actuator Assembly			
			C <sub>v</sub>	K <sub>Vs</sub>	In.	mm			SSC61U	SSC61.5U	SSC81U	SSC81.5U
									24V, 0-10V, Fail-in-Place	24V, 0-10V, Fail-Safe	24V, 3 Pos., Fail-in-Place	24V, 3 Pos., Fail-Safe
									Actuator Code 261	Actuator Code 262	Actuator Code 259	Actuator Code 260
2-Way, Normally Closed, Modified Equal Percentage, Technical Instructions 155-196P25	Brass	FxF	0.4	0.34	0.5	15	10 to 15 psi (69 to 103 kPa)	599-02000	261-02000	262-02000	259-02000	260-02000
			0.63	0.54	0.5	15		599-02002	261-02002	262-02002	259-02002	260-02002
			1	0.85	0.5	15		599-02004	261-02004	262-02004	259-02004	260-02004
			1.6	1.37	0.5	15		599-02006	261-02006	262-02006	259-02006	260-02006
			2.5	2.14	0.5	15		599-02008	261-02008	262-02008	259-02008	260-02008
			4	3.42	0.5	15		599-02010	261-02010	262-02010	259-02010	260-02010
			6.3	5.38	0.75	20		599-02012	261-02012	262-02012	259-02012	260-02012
			10	8.55	1	25		599-02014	261-02014	262-02014	259-02014	260-02014
		16	13.8	1.25	32	599-02085		261-02085	262-02085	259-02085	260-02085	
		FxUM	0.4	0.34	0.5	15		599-02001	261-02001	262-02001	259-02001	260-02001
			0.63	0.54	0.5	15		599-02003	261-02003	262-02003	259-02003	260-02003
			1	0.85	0.5	15		599-02005	261-02005	262-02005	259-02005	260-02005
			1.6	1.37	0.5	15		599-02007	261-02007	262-02007	259-02007	260-02007
			2.5	2.14	0.5	15		599-02009	261-02009	262-02009	259-02009	260-02009
			4	3.42	0.5	15		599-02011	261-02011	262-02011	259-02011	260-02011
			6.3	5.38	0.75	20		599-02013	261-02013	262-02013	259-02013	260-02013
	10		8.55	1	25	599-02015		261-02015	262-02015	259-02015	260-02015	
	Stainless Steel	FxF	0.4	0.34	0.5	15		599-02015	261-02015	262-02015	259-02015	260-02015
			0.63	0.54	0.5	15		599-02017	261-02017	262-02017	259-02017	260-02017
			1	0.85	0.5	15		599-02019	261-02019	262-02019	259-02019	260-02019
			1.6	1.37	0.5	15		599-02021	261-02021	262-02021	259-02021	260-02021
			2.5	2.14	0.5	15		599-02023	261-02023	262-02023	259-02023	260-02023
			4	3.42	0.5	15		599-02025	261-02025	262-02025	259-02025	260-02025
			6.3	5.38	0.75	20		599-02027	261-02027	262-02027	259-02027	260-02027
			10	8.55	1	25		599-02029	261-02029	262-02029	259-02029	260-02029
		FxUM	0.4	0.34	0.5	15		599-02016	261-02016	262-02016	259-02016	260-02016
			0.63	0.54	0.5	15		599-02018	261-02018	262-02018	259-02018	260-02018
			1	0.85	0.5	15		599-02020	261-02020	262-02020	259-02020	260-02020
			1.6	1.37	0.5	15		599-02022	261-02022	262-02022	259-02022	260-02022
			2.5	2.14	0.5	15		599-02024	261-02024	262-02024	259-02024	260-02024
			4	3.42	0.5	15		599-02026	261-02026	262-02026	259-02026	260-02026
			6.3	5.38	0.75	20		599-02028	261-02028	262-02028	259-02028	260-02028
			10	8.55	1	25		599-02028	261-02028	262-02028	259-02028	260-02028

- For details on the SSC61U and SSC61.5U, see Powermite 599 Series MT Series SSC Electronic Valve Actuator 24 Vac Proportional Control Technical Instruction (155-313P25).
- For details on the SSC81U and SSC81.5U, see Powermite 599 Series MT Series SSC Electronic Valve Actuator 24 Vac 3-Position (Floating) Control Technical Instruction (155-314P25).

**Table 5. 1/2 to 1-Inch, MT Series 2-Way, Normally Open Valves with Powermite 599 Series MT Series 2-Inch Pneumatic Valve Actuator (599-01088).**

Port, Action, and Characteristic	Trim	Connection	Flow Rate		Line Size		Valve Body Assembly	Actuator Assembly		
			C <sub>v</sub>	K <sub>vs</sub>	In.	mm		Spring Range *		
								10-15 psi (69-103 kPa)	3-8 psi (21-55 kPa)	8-13 psi (55-90 kPa)
								Actuator Code 256	Actuator Code 257	Actuator Code 258
2-Way, Normally Open, Modified Equal Percentage, Technical Instructions 155-196P25	Brass	FxF	0.4	0.34	0.5	15	599-02030	256-02030A	257-02030	258-02030C
			0.63	0.54	0.5	15	599-02032	256-02032A	257-02032	258-02032C
			1	0.85	0.5	15	599-02034	256-02034A	257-02034	258-02034C
			1.6	1.37	0.5	15	599-02036	256-02036A	257-02036	258-02036C
			2.5	2.14	0.5	15	599-02038	256-02038A	257-02038	258-02038C
			4	3.42	0.5	15	599-02041	256-02041A	257-02041	258-02041C
			6.3	5.38	0.75	20	599-02044	256-02044A	257-02044	258-02044C
		10	8.55	1	25	599-02046	256-02046A	257-02046	258-02046C	
		FxUM	0.4	0.34	0.5	15	599-02031	256-02031A	257-02031	258-02031C
			0.63	0.54	0.5	15	599-02033	256-02033A	257-02033	258-02033C
			1	0.85	0.5	15	599-02035	256-02035A	257-02035	258-02035C
			1.6	1.37	0.5	15	599-02037	256-02037A	257-02037	258-02037C
			2.5	2.14	0.5	15	599-02039	256-02039A	257-02039	258-02039C
			4	3.42	0.5	15	599-02042	256-02042A	257-02042	258-02042C
	6.3		5.38	0.75	20	599-02045	256-02045A	257-02045	258-02045C	
	AF x UM	2.5	2.14	0.5	15	599-02040	256-02040A	257-02040	258-02040C	
		4	3.42	0.5	15	599-02043	256-02043A	257-02043	258-02043C	
	Stainless Steel	FxF	0.4	0.34	0.5	15	599-02047	256-02047A	257-02047	258-02047C
			0.63	0.54	0.5	15	599-02049	256-02049A	257-02049	258-02049C
			1	0.85	0.5	15	599-02051	256-02051A	257-02051	258-02051C
			1.6	1.37	0.5	15	599-02053	256-02053A	257-02053	258-02053C
			2.5	2.14	0.5	15	599-02055	256-02055A	257-02055	258-02055C
			4	3.42	0.5	15	599-02058	256-02058A	257-02058	258-02058C
			6.3	5.38	0.75	20	599-02061	256-02061A	257-02061	258-02061C
		10	8.55	1	25	599-02063	256-02063A	257-02063	258-02063C	
		FxUM	0.4	0.34	0.5	15	599-02048	256-02048A	257-02048	258-02048C
			0.63	0.54	0.5	15	599-02050	256-02050A	257-02050	258-02050C
			1	0.85	0.5	15	599-02052	256-02052A	257-02052	258-02052C
1.6			1.37	0.5	15	599-02054	256-02054A	257-02054	258-02054C	
2.5			2.14	0.5	15	599-02056	256-02056A	257-02056	258-02056C	
4			3.42	0.5	15	599-02059	256-02059A	257-02059	258-02059C	
6.3	5.38		0.75	20	599-02062	256-02062A	257-02062	258-02062C		
AF x UM	2.5	2.14	0.5	15	599-02057	256-02057A	257-02057	258-02057C		
	4	3.42	0.5	15	599-02060	256-02060A	257-02060	258-02060C		

- See Powermite 599 Series MT Series 2-Inch Pneumatic Valve Actuator Technical Instructions (155-189P25) for details on the valve actuator.

- \* The standard Normally Open valves contain a 3 to 8 psi (21 to 55 kPa) spring range.
  - For an alternate spring range of 10 to 15 psi (69 to 103 kPa), add an "A" to the end of the part number.
  - For an alternate spring range of 8 to 13 psi (55 to 90 kPa), add a "C" to the end of the part number.

**Table 6. 1/2 to 1-1/2 Inch, MT Series 2-Way, Normally Open Valves  
 with Powermite 599 Series MT Series SQS... Electronic Valve Actuators.**

Port, Action, and Characteristic	Trim	Connection	Flow Rate		Line Size		Valve Body Assembly	Actuator Assembly		
			C <sub>v</sub>	K <sub>vS</sub>	In.	mm		SQS65U	SQS65.5U	SQS85.53U
								24V, 0-10V, Fail-in-Place	24V, 0-10V, Fail-Safe	24V, 3-Pos., Fail-Safe
								Actuator Code 264	Actuator Code 265	Actuator Code 266
2-Way, Normally Open, Modified Equal Percentage, Technical Instructions 155-196P25	Brass	FxF	0.4	0.34	0.5	15	599-02030	264-02030	265-02030	266-02030
			0.63	0.54	0.5	15	599-02032	264-02032	265-02032	266-02032
			1	0.85	0.5	15	599-02034	264-02034	265-02034	266-02034
			1.6	1.37	0.5	15	599-02036	264-02036	265-02036	266-02036
			2.5	2.14	0.5	15	599-02038	264-02038	265-02038	266-02038
			4	3.42	0.5	15	599-02041	264-02041	265-02041	266-02041
			6.3	5.38	0.75	20	599-02044	264-02044	265-02044	266-02044
			10	8.55	1	25	599-02046	264-02046	265-02046	266-02046
		16	13.8	1.25	33	599-02084	264-02084	265-02084	266-02084	
		25	21.5	1.50	40	599-02087	264-02087	265-02087	266-02087	
		FxUM	0.4	0.34	0.5	15	599-02031	264-02031	265-02031	266-02031
			0.63	0.54	0.5	15	599-02033	264-02033	265-02033	266-02033
			1	0.85	0.5	15	599-02035	264-02035	265-02035	266-02035
			1.6	1.37	0.5	15	599-02037	264-02037	265-02037	266-02037
	2.5		2.14	0.5	15	599-02039	264-02039	265-02039	266-02039	
	4		3.42	0.5	15	599-02042	264-02042	265-02042	266-02042	
	AF x UM	2.5	2.14	0.5	15	599-02040	264-02040	265-02040	266-02040	
		4	3.42	0.5	15	599-02043	264-02043	265-02043	266-02043	
	Stainless Steel	FxF	0.4	0.34	0.5	15	599-02047	264-02047	265-02047	266-02047
			0.63	0.54	0.5	15	599-02049	264-02049	265-02049	266-02049
			1	0.85	0.5	15	599-02051	264-02051	265-02051	266-02051
			1.6	1.37	0.5	15	599-02053	264-02053	265-02053	266-02053
			2.5	2.14	0.5	15	599-02055	264-02055	265-02055	266-02055
			4	3.42	0.5	15	599-02058	264-02058	265-02058	266-02058
			6.3	5.38	0.75	20	599-02061	264-02061	265-02061	266-02061
			10	8.55	1	25	599-02063	264-02063	265-02063	266-02063
		FxUM	0.4	0.34	0.5	15	599-02048	264-02048	265-02048	266-02048
			0.63	0.54	0.5	15	599-02050	264-02050	265-02050	266-02050
1			0.85	0.5	15	599-02052	264-02052	265-02052	266-02052	
1.6			1.37	0.5	15	599-02054	264-02054	265-02054	266-02054	
2.5			2.14	0.5	15	599-02056	264-02056	265-02056	266-02056	
4			3.42	0.5	15	599-02059	264-02059	265-02059	266-02059	
AF x UM	2.5	2.14	0.5	15	599-02057	264-02057	265-02057	266-02057		
	4	3.42	0.5	15	599-02060	264-02060	265-02060	266-02060		

- For details on the SQS65U and SQS65.5U Actuator, see Powermite 599 Series MT Series SQS... Electronic Valve Actuator Technical Instructions (155-190P25).
- For details on the SQS85.53U Actuator, see Powermite 599 Series MT Series SQS... Electronic Valve Actuator Technical Instructions (155-308P25).

**Table 7. 1/2 to 1-1/2 Inch, MT Series 2-Way, Normally Open Valves with Powermite 599 Series MT Series SSC... Electronic Valve Actuators.**

Port, Action, and Characteristic	Trim	Connection	Flow Rate		Line Size		Spring Range	Valve Body Assembly	Actuator Assembly					
			C <sub>v</sub>	K <sub>Vs</sub>	In.	mm			SSC61U	SSC61.5U	SSC81U	SSC81.5U		
									24V, 0-10V, Fail-in-Place	24V, 0-10V, Fail-Safe	24V, 3 Pos., Fail-in-Place	24V, 3 Pos., Fail-Safe		
									Actuator Code 261	Actuator Code 262	Actuator Code 259	Actuator Code 260		
2-Way, Normally Open, Modified Equal Percentage, Technical Instructions 155-196P25	Brass	FxF	0.4	0.34	0.5	15	3 to 8 psi (21 to 55 kPa)	599-02030	261-02030	262-02030	259-02030	260-02030		
			0.63	0.54	0.5	15		599-02032	261-02032	262-02032	259-02032	260-02032		
			1	0.85	0.5	15		599-02034	261-02034	262-02034	259-02034	260-02034		
			1.6	1.37	0.5	15		599-02036	261-02036	262-02036	259-02036	260-02036		
			2.5	2.14	0.5	15		599-02038	261-02038	262-02038	259-02038	260-02038		
			4	3.42	0.5	15		599-02041	261-02041	262-02041	259-02041	260-02041		
			6.3	5.38	0.75	20		599-02044	261-02044	262-02044	259-02044	260-02044		
			10	8.55	1	25		599-02046	261-02046	262-02046	259-02046	260-02046		
			16	13.8	1.25	32		599-02084	261-02084	262-02084	259-02084	260-02084		
			25	21.5	1.50	40		599-02087	261-02087	262-02087	259-02087	260-02087		
			FxUM	0.4	0.34	0.5		15	599-02031	261-02031	262-02031	259-02031	260-02031	
				0.63	0.54	0.5		15	599-02033	261-02033	262-02033	259-02033	260-02033	
		1		0.85	0.5	15		599-02035	261-02035	262-02035	259-02035	260-02035		
		1.6		1.37	0.5	15		599-02037	261-02037	262-02037	259-02037	260-02037		
		2.5		2.14	0.5	15		599-02039	261-02039	262-02039	259-02039	260-02039		
		4		3.42	0.5	15		599-02042	261-02042	262-02042	259-02042	260-02042		
		6.3		5.38	0.75	20		599-02045	261-02045	262-02045	259-02045	260-02045		
		AF x UM		2.5	2.14	0.5		15	599-02040	261-02040	262-02040	259-02040	260-02040	
				4	3.42	0.5		15	599-02043	261-02043	262-02043	259-02043	260-02043	
		Stainless Steel		FxF	0.4	0.34		0.5	15	599-02047	261-02047	262-02047	259-02047	260-02047
					0.63	0.54		0.5	15	599-02049	261-02049	262-02049	259-02049	260-02049
					1	0.85		0.5	15	599-02051	261-02051	262-02051	259-02051	260-02051
			1.6		1.37	0.5		15	599-02053	261-02053	262-02053	259-02053	260-02053	
			2.5		2.14	0.5		15	599-02055	261-02055	262-02055	259-02055	260-02055	
	4		3.42		0.5	15		599-02058	261-02058	262-02058	259-02058	260-02058		
	6.3		5.38		0.75	20		599-02061	261-02061	262-02061	259-02061	260-02061		
	10		8.55		1	25		599-02063	261-02063	262-02063	259-02063	260-02063		
	FxUM		0.4		0.34	0.5		15	599-02048	261-02048	262-02048	259-02048	260-02048	
			0.63		0.54	0.5		15	599-02050	261-02050	262-02050	259-02050	260-02050	
			1		0.85	0.5		15	599-02052	261-02052	262-02052	259-02052	260-02052	
			1.6		1.37	0.5		15	599-02054	261-02054	262-02054	259-02054	260-02054	
			2.5	2.14	0.5	15		599-02056	261-02056	262-02056	259-02056	260-02056		
			4	3.42	0.5	15		599-02059	261-02059	262-02059	259-02059	260-02059		
			6.3	5.38	0.75	20		599-02062	261-02062	262-02062	259-02062	260-02062		
			AF x UM	2.5	2.14	0.5		15	599-02057	261-02057	262-02057	259-02057	260-02057	
				4	3.42	0.5		15	599-02060	261-02060	262-02060	259-02060	260-02060	

- For details on the SSC61U and SSC61.5U, see Powermite 599 Series MT Series SSC Electronic Valve Actuator 24 Vac Proportional Control Technical Instruction (155-313P25).
- For details on the SSC81U and SSC81.5U, see Powermite 599 Series MT Series SSC Electronic Valve Actuator 24 Vac 3-Position (Floating) Control Technical Instruction (155-314P25).

**Table 8. 1/2 to 1-Inch, MT Series 3-Way Valves with Powermite 599 Series MT Series 2-Inch Pneumatic Valve Actuator (599-01088).**

Port, Action, and Characteristic	Trim	Flow Rate		Line Size		Valve Body Assembly	Actuator Assembly		
		C <sub>v</sub>	K <sub>vs</sub>	In.	mm		Spring Range *		
							10-15 psi (69-103 kPa)	3-8 psi (21-55 kPa)	8-13 psi (55-90 kPa)
							Actuator Code 256	Actuator Code 257	Actuator Code 258
3-Way, Mixing, Linear, Technical Instructions 155-197P25	Brass	0.4	0.34	0.5	15	599-02064	256-02064A	257-02064B	258-02064
		0.63	0.54	0.5	15	599-02065	256-02065A	257-02065B	258-02065
		1	0.85	0.5	15	599-02066	256-02066A	257-02066B	258-02066
		1.6	1.37	0.5	15	599-02067	256-02067A	257-02067B	258-02067
		2.5	2.14	0.5	15	599-02068	256-02068A	257-02068B	258-02068
		4	3.42	0.5	15	599-02069	256-02069A	257-02069B	258-02069
		6.3	5.38	0.75	20	599-02070	256-02070A	257-02070B	258-02070
	10	8.55	1	25	599-02071	256-02071A	257-02071B	258-02071	
	Stainless Steel	0.4	0.34	0.5	15	599-02072	256-02072A	257-02072B	258-02072
		0.63	0.54	0.5	15	599-02073	256-02073A	257-02073B	258-02073
		1	0.85	0.5	15	599-02074	256-02074A	257-02074B	258-02074
		1.6	1.37	0.5	15	599-02075	256-02075A	257-02075B	258-02075
		2.5	2.14	0.5	15	599-02076	256-02076A	257-02076B	258-02076
		4	3.42	0.5	15	599-02077	256-02077A	257-02077B	258-02077
6.3		5.38	0.75	20	599-02078	256-02078A	257-02078B	258-02078	
10	2.14	0.5	15	599-02079	256-02079A	257-02079B	258-02079		

- See Powermite 599 Series MT Series 2-Inch Pneumatic Valve Actuator Technical Instructions (155-189P25) for details on the valve actuator.

- \* The standard three-way valves contain a 8 to 13 psi (55 to 90 kPa) spring range.
- For an alternate spring range of 10 to 15 psi (69 to 103 kPa), add an "A" to the end of the part number.
  - For an alternate spring range of 3 to 8 psi (21 to 55 kPa), add a "B" to the end of the part number.



**Table 9. 1/2 to 1-1/2-inch, MT Series 3-Way Valves with Powermite 599 Series MT Series SQS–Electronic Valve Actuators.**

Port, Action, and Characteristic	Trim	Flow Rate		Line Size		Valve Body Assembly	Actuator Assembly		
		C <sub>v</sub>	K <sub>vs</sub>	In.	mm		SQS65U	SQS65.5U	SQS85.53 U
							24V, 0-10V, Fail-in-Place	24V, 0-10V, Fail-Safe	24V, 3-Pos., Fail-Safe
							Actuator Code 264	Actuator Code 265	Actuator Code 266
3-Way, Mixing, Linear, Technical Instructions 155-197P25	Brass	0.4	0.34	0.5	15	599-02064	264-02064	265-02064	266-02064
		0.63	0.54	0.5	15	599-02065	264-02065	265-02065	266-02065
		1	0.85	0.5	15	599-02066	264-02066	265-02066	266-02066
		1.6	1.37	0.5	15	599-02067	264-02067	265-02067	266-02067
		2.5	2.14	0.5	15	599-02068	264-02068	265-02068	266-02068
		4	3.42	0.5	15	599-02069	264-02069	265-02069	266-02069
		6.3	5.38	0.75	20	599-02070	264-02070	265-02070	266-02070
		10	8.55	1	25	599-02071	264-02071	265-02071	266-02071
		16	13.8	1.25	32	599-02086	264-02086	265-02086	266-02086
	25	21.5	1.50	40	599-02089	264-02089	265-02089	266-02089	
	Stainless Steel	0.4	0.34	0.5	15	599-02072	264-02072	265-02072	266-02072
		0.63	0.54	0.5	15	599-02073	264-02073	265-02073	266-02073
		1	0.85	0.5	15	599-02074	264-02074	265-02074	266-02074
		1.6	1.37	0.5	15	599-02075	264-02075	265-02075	266-02075
		2.5	2.14	0.5	15	599-02076	264-02076	265-02076	266-02076
		4	3.42	0.5	15	599-02077	264-02077	265-02077	266-02077
		6.3	5.38	0.75	20	599-02078	264-02078	265-02078	266-02078
		10	2.14	0.5	15	599-02079	264-02079	265-02079	266-02079

- For details on the SQS65U and SQS65.5U Actuator, see Powermite 599 Series MT Series SQS... Electronic Valve Actuator Technical Instructions (155-190P25).
- For details on the SQS85.53U Actuator, see Powermite 599 Series MT Series SQS... Electronic Valve Actuator Technical Instructions (155-308P25).

**Table 10. 1/2 to 1 inch, MT Series 3-Way Valves with Powermite 599 Series MT Series SSC–Electronic Valve Actuators.**

Port, Action, and Characteristic	Trim	Flow Rate		Line Size		Spring Range	Valve Body Assembly	Actuator Assembly			
								SSC61U	SSC61.5U	SSC81U	SSC81.5U
		C <sub>v</sub>	K <sub>vs</sub>	In.	mm			24V, 0-10V, Fail-in-Place	24V, 0-10V, Fail-Safe	24V, 3 Pos., Fail-in-Place	24V, 3 Pos., Fail-Safe
								Actuator Code 261	Actuator Code 262	Actuator Code 259	Actuator Code 260
3-Way, Mixing, Linear, Technical Instructions 155-197P25	Brass	0.4	0.34	0.5	15	8 to 13 psi (55 to 90 kPa)	599-02064	261-02064	262-02064	259-02064	260-02064
		0.63	0.54	0.5	15		599-02065	261-02065	262-02065	259-02065	260-02065
		1	0.85	0.5	15		599-02066	261-02066	262-02066	259-02066	260-02066
		1.6	1.37	0.5	15		599-02067	261-02067	262-02067	259-02067	260-02067
		2.5	2.14	0.5	15		599-02068	261-02068	262-02068	259-02068	260-02068
		4	3.42	0.5	15		599-02069	261-02069	262-02069	259-02069	260-02069
		6.3	5.38	0.75	20		599-02070	261-02070	262-02070	259-02070	260-02070
		10	8.55	1	25		599-02071	261-02071	262-02071	259-02071	260-02071
	16	13.8	1.25	32	599-02086		261-02086	262-02086	259-02086	260-02086	
	Stainless Steel	0.4	0.34	0.5	15		599-02072	261-02072	262-02072	259-02072	260-02072
		0.63	0.54	0.5	15		599-02073	261-02073	262-02073	259-02073	260-02073
		1	0.85	0.5	15		599-02074	261-02074	262-02074	259-02074	260-02074
		1.6	1.37	0.5	15		599-02075	261-02075	262-02075	259-02075	260-02075
		2.5	2.14	0.5	15		599-02076	261-02076	262-02076	259-02076	260-02076
		4	3.42	0.5	15		599-02077	261-02077	262-02077	259-02077	260-02077
		6.3	5.38	0.75	20		599-02078	261-02078	262-02078	259-02078	260-02078
		10	2.14	0.5	15		599-02079	261-02079	262-02079	259-02079	260-02079

- For details on the SSC61U and SSC61.5U, see Powermite 599 Series MT Series SSC Electronic Valve Actuator 24 Vac Proportional Control Technical Instruction (155-313P25).
- For details on the SSC81U and SSC81.5U, see Powermite 599 Series MT Series SSC Electronic Valve Actuator 24 Vac 3-Position (Floating) Control Technical Instruction (155-314P25).

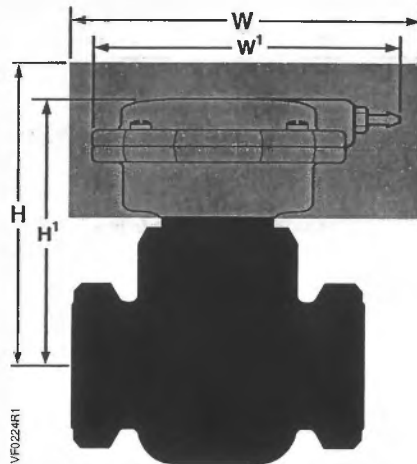


Figure 5. Service Envelope

**Table 11. Actuator Dimensions and Recommended Service Envelope.  
Dimensions in Inches (millimeters).**

Actuator	Actuator Prefix Code	Valve Line Size	Center line to Top of Actuator, H1		Service Height, H		Width or Diameter Of Actuator, W1	Service Width W
			NO	NC	NO	NC		
599-01088 2-Inch Pneumatic	256, 257, 258	1/2 (15)	3-1/16 (78)		11 (280)		4 (100)	10 (250)
		3/4 (20)	3-1/16 (78)		11 (280)		4 (100)	10 (250)
		1 (25)	3-5/16 (84)		11-1/4 (285)		4 (100)	10 (250)
SQS65U 0 – 10V Fail-in-Place	264	1/2 (15)	6-5/8 (167)		14-1/2 (370)		5-1/16 (128)	9 (225)
		3/4 (20)	6-5/8 (167)		14-1/2 (370)		5-1/16 (128)	9 (225)
		1 (25)	6-7/8 (173)		15 (380)		5-1/16 (128)	9 (225)
		1-1/4 (32)	8-1/4 (210)	7-3/4 (197)	16 (406)	15-3/4 (400)	5-1/16 (128)	9 (225)
		1-1/2 (38)	8-3/16 (208)	7-9/16 (192)	16 (406)	15-9/16 (400)	5-1/16 (128)	9 (225)
SQS65.5U 0 – 10V Fail-Safe	265	1/2 (15)	6-1/16 (153)		14 (355)		5-1/16 (128)	9 (225)
		3/4 (20)	6-1/16 (153)		14 (355)		5-1/16 (128)	9 (225)
		1 (25)	6-5/16 (159)		14-1/2 (370)		5-1/16 (128)	9 (225)
		1-1/4 (32)	7-11/16 (195)	7-3/16 (183)	15-1/2 (394)	15 3/16 (387)	5-1/16 (128)	9 (225)
		1-1/2 (38)	7-3/4 (197)	7-1/8 (181))	16 (406)	15 (380)	5-1/16 (128)	9 (225)
SQS85.53U 3-Position Fail-Safe	266	1/2 (15)	6-1/16 (153)		14 (355)		5-1/16 (128)	9 (225)
		3/4 (20)	6-1/16 (153)		14 (355)		5-1/16 (128)	9 (225)
		1 (25)	6-5/16 (159)		14-1/2 (370)		5-1/16 (128)	9 (225)
		1-1/4 (32)	7-11/16 (195)	7-3/16 (183)	15-1/2 (394)	15 3/16 (387)	5-1/16 (128)	9 (225)
		1-1/2 (38)	7-3/4 (197)	7-1/8 (181))	16 (406)	15 (380)	5-1/16 (128)	9 (225)
SSC61U 0 – 10V Fail-in-Place	261	1/2 (15)	5-1/2 (140)		13-1/2 (343)		5-1/2 (140)	13-1/2 (343)
		3/4 (20)	5-1/2 (140)		13-1/2 (343)		5-1/2 (140)	13-1/2 (343)
		1 (25)	5-3/4 (146)		13-3/4 (349)		5-3/4 (146)	13-3/4 (349)
		1-1/4 (32)	7-1/4 (184)	6-3/4 (171)	15-3/8 (390)	14-7/8 (377)	4-3/4 (121)	12-3/4 (324)
		1-1/2 (38)	7-5/16 (186)	–	15-3/8 (390)	14-7/8 (377)	4-3/4 (121)	12-3/4 (324)
SSC61.5U 0 – 10V Fail-Safe	262	1/2 (15)	5-1/2 (140)		13-1/2 (343)		5-1/2 (140)	13-1/2 (343)
		3/4 (20)	5-1/2 (140)		13-1/2 (343)		5-1/2 (140)	13-1/2 (343)
		1 (25)	5-3/4 (146)		13-3/4 (349)		5-3/4 (146)	13-3/4 (349)
		1-1/4 (32)	7-1/4 (184)	6-3/4 (171)	15-3/8 (390)	14-7/8 (377)	4-3/4 (121)	12-3/4 (324)
		1-1/2 (38)	7-5/16 (186)	–	15-3/8 (390)	–	4-3/4 (121)	12-3/4 (324)
SSC81U 3-Position Fail-in-Place	259	1/2 (15)	5-1/2 (140)		13-1/2 (343)		5-7/8 (140)	13-1/2 (343)
		3/4 (20)	5-1/2 (140)		13-1/2 (343)		5-7/8 (140)	13-1/2 (343)
		1 (25)	5-3/4 (146)		13-3/4 (349)		5-3/4 (146)	13-3/4 (349)
		1-1/4 (32)	7-1/4 (184)	6-3/4 (171)	15-3/8 (390)	14-7/8 (377)	4-3/4 (121)	12-3/4 (324)
		1-1/2 (38)	7-5/16 (186)	–	15-3/8 (390)	–	–	12-3/4 (324)
SSC81.5U 3-Position Fail-Safe	260	1/2 (15)	5-1/2 (140)		13-1/2 (343)		5-1/2 (140)	13-1/2 (343)
		3/4 (20)	5-1/2 (140)		13-1/2 (343)		5-1/2 (140)	13-1/2 (343)
		1 (25)	5-3/4 (146)		13-3/4 (349)		5-3/4 (146)	13-3/4 (349)
		1-1/4 (32)	7-1/4 (184)	6-3/4 (171)	15-3/8 (390)	14-7/8 (377)	4-3/4 (121)	12-3/4 (324)
		1-1/2 (38)	7-5/16 (186)	–	15-3/8 (390)	–	4-3/4 (121)	12-3/4 (324)

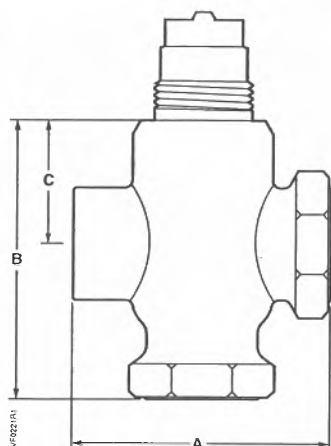
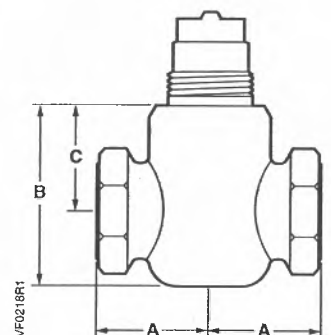
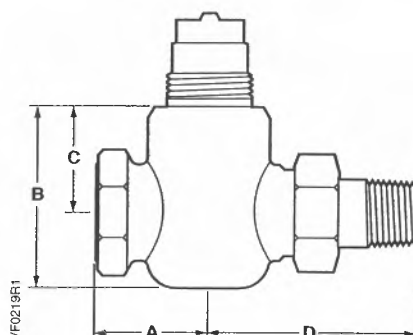


Table 12. 3-Way Valve Dimensions.

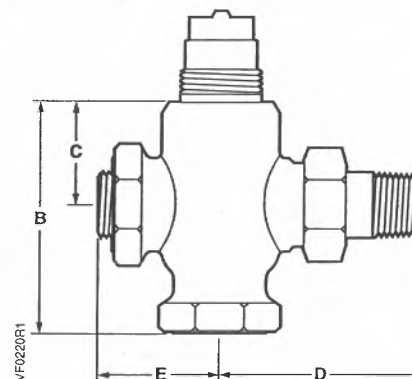
Valve Size inch (mm)	A	B	C	Weight lb (kg)
1/2 (15)	2-3/4 (70)	2-15/16 (74)	1-5/16 (33)	1.5 (0.7)
3/4 (20)	3-1/4 (83)	3-9/16 (90)	1-5/16 (33)	2.3 (1.05)
1 (25)	3-7/8 (98)	3-15/16 (99)	1-9/16 (39)	3.3 (1.5)
1-1/4 (32)	4-15/16 (125)	4-1/4 (108)	1-11/16 (42.9)	4 (1.8)
1-1/2 (40)	5-1/8 (130)	4-1/2 (114)	1-5/8 (41.3)	5 (2.3)



Female NPT x Female NPT  
FxF



Female NPT x Union Male  
FxUM



Angle Female x Union Male  
AFxUM

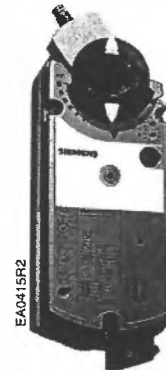
Table 13. 2-Way Valve Dimensions.

Valve Size inch (mm)	A	B		C	D	E	Weight lb (kg)		
		FxF & FxUM	AFxUM				FxF	FxUM	AFxUM
1/2 (15)	1-3/8 (35)	2-1/4 (57)	2-15/16 (74) NO Only	1-5/16 (33)	2-5/8 (67)	1-1/2 (38) NO only	.96 (0.64)	1.14 (0.5)	1.4 (0.6)
3/4 (20)	1-5/8 (41)	2-3/8 (59)	—	1-5/16 (33)	3-1/8 (79)	—	1.8 (0.8)	2.2 (1)	—
1 (25)	1-15/16 (49)	2-3/4 (69)	—	1-9/16 (39)	—	—	2.6 (1.2)	—	—

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## OpenAir™

### GCA Series Spring Return Rotary 24 Vac Modulating 0 to 10 Vdc Control, 24 Vac/dc Modulating 2 to 10 Vdc Control Electric Damper Actuators



#### Description

The OpenAir direct coupled 24 Vac/dc spring return rotary electric actuator is designed for modulating control of building HVAC dampers.

#### Features

- Brushless DC motor technology with stall protection
- Bi-directional fail-safe spring return
- Unique self-centering shaft coupling
- Manual override
- 142 lb-in (16 Nm) torque
- 5° preload as shipped from factory
- Offset and span adjustment models available
- Models with independently adjustable dual auxiliary switches available
- UL and cUL listed

#### Product Numbers



Table 1.

Operating Voltage	Input/Output Signal	Input/Output Signal versus Position	Cabling	Standard	Span/Offset Adjustable	Dual Auxiliary Switches and Span/Offset Adjustable	Dual Auxiliary Switches only
24 Vac	0 to 10 Vdc	Direct Acting	Standard	GCA161.1U	GCA163.1U	GCA164.1U	GCA166.1U
			Plenum	GCA161.1P	GCA163.1P	GCA164.1P	GCA166.1P
24 Vac/dc	2 to 10 Vdc	Switch selectable: Direct or Inverse Acting	Standard	GCA151.1U	—	—	GCA156.1U
			Plenum	GCA151.1P	—	—	GCA156.1P

## Application


These actuators are used in constant or variable air volume installations for the control of return air, mixed air, exhaust, and face and bypass dampers requiring up to 142 lb-in (16 Nm) torque. They are designed for applications that require the damper to return to a fail-safe position when there is a power failure.

## Warning/Caution Notations

<b>WARNING:</b>		Personal injury/loss of life may occur if a procedure is not performed as specified.
<b>CAUTION:</b>		Equipment damage may occur if the user does not follow a procedure as specified.

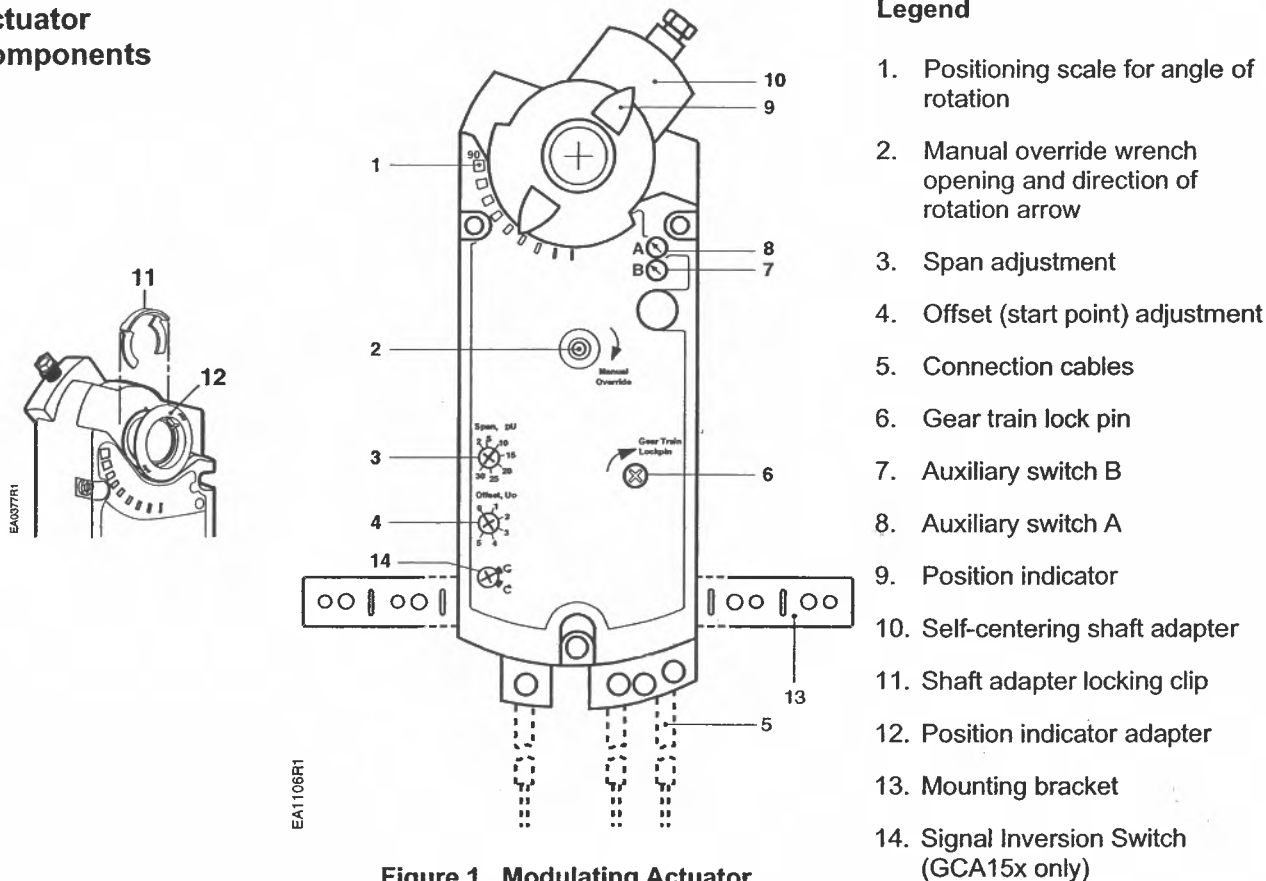
## Specifications

<b>Ambient conditions</b>	Ambient temperature operation	-25°F to 130°F (-32°C to 55°C)	
	storage and transport	-40°F to 158°F (-40°C to 70°C)	
	Ambient humidity (non-condensing)	95% rh	
<b>Agency certification</b>		UL listed to UL60730 (to replace UL873)	
		cUL certified to Canadian Standard C22.2 No. 24-93	
		GCA15x only:	Australian Electromagnetic Compatibility (EMC) per AS/NZS 4251.1/2:1999 (C-tick)
<b>Power Supply</b>		<b><u>GCA16x</u></b>	<b><u>GCA15x</u></b>
	Operating Voltage (G-G0)	24 Vac ± 20%	24 Vac ± 20% 24 Vdc ± 10%
	Frequency	50/60 Hz	50/60 Hz
	Power Consumption		
	running	9 VA	9 VA/7W
	holding	5 VA	5 VA/4W
<b>Control Signal</b>		<b><u>GCA16x</u></b>	<b><u>GCA15x</u></b>
	Input Signal (Y-G0) voltage input	0 to 10 Vdc (max. 35 Vdc)	2 to 10 Vdc (max. 35 Vdc)
	input resistance	>100K ohms	>100K ohms
<b>Feedback Signal</b>		<b><u>GCA16x</u></b>	<b><u>GCA15x</u></b>
	Position output signal (U-G0) voltage output	0 to 10 Vdc	2 to 10 Vdc
	maximum output current	±1 mA	+1 mA, -.5 mA

<b>Specifications, continued</b>	<b>Control signal adjustment</b>	
	Offset (start point)	Between 0 to 5 Vdc
<b>Auxiliary features</b>	Factory setting	0 Vdc
	Span	Between 2 to 30 Vdc
	<b>Dual auxiliary switches</b>	
	AC rating (Standard cable)	24 to 250 Vac AC 6A resistive AC 2A general purpose
	AC rating (Plenum cable)	24 Vac AC 4A resistive AC 2A general purpose
	DC rating (Standard/Plenum cable)	12 to 30 Vdc DC 2A
	<b>Switch Range</b>	
	Switch A	0 to 90° with 5° intervals
	Recommended range usage	0 to 45°
	Factory setting	5°
	Switch B	0 to 90° with 5° intervals
	Recommended range usage	45° to 90°
	Factory setting	85°
	Switching hysteresis	2°
	<div style="border: 1px solid black; padding: 5px;">  <p><b>WARNING:</b> Apply only AC-line voltage from the same phase or only UL-Class 2 voltage to the switching outputs of both auxiliary switches A and B. Mixed operation is not permissible.</p> <p><b>NOTE:</b> With plenum cables, only UL-Class 2 voltage is permitted.</p> </div>	
<b>Equipment rating</b>	Class 2, in accordance with UL/CSA	
<b>Function</b>	Running/spring return torque	
	Operating with 24 Vac	142 lb-in (16 Nm)
	Operating with 24 Vdc (GCA15x only)	106 lb-in (12 Nm)
	Maximum torque	<360 lb-in (40 Nm)
	Runtime for 90° operating with motor closing (on power loss) with spring return	90 seconds 15 seconds typical
<b>Mounting</b>	Nominal angle of rotation	90°
	Maximum angular rotation	95°
	Shaft size	3/8 to 1-inch (8 to 25.6 mm) diameter 1/4 to 5/8-inch (6 to 18 mm) square
	Minimum shaft length	3/4-inch (20 mm)

<b>Specifications, continued</b>	Enclosure	NEMA 2 in vertical to horizontal 90° See Figure 15.
	Housing	NEMA 3R rated when installed with ASK75.1U Weather Shield in the vertical position. See <i>Accessories</i> .
	Material	Die cast aluminum alloy
	Gear lubrication	Silicone free
<b>Miscellaneous</b>	Pre-cabled connection	18 AWG
	Cable length	3 feet (0.9 m)
	Noise level	<45 dBA (running)
	Life cycle	Designed for over 60,000 full strokes and a minimum of 1.5 million repositions at rated torque and temperature.
	Dimensions	See Figure 20.
	Weight	4.85 lb (2.2 kg)

**Actuator Components**

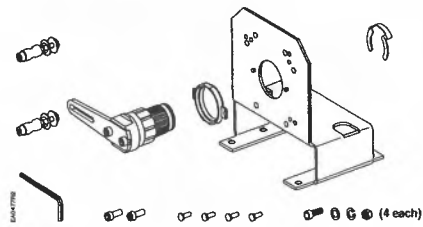


**Figure 1. Modulating Actuator.**



**Accessories**

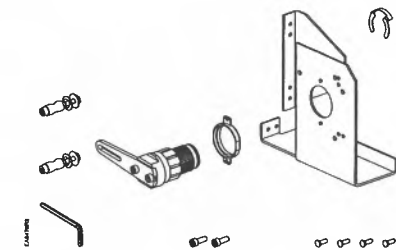
**NOTE:** The auxiliary switches and/or the control signal adjustment cannot be added in the field. Order the product number that includes the option(s).



**Figure 2. Floor Mount Kit.**

**ASK71.1U:** Allows foot mounting of OpenAir actuators. Should be used for in-the-airstream applications, and generally, anywhere a foot-mounted actuator can be mounted. Kit contains:

- Crank arm for changing angular rotation into a linear stroke.
- Support bearing ring to minimize side loading on the actuator's output bearing.
- Mounting bracket.
- Required mounting fasteners.



**Figure 3. Frame Mount Kit.**

**ASK71.2U:** Allows mounting OpenAir actuators directly to damper frame. Should be used with louvers and vents and in applications where floor mount kit is not possible. Kit contains:

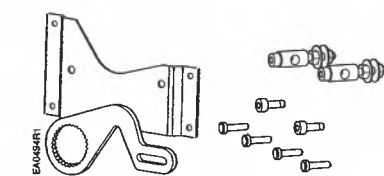
- Crank arm for changing angular rotation into a linear stroke.
- Support bearing ring to minimize side loading on the actuator's output bearing.
- Mounting bracket.
- Required mounting fasteners.



**Figure 4. Crank Arm Kit.**

**ASK71.3:** Allows direct-coupled actuator to provide an auxiliary linear drive. Crank arm kit can be used to simultaneously drive a set of opposing or adjacent dampers with single actuator. Kit includes:

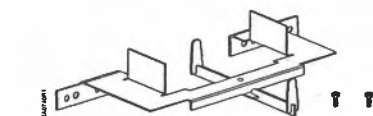
- Crank arm to attach to the splined hub of the shaft adapter.
- Other required mounting fasteners.



**Figure 5. Crank Arm Kit with Mounting Bracket.**

**ASK71.4:** Allows economical mounting of OpenAir actuator to a variety of surfaces. Kit should be used in applications where the actuator can be rigid-surface mounted and linear stroke output is required. Kit includes:

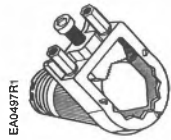
- Crank arm to attach to the splined hub of the shaft adapter.
- Mounting bracket.
- Other required mounting fasteners.



**Figure 6. Tandem Mount Bracket.**

**ASK73.2U:** Bracket provides an extended anti-rotation pin allowing two modulating actuators to directly drive a single damper shaft.

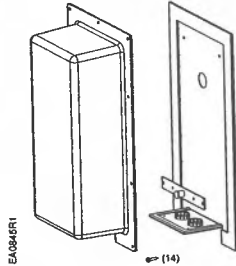
**Accessories,  
 continued**



**Figure 7. Special Shaft Adapter.**

**ASK74.1U:** Shaft adapter will attach to a 1.05-inch (26.6 mm) diameter shaft; the standard self-centering adapter will accept up to a one-inch (25.4 mm) diameter shaft.

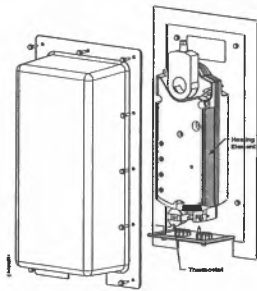
- Adapter can be used for coupling to slightly oversized one-inch (25.4 mm) jackshafts.
- Shaft adapter is 13/16-inches (20 mm) shorter than the height of the self-centering shaft adapter.



**Figure 8. Weather Shield.**

**ASK75.1U:** GCA actuators are UL listed to meet NEMA 3R requirements (a degree of protection against rain, sleet, and damage from external ice formation) when installed with ASK75.1U Weather Shield and outdoor-rated conduit fittings in the vertical position.

For dimensions, see Figure 19.



**Figure 9. Heater/Weather Shield Assembly.**

**985-106:** Provides protection for GIB, GBB and GCA OpenAir actuators down to temperatures of -58°F (-50°C). Assembly includes:

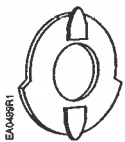
- Weather Shield
- Heater Kit



**Figure 10.  
 499 Ohm Resistor Assembly Kit.**

**985-124:** used for converting a 4 to 20 mA controller output signal into a 2 to 10 Vdc actuator signal.

**Service Parts**



**985-003**  
 Position indicators  
 (10/pkg)



**985-004**  
 Standard shaft adapter



**985-006**  
 Anti-rotation (mounting)  
 bracket



**985-008**  
 Conduit adapter, 1/2-inch (12 mm)  
 for 1/2-inch NPT connector.

**Figure 11. Orderable Parts.**

**Operation**

**GCA16x and GCA15x**

A continuous 0 to 10 Vdc or 2 to 10 Vdc signal from a controller to wire Y operates the damper actuator. The angle of rotation is proportional (or inverse proportional) to the control signal. A 0 to 10 Vdc, or 2 to 10 Vdc position feedback output signal is available between wires U and G0 (system neutral) to monitor the position of the damper actuator.

In the event of a power failure or when the operating voltage is shut off, the actuator returns to the "0" position.

In the event of a blockage in the damper, the actuator is overload protected over the full range to prevent damage to the actuator.

**Life expectancy**

An improperly tuned loop will cause excessive repositioning that will shorten the life of the actuator.

**Signal Inversion Switch  
GCA15x**

The switch setting affects both the control (input) signal and the feedback signal.

EA0320R2



**CLOCKWISE**  
(Direct acting)

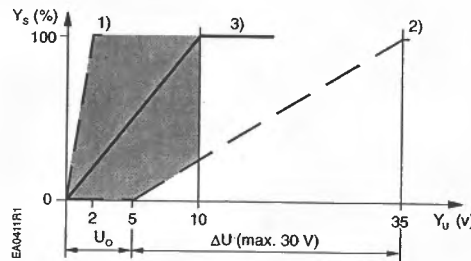


**COUNTER CLOCKWISE**  
(Inverse acting)

**Control signal  
adjustment**

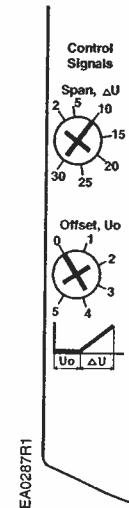
**GCA 163 and GCA164**

The offset (start point) and span of the control signal can be adjusted. The offset,  $U_o$ , can be adjusted between 0 to 5 Vdc. The span,  $\Delta U$ , can be adjusted between 2 to 30 Vdc.



- $Y_s$  Mechanical positioning range  
(100% = angle of rotation 90°)
- $Y_u$  Control signal
- $U_o$  Offset (start point)
- $\Delta U$  Span
- $U_o = 0V, \Delta U = 2V$  The minimum working range for  $Y_s = 100\%$

1.  $U_o = 5V, \Delta U = 30V$  The maximum working range for  $Y_s = 100\%$
2.  $U_o = 0V, \Delta U \approx 10V$  Factory setting



Setting for  
10V span  
0V offset

**Figure 12. The Minimum and Maximum Control Signal Adjustment.**

**Control signal adjustment, continued**

**Example:**

Open the actuator from 0% to 50% (45°) using a control signal of  $U_{min} = 2V$  to  $U_{max} = 10V$ .

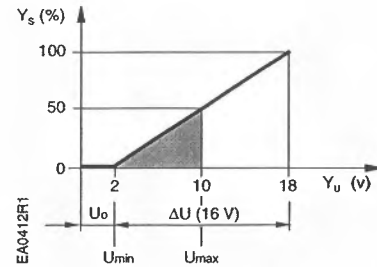
**Calculating the value of  $\Delta U$ :**

$$\Delta U = \frac{100 [\%] (U_{max} - U_{min})}{\text{Working angle of rotation in } \%} = \frac{100 \times (10 - 2)}{50} = 16V$$

**Settings**

$U_0 = 2Y; \Delta U = 16V$

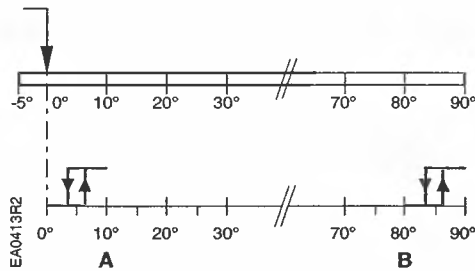
$U_{min}$  = minimum control signal  
 $U_{max}$  = maximum control signal



**Figure 13. Example.**

**Dual auxiliary switch**

**GCA156, GCA164, and GCA166**



Actuator rotary range with the shaft adapter mounted at position "0".

Setting range for switches A and B

Setting interval: 5°

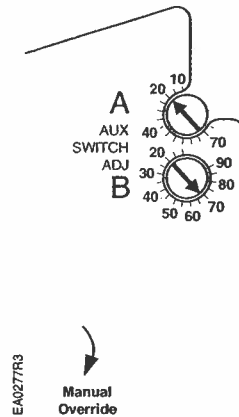
Switching hysteresis: 2°

To change the settings of A and B:

1. Make sure the actuator is in the "0", fail-safe position. The scale is valid only in the "0" position.
2. Use a flat-blade screwdriver to turn the switch adjustment dials to the desired setting at which a signal is to be given.

Factory setting:

Switch A      5°  
 Switch B      85°



**Figure 14. Dual Auxiliary Switch Dials.**

**NOTE:** For 2 to 10 Vdc GCA15x actuators with signal inversion switch set to Inverse Acting, 90° corresponds to a 2 Vdc input signal.

## Sizing

The type of actuator required depends on several factors.

1. Obtain damper torque ratings (ft-lb/ft<sup>2</sup> or Nm/m<sup>2</sup>) from the damper manufacturer.
2. Determine the area of the damper.
3. Calculate the total torque required to move the damper:

$$\text{Total Torque} = \frac{\text{Torque Rating} \times \text{Damper Area}}{\text{SF}^1}$$

<sup>1</sup> Safety Factor: When calculating the total torque required, a safety factor should be included for unaccountable variables such as slight misalignments, aging of the damper, etc. A suggested safety factor is 0.80.

4. Select the actuator type using Table 2.

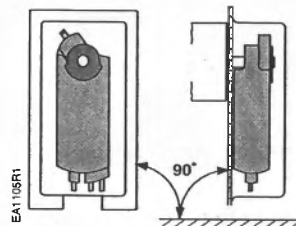
**NOTE:** Mechanically coupled actuators must all be of the exact same type except for the dual auxiliary switches and feedback potentiometer options. Make sure to use the correct tandem-mounting bracket. See Table 2.

**Table 2.**

DC Power (24 Vdc)		AC Power (24 Vac, 120 Vac)	
Total Torque	Actuator	Total Torque	Actuator
<62 lb-in (7 Nm)	GMA1xx	<62 lb-in (7 Nm)	GMA
>62 lb-in <106 lb-in (>7 Nm <12 Nm)	GCA12x, GCA13x, GCA15x*	>62 lb-in <142 lb-in (>7 Nm <16 Nm)	GCA
>106 lb-in <212 lb-in (>12 Nm <24 Nm)	Use tandem mounting bracket ASK73.1 with any combination of: <ul style="list-style-type: none"> <li>• GCA12x actuators</li> <li>• GCA13x actuators</li> </ul> Use tandem mounting bracket ASK73.2U with any combination of GCA151 and GCA156 actuators. *	>142 lb-in <284 lb-in (>16 Nm <32 Nm)	Use tandem mounting bracket ASK73.1 with any combination of: <ul style="list-style-type: none"> <li>• GCA12x actuators</li> <li>• GCA22x actuators</li> <li>• GCA13x actuators</li> <li>• Master/Slave actuators (See <i>Technical Instructions 155-543P25</i>)</li> </ul> Use tandem mounting bracket ASK73.2U with any combination of: <ul style="list-style-type: none"> <li>• GCA151x actuators</li> <li>• GCA161x actuators</li> </ul>

\*Only with revision 2 of GCA15x (2 to 10 Vdc)

## Mounting and Installation

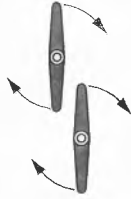
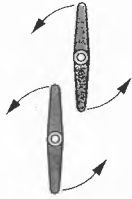


























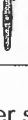

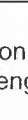





**Figure 15. Acceptable NEMA 2 Positions.**

## Mounting and Installation, continued

Flip the actuator to select either clockwise or counterclockwise fail-safe rotation of the damper shaft. Follow steps 1, 2, and 3 of Table 3 to determine the correct actuator mounting orientation.

**Table 3. Actuator Mounting Orientation and Damper Control.**

Determining the Actuator Mounting Orientation	①	Damper Type				
	②	Power Fail Spring Return Position	 Close	 Open	 Close	 Open
	③	Actuator Mounting Orientation				
Modulating Control	GCA15x	Y = 10V Ω	 Open	 Close	 Open	 Close
		Y = 2V Ω	 Open	 Close	 Open	 Close
	GCA16x	Y = 10V (or Y = U <sub>o</sub> + ΔU)	 Open	 Close	 Open	 Close
	GCA15x	Y = 2V Ω	 Close	 Open	 Close	 Open
		Y = 10V Ω	 Close	 Open	 Close	 Open
GCA16x	Y = 0V (or Y = U <sub>o</sub> )	 Close	 Open	 Close	 Open	

- The shaft adapter and the position indicator can be mounted on either side of the actuator. The actuator mounting orientation and shaft length determine how they will be mounted on the actuator.
- The minimum damper drive shaft length is 3/4-inch (20 mm).
- See *Specifications* for the minimum and maximum damper shaft dimensions.
- The actuator is shipped from the factory with a 5° preload enabling tight close off of the damper in power-fail-close applications.
- A mounting bracket is included with the actuator.
- The shaft adapter and mounting parts are shipped in a separate container with the actuator.
- See the detailed mounting instructions included with each actuator.

### Manual override

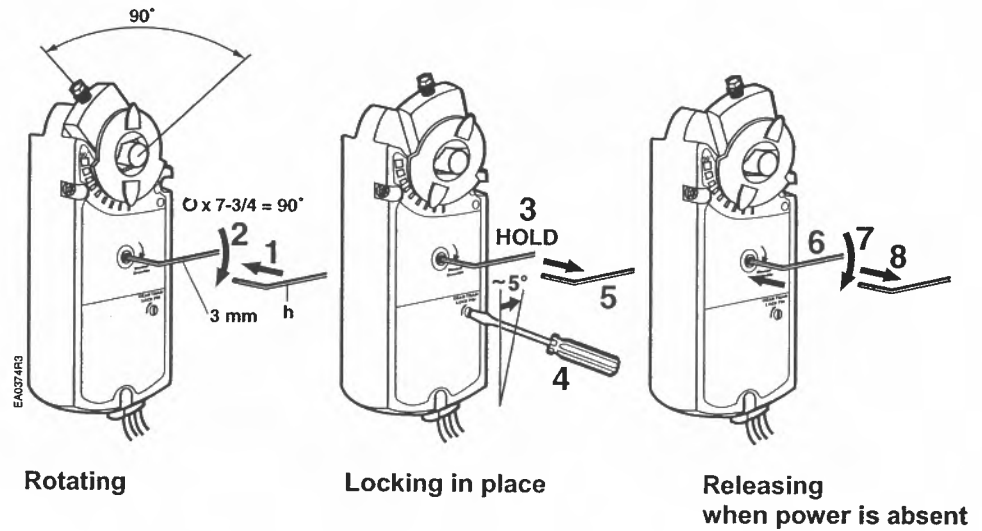


Figure 16. Manual Override.

Always turn the key in the direction of the arrow.

	<p><b>CAUTION:</b></p> <p>When engaging the gear train lock pin, be careful to turn only about five degrees until you hear a click or meet slight resistance. Turning too far will strip the lock pin.</p>
--	--

To release manual override, either restore power and send a control signal, or when power is absent, insert the 3 mm hex key in the override opening, turn the key in the direction of the arrow and remove the key.

### Mechanical range adjustment

The angular rotation is adjustable between 0 and 90° at five-degree intervals. To limit the range of shaft movement, remove the locking clip and self-adjusting shaft adapter. Rotate the damper blade shaft to its failed position. Rotate the shaft coupling to the desired position. Insert the shaft adapter into the actuator and fasten it with the locking clip. See Figure 17.

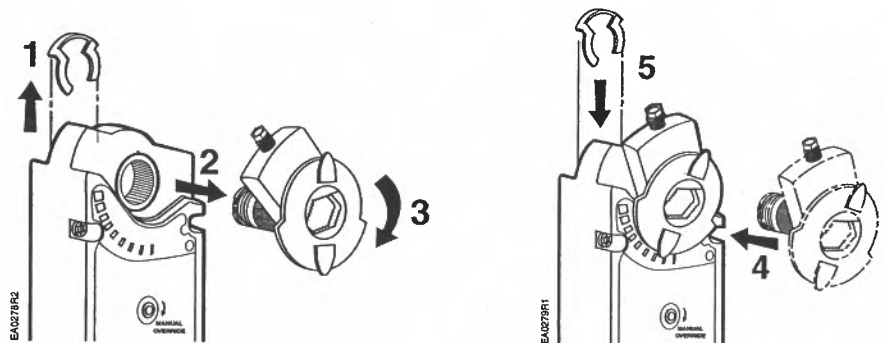



Figure 17. Mechanical Range Adjustment.

## Wiring

All wiring must conform to NEC and local codes and regulations.

Use earth ground isolating step-down Class 2 transformers. Do not use autotransformers.

The maximum rating for a Class 2 step-down transformer is 100 VA. Determine the supply transformer rating by summing the VA ratings of all actuators and other components used. It is recommended that one transformer power not more than nine actuators (or 80% of its VA).

	<p><b>WARNING:</b></p> <p>Mixed switch operation is not permitted to the switching outputs of both auxiliary switches (A and B).</p> <p>Either AC line voltage from the same phase must be applied to all six outputs of the dual auxiliary switches, or UL-Class 2 voltage must be applied to all six outputs.</p> <p><b>NOTE:</b> With plenum cables, only UL-Class 2 voltage is permitted.</p>
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## Wire Designations

Each wire has the standard symbol printed on it. See Table 4.

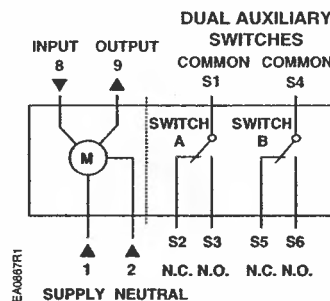


Table 4. Wire Designations.

Standard Symbol	Function	Terminal Designations	Color	
			Standard	Plenum
1	Supply (SP)	G	Red	Red
2	Neutral (SN)	G0	Black	Black
8	Input signal: 0 to 10 Vdc (GCA16x) or 2 to 10 Vdc (GCA15x)	Y	Gray	Gray
9	Position output: 0 to 10 Vdc (GCA16x) or 2 to 10 Vdc (GCA15x)	U	Pink	Pink
S1	Switch A Common	Q11	Gray/red	Gray/red
S2	Switch A NC	Q12	Gray/blue	Gray/blue
S3	Switch A NO	Q14	Gray/pink	Gray/pink
S4	Switch B Common	Q21	Black/red	Black/red
S5	Switch B NC	Q22	Black/blue	Black/blue
S6	Switch B NO	Q24	Black/pink	Black/pink



---

## Start-Up/ Commissioning

1. Check Operation:
  - a. Connect wires 1 (red) and 2 (black) to the 24 Vac (GCA16x) or 24 Vac/dc (GCA15x) power supply.

**NOTE:** With no input signal present, the GCA15x actuator with signal inversion switch set to Inverse Acting will start driving towards 90°.
  - b. Use a Digital Multimeter (DDM) and set the dial to Vdc for the actuator input signal.
  - c. Connect wires 2 (black) and 8 (gray) to the DMM.
  - d. Apply to input signal wire 8 (gray):  
Y = 10 Vdc or Y = U<sub>o</sub> + ΔU (GCA16x)  
Y = 10 Vdc (GCA15x in direct-acting mode)  
Y = 2 Vdc (GCA15x in inverse-acting mode)
  - e. Allow the actuator shaft coupling to rotate from 0 to 90.
  - f. Apply to input signal wire 8 (gray):  
Y = 0 Vdc or Y = U<sub>o</sub> (GCA16x)  
Y = 2 Vdc (GCA15x in direct acting mode)  
Y = 10 Vdc (GCA15x in inverse acting mode)

The shaft coupling returns to the "0" position.

---

2. Check Spring Return:
  - a. Set the DMM dial to Vdc.
  - b. Connect wires 2 (black) and 8 (gray) to the DMM.
  - c. Apply to input signal wire 8 (gray):  
Y = 5 Vdc or Y = U<sub>o</sub> + 1/2 ΔU (GCA16x)  
Y = 6 Vdc (GCA15x)
  - d. Allow the actuator shaft coupling to rotate halfway.
  - e. Disconnect wire 1 (red).

The spring returns the actuator shaft coupling to the fail "0" position.

- f. Connect wire 1 (red) and the actuator moves.
- 

3. Check Feedback:
    - a. Set the DMM dial to Vdc.
    - b. Attach wires 2 (black) and 9 (pink) to the DMM.
    - c. Apply the input signal as in *Step 1d*, to wire 8 (gray).

The reading at the DMM should increase (decrease for GCA15x in inverse acting mode).
    - d. Apply the input signal as in *Step 1f*, to wire 8 (gray).

The reading at the DMM should decrease (increase for GCA15x in inverse acting mode) and the actuator shaft coupling returns to the fail "0" position.
- 

4. Check the Auxiliary Switch A:
    - a. Set the DMM dial to ohms (resistance) or continuity check.
    - b. Connect wires S1 and S3 to the DMM. The DMM should indicate open circuit or no resistance.
    - c. Apply the input signal as in *Step 1d*, to wire 8 (gray).

The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
    - d. Connect wires S1 and S2 to the DMM. The DMM should indicate open circuit or no resistance.
    - e. Apply the input signal as in *Step 1f*, to wire 8 (gray).

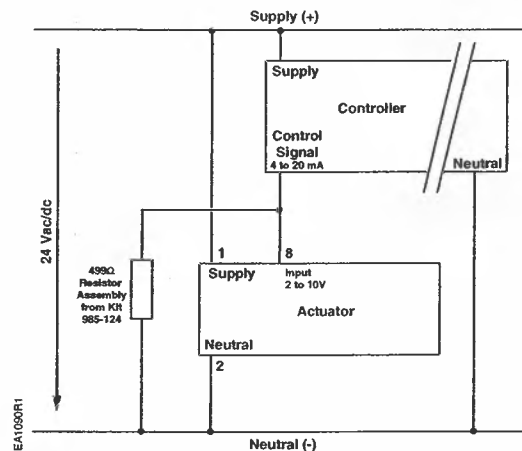
The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
-

**Start-Up  
 Commissioning,  
 continued**

5. Check the Auxiliary Switch B:
  - a. Set the DMM dial to ohms (resistance) or continuity check.
  - b. Connect wires S4 and S6 to the DMM. The DMM should indicate open circuit or no resistance.
  - c. Apply the input signal as in *Step 1d*, to wire 8 (gray).  
 The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.
  - d. Connect wires S4 and S5 to the DMM. The DMM should indicate open circuit or no resistance.
  - e. Apply the input signal as in *Step 1f*, to wire 8 (gray).  
 The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.

**Special  
 Application**

Modulating 4 to 20 mA control with GCA15x and an external 499-ohm resistor (985-124, See *Accessories*).



**Figure 18.**  
**Wiring Diagram for Converting  
 4 to 20 mA into 2 to 10 Vdc.**

**Service**



**WARNING:**

Do not open the actuator. If the actuator is inoperative, replace the unit.

**Troubleshooting**

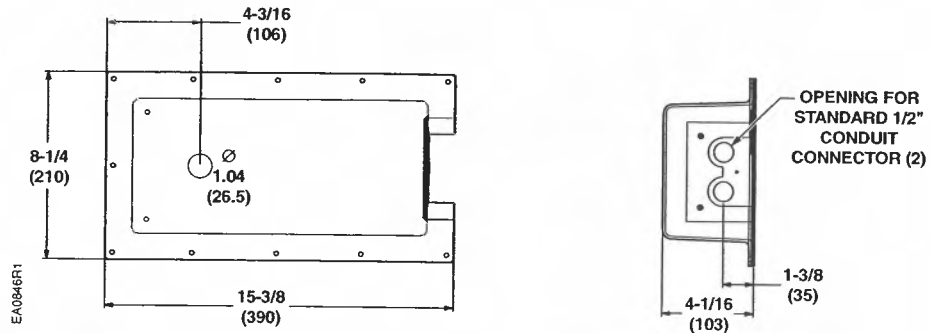


**WARNING:**

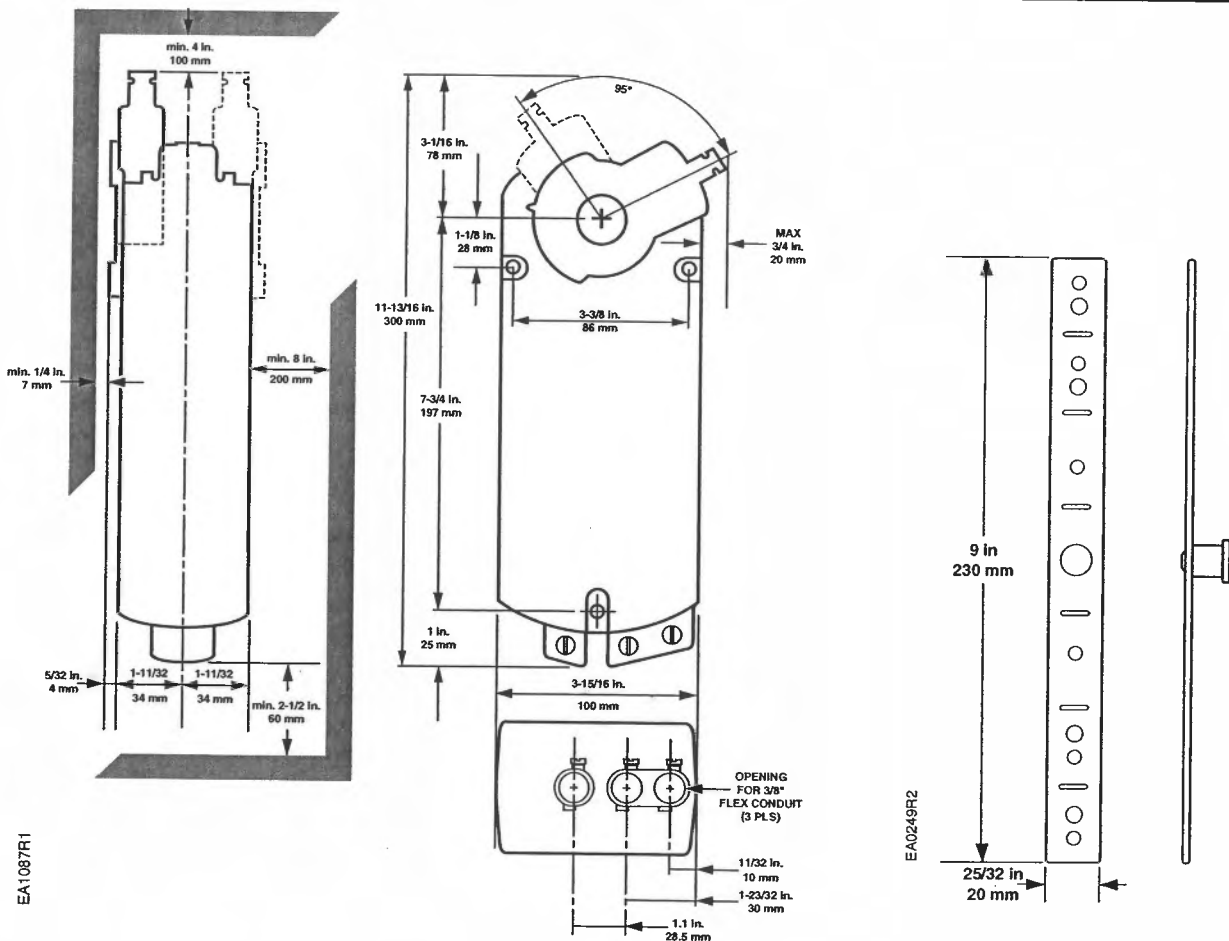
To avoid injury or loss of life, pay attention to any hazardous voltage (for example, 120 Vac) when performing checks.

- Check that wires are connected correctly.
- Check that offset (start point) and span are set correctly, if used.
- Use a Digital Multimeter (DMM) to verify that the operating voltage is within range.
- If the actuator is not working, check the damper for blockage. If blocked, remove the obstacle and cycle the actuator power off and on. The actuator should resume normal operating mode.

**Dimensions**



**Figure 19. Dimensions of the ASK75.1U Weather Shield in Inches (Millimeters).**

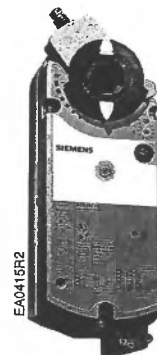


**Figure 20. Dimensions of the GCA Actuator and Mounting Bracket in inches (mm).**

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## OpenAir™

GCA Series Spring Return Rotary  
 24 Vac/dc 2-Position Control,  
 120 Vac 2-Position Control  
 Electric Damper Actuators



**Description** The OpenAir direct coupled 2-position spring return electric actuator is available in 24 Vac/dc or 120 Vac models for control of building HVAC dampers.

- Features**
- Brushless DC motor technology with stall protection
  - Bi-directional fail-safe spring return
  - Unique self-centering shaft coupling
  - All metal housing
  - 142 lb-in (16Nm) torque
  - Manual override
  - 5° preload as shipped from factory
  - UL and cUL listed



**Application** Used for the control of dampers requiring up to 142 lb-in (16 Nm) torque. Designed for applications that require the damper to return to its fail-safe position when there is a power failure.

**Product Numbers**

Table 1.

Cabling	Operating Voltage			
	24 Vac/dc		120 Vac	
	Standard	Dual Auxiliary Switches	Standard	Dual Auxiliary Switches
Standard	GCA121.1U	GCA126.1U	GCA221.1U	GCA226.1U
Plenum Cable	GCA121.1P	GCA126.1P	—	—

## Warning/Caution Notations

<b>WARNING</b> :		Personal injury/loss of life may occur if a procedure is not performed as specified.
<b>CAUTION:</b>		Equipment damage or loss of data may occur if the user does not follow a procedure as specified.

## Specifications

<b>Power supply</b>	Operating voltage	
	GCA12x	24 Vac $\pm 20\%$ / 24 Vdc $\pm 10\%$
	GCA22x	120 Vac $\pm 10\%$
	Frequency	50/60 Hz
	Equipment rating GCA12x (24V)	Class 2, in accordance with UL/CSA
	Power consumption	
	GCA12x (24Vac/dc)	
	running	8 VA/6W
	holding	3 VA/3W
	GCA22x (120Vac)	
	running	9 VA
	holding	9 VA

## Auxiliary features

	<b>Dual auxiliary switches</b>	
	AC rating (standard cable)	24 to 250 Vac AC 6A resistive AC 2A general purpose
	AC rating (Plenum cable)	24 Vac AC 4A resistive AC 2A general purpose
	DC rating (Standard/Plenum cable)	12 to 30 Vdc DC 2A
	Switch Range	
	Switch A	0 to 90° with 5° intervals
	Recommended range usage	0 to 45°
	Factory setting	5°
	Switch B	0 to 90° with 5° intervals
	Recommended range usage	45 to 90°
	Factory setting	85°
	Switching hysteresis	2°



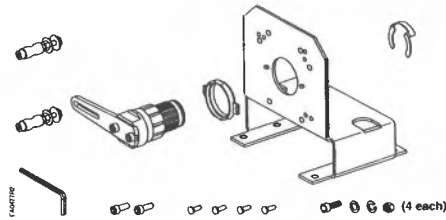
### WARNING:

Apply only AC-line voltage from the same phase, or only UL-Class 2 voltage to the switching outputs of both auxiliary switches A and B. Mixed operation is not permissible. See *Wiring* for details.

<b>Specifications, continued</b>	Running/spring return torque	
	24 Vac, 120 Vac	142 lb-in (16 Nm)
<b>Function</b>	24 Vdc	106 lb-in (12 Nm)
	Maximum torque	<360 lb-in (40 Nm)
	Runtime for 90° operating with motor	90 seconds
	closing (on power loss) with spring return	15 seconds typical
<b>Mounting</b>	Nominal angle of rotation	90°
	Maximum angular rotation	95°
	Shaft size	3/8 to 1-inch (8 to 25.6 mm) diameter 1/4 to 3/4-inch (6 to 18 mm) square
	Minimum shaft length	3/4-inches (20 mm)
<b>Housing</b>	Enclosure	NEMA 2 in vertical to horizontal 90° See Figure 12.  NEMA 3R rated when installed with ASK75.1U Weather Shield in the vertical position. See <i>Accessories</i> .
	Material	Die cast aluminum alloy
	Gear lubrication	Silicone free
<b>Ambient conditions</b>	Ambient temperature operation	-25°F to 130°F (-32°C to 55°C)
	storage and transport	-40°F to 158°F (-40°C to 70°C)
	Ambient humidity (non-condensing)	95% rh
<b>Agency certification</b>		UL listed to UL60730 (replacing UL873) cUL certified to Canadian Standard C22.2 No. 24-93
<b>Miscellaneous</b>	Pre-cabled connection	18 AWG
	Cable length	3 feet (0.9m)
	Life cycle	Designed for over 60,000 full strokes at rated torque and temperature
	Noise level	<45 dBA (running)
	Dimensions	See Figure 16
	Weight	4.85 lb (2.2 kg)

## Accessories

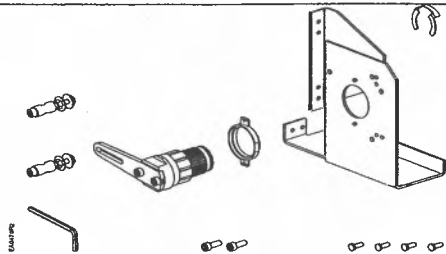
**NOTE:** The auxiliary switches cannot be added in the field. Order the product number which includes the option.



**Figure 1. Floor Mount Kit.**

**ASK71.1U** Kit allows foot mounting of OpenAir actuators. Kit should be used for in-the-airstream applications, and generally, anywhere a foot-mounted actuator can be mounted. Kit contains:

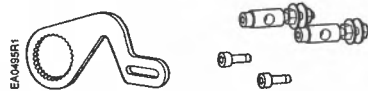
- Crank arm to change angular rotation to linear stroke.
- Support bearing ring to minimize side loading on the actuator's output bearing.
- Mounting bracket.
- Required mounting fasteners.



**Figure 2. Frame Mount Kit.**

**ASK71.2U** Kit allows mounting OpenAir actuators directly to a damper frame. Kit should be used with louvers and vents and in applications where use of the floor mount kit is not possible. Kit contains:

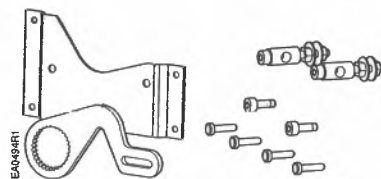
- Crank arm to change angular rotation to linear stroke.
- Support bearing ring to minimize side loading.
- Mounting bracket.
- Required mounting fasteners.



**Figure 3. Crank Arm Kit.**

**ASK71.3** Kit allows direct-coupled actuator to provide auxiliary linear drive. Crank arm kit can be used to simultaneously drive a set of opposing or adjacent dampers with a single actuator. Kit includes:

- Crank arm to attach to splined hub of shaft adapter.
- Other required mounting fasteners.

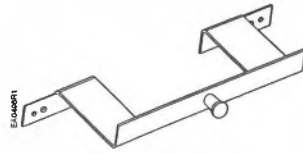


**Figure 4. Crank Arm Kit with Mounting Bracket.**

**ASK71.4** Kit allows economical mounting of OpenAir actuator to a variety of surfaces. Kit to be used in applications where actuator can be rigid-surface mounted and linear stroke output is required. Kit includes:

- Crank arm that attaches to splined hub of shaft adapter.
- Mounting bracket.
- Other required mounting fasteners.

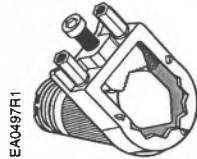
**Accessories,  
 continued**



**ASK73.1** Bracket provides extended anti-rotation pin allowing two OpenAir actuators to directly drive a single damper shaft.

For use with two- and three-position actuators.

**Figure 5. Tandem Mount Bracket.**

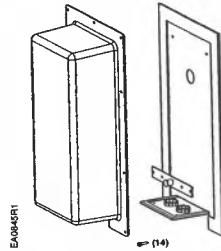


**ASK74.1U** Will attach to a 1.05 inch (26.6 mm) diameter shaft; whereas, the standard self-centering adapter accepts up to a one-inch (25.4 mm) diameter shaft.

Adapter can be used for coupling to one-inch jackshafts that are slightly oversized.

This adapter is 13/16-inch (20 mm) shorter than the height of the self-centering shaft adapter.

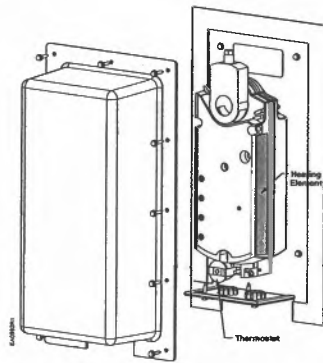
**Figure 6. Special Shaft Adapter.**



**ASK75.1U** GCA actuators are UL listed to meet NEMA 3R requirements (degree of protection against rain, sleet, and damage from external ice formation) when installed with ASK75.1U Weather Shield and outdoor-rated conduit fittings in the vertical position.

For dimensions, see Figure 15.

**Figure 7. Weather Shield.**

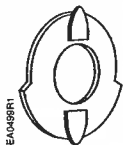


**985-106** Provides protection for GCA, GIB and GBB OpenAir actuators down to temperatures of -58°F (-50°C) when used with the ASK75.1U Weather Shield. Assembly includes:

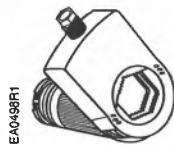
- Weather Shield
- Heater Kit

**Figure 8. Heater/Weather Shield Assembly.**

**Service Parts**



**985-003**  
 Position Indicators (10/pkg)



**985-004**  
 Standard Shaft Adapter



**985-006**  
 Anti-rotation (mounting) Bracket

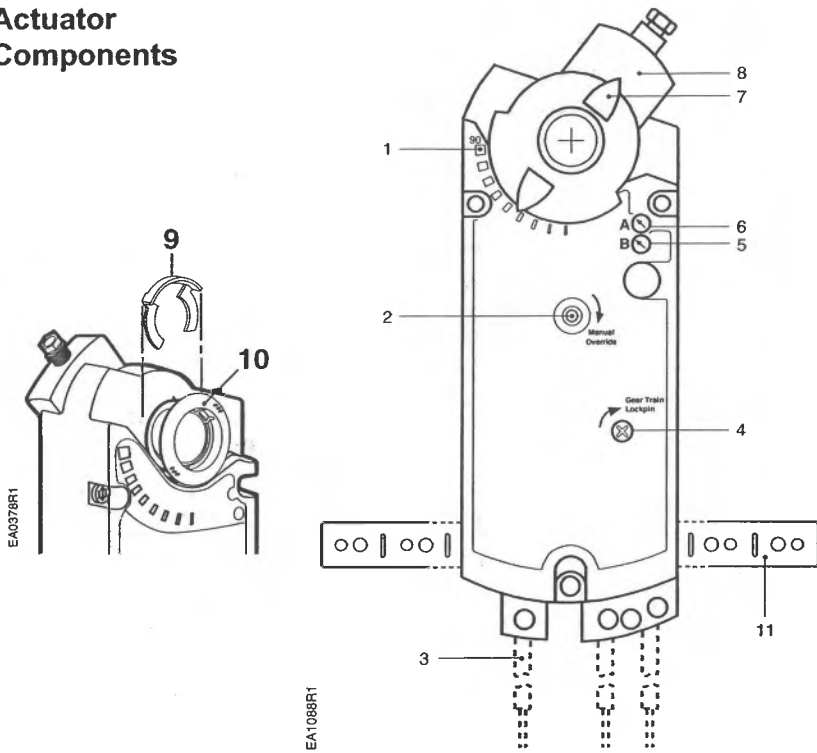


**985-008**  
 Conduit adapter 1/2-inch (12 mm) for 1/2-inch NPT connector.

**Figure 9. Orderable Parts.**



**Actuator Components**



**Legend**

1. Positioning scale for angle of rotation
2. Manual override wrench opening and direction of rotation arrow
3. Connection cables
4. Gear train lock pin
5. Auxiliary switch B
6. Auxiliary switch A
7. Position indicator
8. Self-centering shaft adapter
9. Shaft adapter locking clip
10. Position indicator adapter
11. Mounting bracket

**Figure 10. Two-position Actuator.**

**Operation**

When power is applied, the actuator coupling moves toward the open position "90°".  
 In the event of a power failure or when operating voltage is turned off, the actuator returns to the "0°" position.

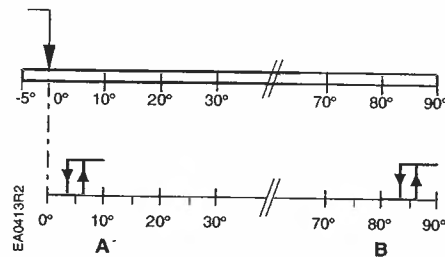
In the event of a blockage in the damper, the actuator is overload protected over the full range to prevent damage to the actuator.

**Life expectancy**

An improperly-tuned loop will cause excessive repositioning that will shorten the life of the actuator.

**GCA126 and GCA226**

**Dual auxiliary switch**



Actuator rotary range with the shaft adapter mounted at position "0".

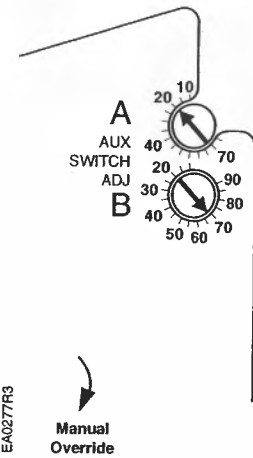
Setting range for switches A and B  
 Setting interval: 5°  
 Switching hysteresis: 2°

To change the settings of A and B:

1. Make sure the actuator is in the "0" position. The scale is valid only in the "0" position.
2. Use a flat-blade screwdriver to turn the switch adjustment dials to the desired setting at which a signal is to be given.

Factory setting

Switch A	5°
Switch B	85°



**Figure 11. Dual Auxiliary Switch Dials.**

## Sizing

The type of actuator required depends on several factors.

1. Obtain damper torque ratings (ft-lb/ft<sup>2</sup> or Nm/m<sup>2</sup>) from the damper manufacturer.
2. Determine the area of the damper.
3. Calculate the total torque required to move the damper:

$$\text{Total Torque} = \frac{\text{Torque Rating} \times \text{Damper Area}}{\text{SF}^1}$$

4. Select the actuator type using Table 2.

<sup>1</sup> Safety Factor: When calculating the total torque required, a safety factor should be included for unaccountable variables such as slight misalignments, aging of the damper, etc. A suggested safety factor is 0.80.

**NOTE:** Mechanically coupled actuators must all be of the exact same type except for the dual auxiliary switches and feedback potentiometer options. Make sure to use the correct tandem-mounting bracket. See Table 2.

Table 2.

DC Power (24 Vdc)		AC Power (24 Vac, 120 Vac)	
Total Torque	Actuator	Total Torque	Actuator
<62 lb-in (7 Nm)	GMA1xx	<62 lb-in (7 Nm)	GMA
>62 lb-in <106 lb-in (>7 Nm <12 Nm)	GCA12x, GCA13x, GCA15x*	>62 lb-in <142 lb-in (>7 Nm <16 Nm)	GCA
>106 lb-in <212 lb-in (>12 Nm <24 Nm)	Use tandem mounting bracket ASK73.1 with any combination of: <ul style="list-style-type: none"> <li>• GCA12x actuators</li> <li>• GCA13x actuators</li> </ul> Use tandem mounting bracket ASK73.2U with any combination of GCA151 and GCA156 actuators.*	>142 lb-in <284 lb-in (>16 Nm <32 Nm)	Use tandem mounting bracket ASK73.1 with any combination of: <ul style="list-style-type: none"> <li>• GCA12x actuators</li> <li>• GCA22x actuators</li> <li>• GCA13x actuators</li> <li>• Master/Slave actuators (See <i>Technical Instructions 155-543P25</i>)</li> </ul> Use tandem mounting bracket ASK73.2U with any combination of: <ul style="list-style-type: none"> <li>• GCA15x actuators</li> <li>• GCA16x actuators*</li> </ul>

\*Only with revision 2 of GCA15x (2 to 10 Vdc).

## Mounting and Installation

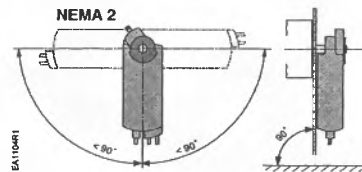


Figure 12. Acceptable NEMA 2 positions.

**Mounting and Installation, continued**

Flip the actuator to select either clockwise or counterclockwise fail-safe rotation of the damper shaft. Follow steps 1, 2, and 3 of Table 3 to determine the correct actuator mounting orientation.

**Table 3. Actuator Mounting Orientation and Damper Control.**

EA1037R2	Determining the Actuator Mounting Orientation	① Damper Type				
		② Power Fail Spring Return Position	Close	Open	Close	Open
		③ Actuator Mounting Orientation				
EA1038R1	2-Position	GCA12x GCA22x Power On	Open	Close	Open	Close

The shaft adapter and the position indicator can be mounted on either side of the actuator. The actuator mounting orientation and shaft length determine how they will be mounted on the actuator.

The minimum damper drive shaft length is 3/4-inches (20 mm). See *Specifications* for the minimum and maximum damper shaft dimensions.

The actuator is shipped from the factory with a 5° preload enabling tight close off of the damper in power-fail-close applications.

A mounting bracket is included with the actuator. The shaft adapter and mounting parts are shipped in a separate container with the actuator.

See the detailed mounting instructions included with each actuator.

## Manual override

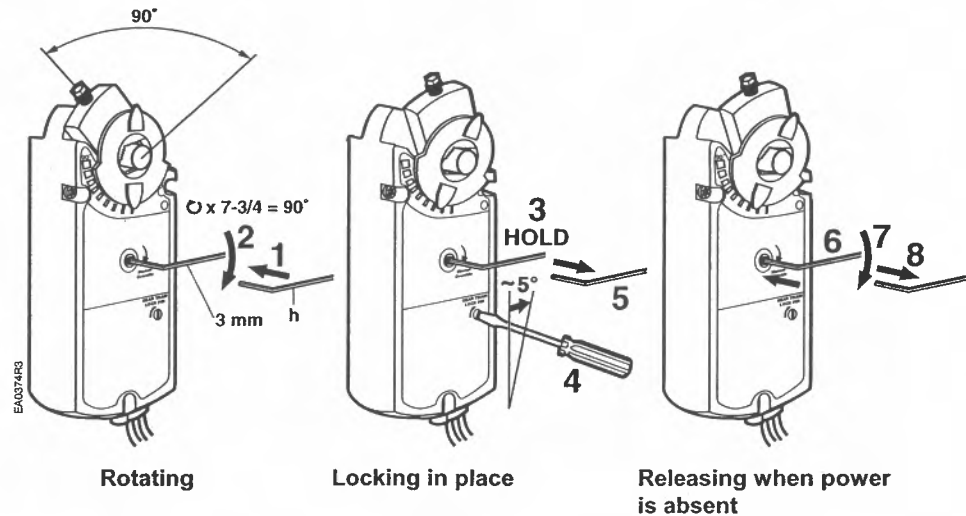


Figure 13. Manual Override.

Always turn the key in the direction of the arrow.



### CAUTION:

When engaging the gear train lock pin, be careful to turn only about five degrees until you hear a click or meet slight resistance. Turning too far will strip the lock pin.

To release manual override either restore power and send a control signal, or when power is absent, insert the 3 mm hex key in the override opening, turn the key in the direction of the arrow and remove the key.

## Mechanical range adjustment

The angular rotation is adjustable between 0 and 90° at 5 degree intervals. To limit the range of shaft movement, remove the locking clip and self-adjusting shaft adapter. Rotate the damper blade shaft to its failed position. Rotate the shaft coupling to the desired position. Insert the shaft adapter into the actuator and fasten it with the locking clip. See Figure 14.

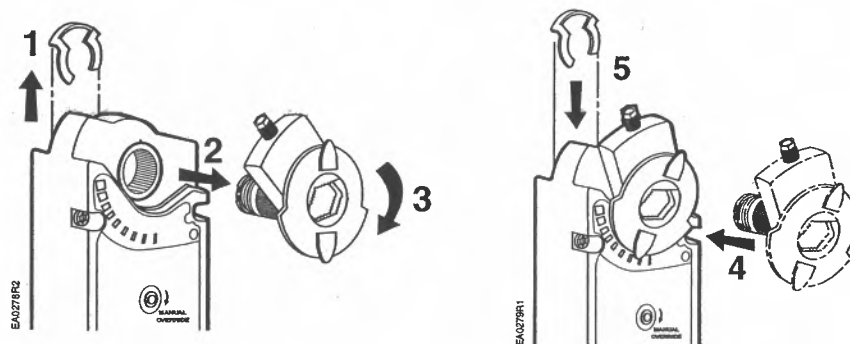


Figure 14. Mechanical Range Adjustment.

## Wiring

All wiring must conform to NEC and local codes and regulations.



### WARNING:

Mixed switch operation is not permitted to the switching outputs of both auxiliary switches (A and B).

Either AC line voltage from the same phase must be applied to all six outputs of the dual auxiliary switches, or UL-Class 2 voltage must be applied to all six outputs.

**NOTE:** With plenum cables, only UL-Class 2 voltage is permitted.

## Wiring For 24 Vac

Use earth ground isolating step-down Class 2 transformers. Do not use auto transformers.

The maximum rating for a Class 2 step-down transformer is 100 VA. Determine the supply transformer rating by summing the VA ratings of all actuators and all other components used. It is recommended that one transformer power no more than 10 actuators (or 80% of its VA).

## Wire Designations

Each wire has the standard symbol printed on it. See Table 4.

24 Vac/dc

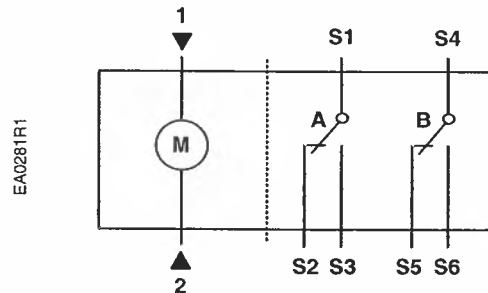


Table 4. Wire Designations.

Standard Symbol	Function	Terminal Designations	Cabling
1	Supply (SP)	G	Red
2	Neutral (SN)	G0	Black
S1	Switch A Common	Q11	Gray/red
S2	Switch A N.C.	Q12	Gray/blue
S3	Switch A N.O.	Q14	Gray/pink
S4	Switch B Common	Q21	Black/red
S5	Switch B N.C.	Q22	Black/blue
S6	Switch B N.O.	Q24	Black/pink

---

## Start-Up/ Commissioning

### 24 Vac/dc

1. Check Operation:
    - a. Connect wires 1 (red) and 2 (black) to 24 Vac/dc power supply.
    - b. Allow the actuator shaft coupling to rotate from 0 to 90.
    - c. Disconnect wire 1 (red) and the actuator shaft coupling returns to the "0" position.
- 

2. Check Spring Return:
    - a. Connect wire 1 (red).
    - b. Allow the actuator shaft coupling to rotate halfway.
    - c. Disconnect wire 1 (red).

The spring returns the actuator shaft coupling to the fail "0" position.
- 

3. Check the Auxiliary Switch A:
    - a. Set the DMM dial to ohms (resistance) or continuity check.
    - b. Connect wires S1 and S3 to the DMM. The DMM should indicate open circuit or no resistance.
    - c. Connect wire 1 (red).

The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.

    - d. Connect wires S1 and S2 to the DMM. The DMM should indicate open circuit or no resistance.
    - e. Disconnect wire 1 (red).

The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
- 

4. Check the Auxiliary Switch B:
    - a. Set the DMM dial to ohms (resistance) or continuity check.
    - b. Connect wires S4 and S6 to the DMM. The DMM should indicate open circuit or no resistance.
    - c. Connect wire 1 (red).

The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.

    - d. Connect wires S4 and S5 to the DMM. The DMM should indicate open circuit or no resistance.
    - e. Disconnect wire 1 (red).

The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.
-

## Wire Designations

Each wire has the standard symbol printed on it. See Table 5.

### 120 Vac

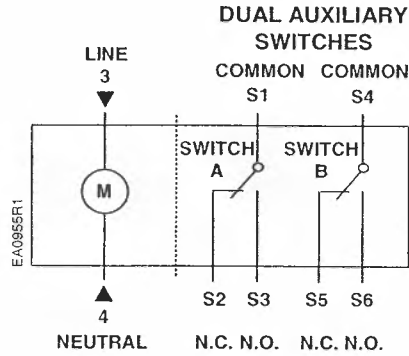


Table 5. Wire Designations.

Standard Symbol	Function	Terminal Designations	Color
3	Line	L	Black
4	Neutral	N	White
S1	Switch A Common	Q11	Gray/red
S2	Switch A NC*	Q12	Gray/blue
S3	Switch A NO**	Q14	Gray/pink
S4	Switch B Common	Q21	Black/red
S5	Switch B NC	Q22	Black/blue
S6	Switch B NO	Q24	Black/pink

\* NC = Normally Closed

\*\* NO = Normally Open



## Start-Up/ Commissioning

### 120 Vac



**WARNING:** Switch off 120 Vac power before connecting the GND wire (green/yellow), the 3 wire (black) and the 4 wire (white).

- 
1. Check Operation:
    - a. Switch on 120 Vac power.
    - b. Allow the actuator shaft coupling to rotate from 0 to 90°.
    - c. Switch off 120 Vac power  
The actuator shaft coupling will return to the "0" position.

---

  2. Check Spring Return:
    - a. Switch on 120 Vac power.
    - b. Allow the actuator shaft coupling to rotate halfway.
    - c. Switch off 120 Vac power.  
The spring returns the actuator shaft coupling to the fail "0" position.

---

  3. Check the Auxiliary Switch A:
    - a. Set the DMM dial to ohms (resistance) or continuity check.
    - b. Connect wires S1 and S3 to the DMM.  
The DMM should indicate an open circuit or no resistance.
    - c. Switch on 120 Vac power.  
The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.
    - d. Connect wires S1 and S2 to the DMM.  
The DMM should indicate open circuit or no resistance.
    - e. Switch off 120 Vac power.  
The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch A.

---

  4. Check the Auxiliary Switch B:
    - a. Set the DMM dial to ohms (resistance) or continuity check.
    - b. Connect wires S4 and S6 to the DMM.  
The DMM should indicate open circuit or no resistance.
    - c. Switch on 120 Vac power.  
The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.
    - d. Connect wires S4 and S5 to the DMM.  
The DMM should indicate open circuit or no resistance.
    - e. Switch off 120 Vac power.  
The DMM should indicate contact closure as the actuator shaft coupling reaches the setting of switch B.
-

---

### Service



#### WARNING:

Do not open the actuator. If the actuator is inoperative, replace the unit.

---

### Troubleshooting



#### WARNING:

To avoid injury or loss of life, pay attention to any hazardous voltage (for example, 120 Vac) when performing checks.

- Check that wires are connected correctly.
- Use a Digital Multimeter (DMM) to verify that the operating voltage is within range.
- If the actuator is not working, check the damper for blockage. If blocked, remove the obstacle and cycle the actuator power off and on. The actuator should resume normal operating mode.

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### Dimensions

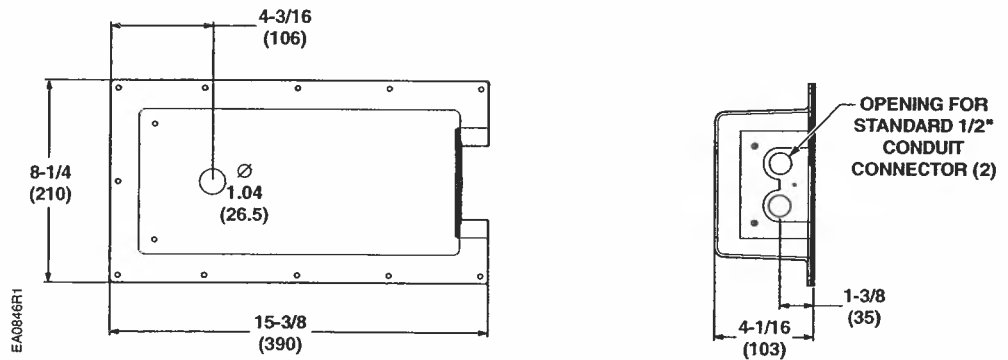
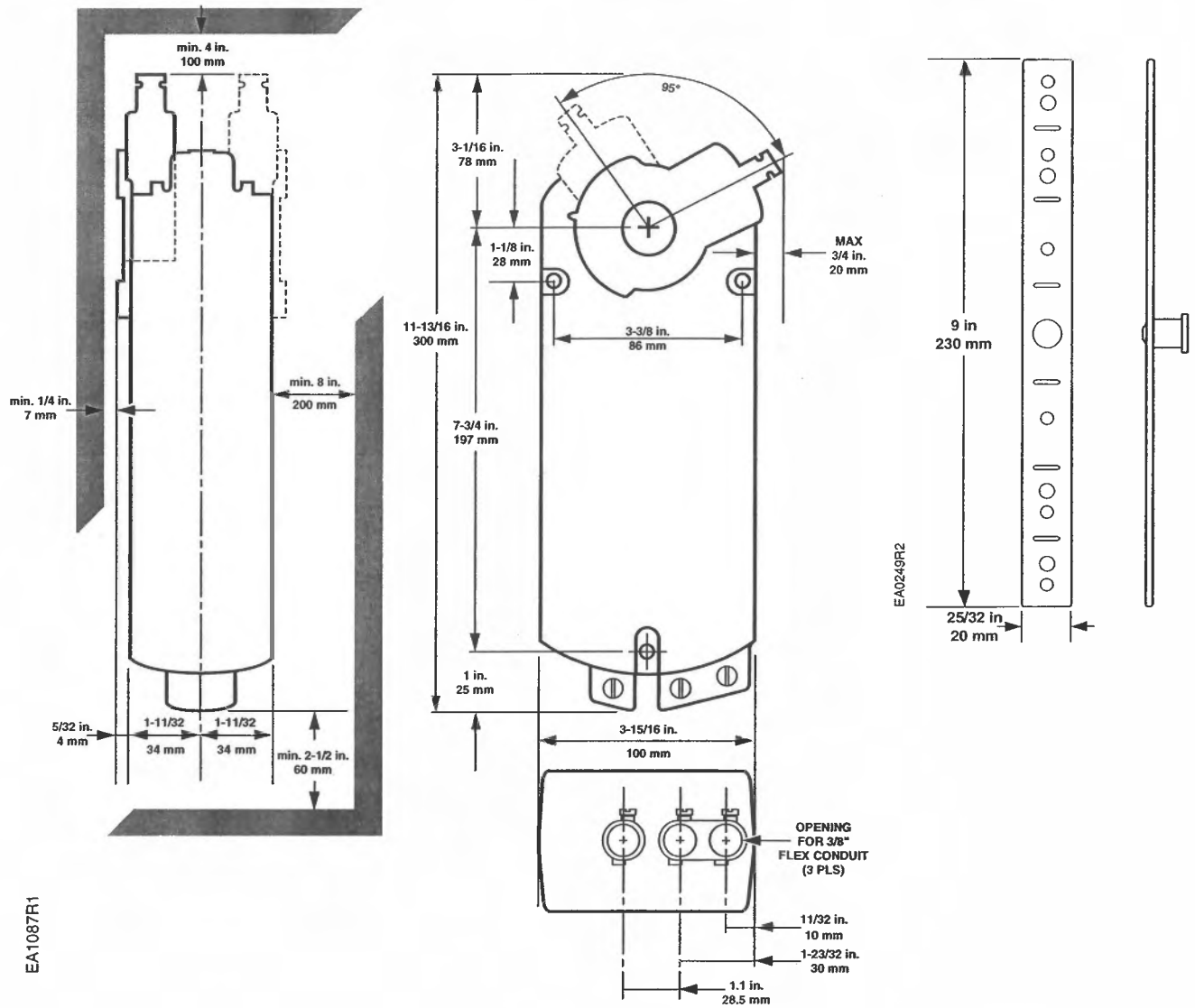


Figure 15. Dimensions of the ASK75.1U Weather Shield in Inches (Millimeters).

**Dimensions, Continued**



**Figure 16. Dimensions of the GCA Actuator and Mounting Bracket.**

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. OpenAir is a trademark of Siemens Building Technologies, Inc. Other product or company names mentioned herein may be the trademarks of their respective owners. © 2003 Siemens Building Technologies, Inc.




Functional Devices, Inc.  
310 South Union Street  
Russiaville, IN 46979  
www.functionaldevices.com


Office: (765) 883-5538  
Sales: (800) 888-5538  
Fax: (765) 883-7505  
Email: sales@functionaldevices.com

Manufacturing quality products in the United States of America since 1969

**RIBU1C** Enclosed Relay 10 Amp SPDT with 10-30 Vac/dc / 120 Vac Coil



Functional Devices, Inc. A600C 2005

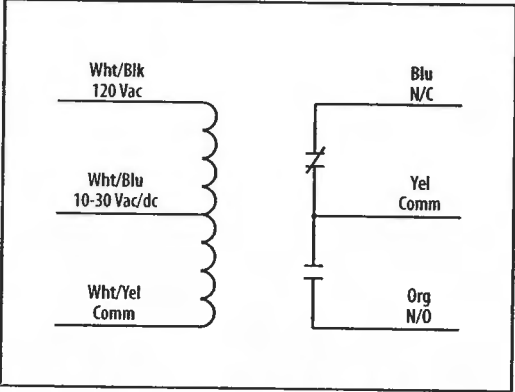



**Contact Ratings:**  
 10 Amp Resistive @ 120-277 Vac  
 10 Amp Resistive @ 28 Vdc  
 480 VA Pilot Duty @ 240-277 Vac  
 480 VA Ballast @ 277 Vac  
 600 Watt Tungsten @ 120 Vac N/O  
 240 Watt Tungsten @ 120 Vac N/C  
 1/3 HP for N/O @ 120-240 Vac  
 1/6 HP for N/C @ 120-240 Vac  
 1/4 HP for N/O @ 277 Vac  
 1/8 HP for N/C @ 277 Vac

**# Relays & Contact Type:** One (1) SPDT Continuous Duty Coil  
**Expected Relay Life:** 10 million cycles minimum mechanical  
**Operating Temperature:** -30 to 140° F  
**Operate Time:** 20mS  
**Relay Status:** LED On = Activated  
**Dimensions:** 1.70" x 2.80" x 1.50" with .50" NPT nipple  
**Wires:** 16', 600V Rated  
**Approvals:** UL Listed, UL916, UL864, C-UL Canada  
 California State Fire Marshal, CE Approved  
**Housing Rating:** Plenum, NEMA 1  
**Gold Flash:** Yes  
**Override Switch:** No


**Coil Current:**  
 30 mA @ 10 Vac    12 mA @ 10 Vdc  
 32 mA @ 12 Vac    14 mA @ 12 Vdc  
 42 mA @ 24 Vac    16 mA @ 24 Vdc  
 50 mA @ 30 Vac    18 mA @ 30 Vdc  
 25 mA @ 120 Vac

**Coil Voltage Input:**  
 10-30 Vac/dc ; 120 Vac ; 50-60 Hz  
 Drop Out = 2.1 Vac / 2.8 Vdc  
 Pull In = 9 Vac / 10 Vdc





RIBU1C-RD  
» Red housing

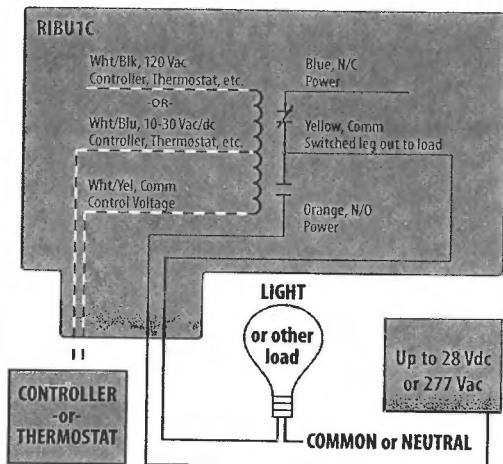


RIBU1C-N4  
» NEMA 4X housing

**Notes:**

**TYPICAL RIBU1C INSTALLATION**

Allow a controller, thermostat, etc. to control any load.



**ENCLOSED 10 AMP**

- RIBU1C
- RIBU1C-RD
- RIBU1C-N4

# PSH75A SERIES

Enclosed Single 75 VA Power Supplies, 480/277/240/208/120 Vac to 24 Vac



**Class II**



Model Shown:  
PSH75A10

Functional Devices, Inc. A600B 2004

### GENERAL SPECIFICATIONS

- Transformer:** One 75VA Split-Bobbin
- Primary:** 480/277/240/208/120 Vac
- Secondary:** 24 Vac, w/ LED Indicator
- 24 Vac ON/OFF:** Switch / Breaker (3 Amp)
- Main Breaker ON/OFF:** Switch / Breaker (10 Amp)
- Outputs:** Outlets (2)  
Aux. Output Wire (1)  
Total Combined Output 9A
- Approvals:** Class II UL Listed, UL916, C-UL Canada
- Dimensions:** W=5.15", H=4.25", D=3.75"
- Weight:** 4.5 lbs.

### INPUT WIRES

"B10" Models Only

#### INPUT POWER WIRES

- Black: 120 Vac
- White: Neutral
- Green: Ground

All Other Models

#### PRIMARY WIRES

- Grey: 480 Vac
- Brown: 277 Vac
- Orange: 240 Vac
- Red: 208 Vac
- White: 120 Vac
- Black: Common

#### OUTLET WIRES

- Black: 120 Vac
- White: Neutral
- Green: Ground

### OUTPUT WIRES

"B10" Models Only  
120 Vac, 1 Aux. Output Wire (Blue)

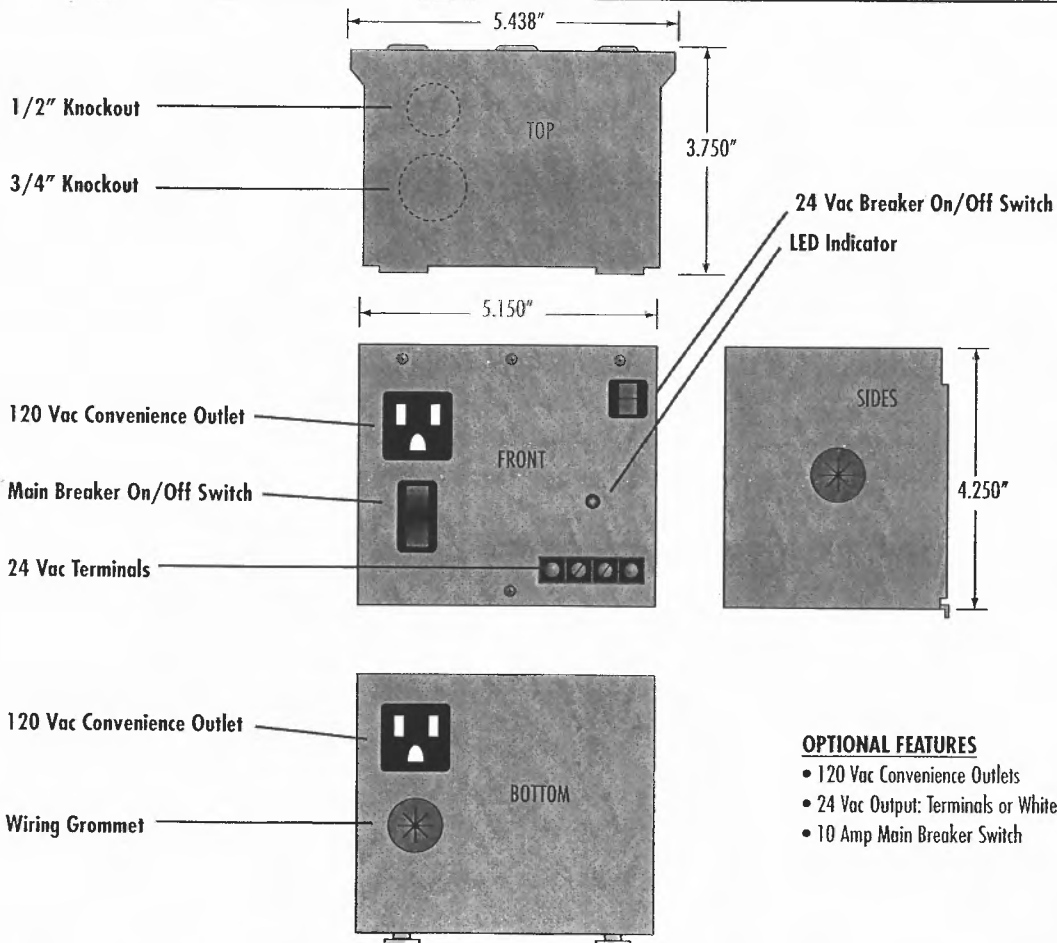
"W" Models Only  
24 Vac, 2 Wires (White/Yellow)

### NOTES

- Mounting plate included with all models.

### PSH75A SELECTION GUIDE

MODEL #	120 VAC OUTLETS	AUX. OUTPUT WIRE	MAIN BREAKER ON INPUT POWER	SECONDARY CONFIGURATION
PSH75A	•			External Terminal Strip
PSH75AN				External Terminal Strip
PSH75ANW				Internal Wires
PSH75AW	•			Internal Wires
PSH75A10	•	•	10A Switch / Breaker	External Terminal Strip
PSH75ANB10		•	10A Switch / Breaker	External Terminal Strip
PSH75ANWB10		•	10A Switch / Breaker	Internal Wires
PSH75AWB10	•	•	10A Switch / Breaker	Internal Wires



### OPTIONAL FEATURES

- 120 Vac Convenience Outlets
- 24 Vac Output: Terminals or White/Yellow Wires
- 10 Amp Main Breaker Switch



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Manufacturing quality products in the United States of America since 1969

**PSH500A**

Enclosed 500VA Power Supply with Five 100VA Class II Outputs, 240/120 Vac to 24 Vac

Shown Without Cover



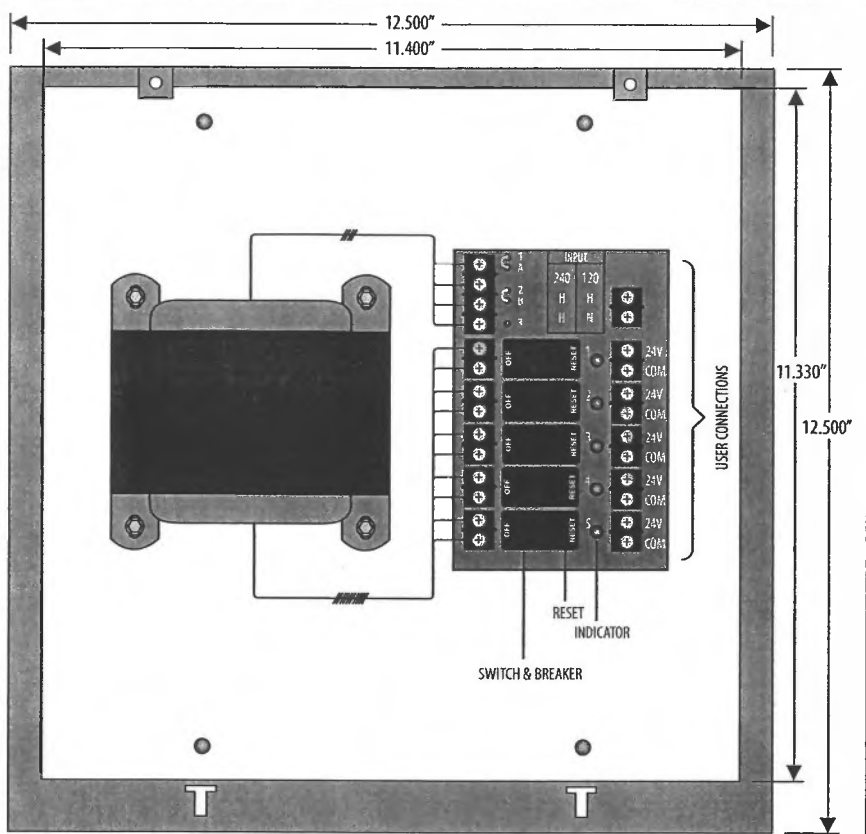
Shown With Cover



Functional Devices, Inc. A600C 2005

- Transformer:** One (1) 500 VA
- Primary:** 240/120 Vac
- 5 Secondaries:** 24 Vac, with LED Indicators
- 24 Vac ON/OFF:** Switch / Breaker
- Dimensions:** 12.500" x 12.500" x 7.000"
- Approvals:** Class II UL Listed, UL916, C-UL Canada
- Housing:** NEMA1 Metal Enclosure  
See MH3300 on page 119 for details
- Sub-Panel:** Plenum Rated Polymetal Sub-Panel
- Weight:** 30.16 lbs.
- Input:** 240/120 Vac Terminals, Jumper Selectable
- Output:** 5 Isolated 100 VA Class II 24 Vac Terminals
- Jumper Setup:** 240/120 Vac Selectable (Factory set to 240 Vac)
- 240 Vac:** Jumper A to 1, Jumper B to 2
- 120 Vac:** Jumper A to 2, Jumper B to 3

**Notes:**  
 » Power supply assembly and metal enclosure are shipped separately  
 » Order the power supply assembly without metal enclosure by using model number PSMN500A



**Notes:**

Blank area for additional notes.

# Hawkeye® Mini Split-Core Adjustable Setpoint Digital Output Current Switches 608 Series

22



The Hawkeye 608 Series is a high performance miniature split-core current status switch. Its low minimum setpoint (1.25A) and small size make it ideal for monitoring status of small to medium motor loads. With an amperage range of 1.25 to 50 amps, the 608 series can accurately detect belt loss, coupling shear, or other mechanical failure on loads from 1/5 to 40HP.

**APPLICATIONS**

- Detect belt loss, coupling shear and mechanical failure
- Verify lighting circuit and other electrical service run times
- Monitor status of industrial process equipment
- Monitor status of critical motors (compressor, fuel, etc.)

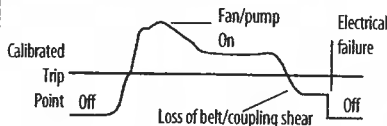
**New high performance miniature split-core**

- Low (1.25A) minimum setpoint...eliminates the need for multiple wraps of the conductor through the sensor even on loads as small as 1/5HP
- Small size fits easily inside small starter enclosures
- Self-gripping iris eliminates the need for drill mounting...easy installation
- Status LEDs for easy setup and local indication
- 1 Amp status output for increased application flexibility

**Monitor status of fans, pumps & electrical loads**

- Detects belt loss and mechanical failure...ideal for fan/pump status monitoring
- Reliable cost-effective fan/pump status sensor...the 608 series replaces pressure switches and other electromechanical devices...no fitting or tapping required
- Adjustable set point (1.25-50A)
- 100% solid state...no moving parts to fail
- Mounting bracket for installation flexibility
- 5-year limited warranty

**Detects belt loss/coupling shear!**



Now you can easily detect when drive belts slip, break, or pump couplings shear. In fact, a typical HVAC motor that loses its load has a reduction of current draw of up to 50%. That's why our sensors are the industry standard for status.



**ORDERING INFORMATION**

MODEL	AMPERAGE RANGE	OUTPUT TYPE (MAX.)	TRIP POINT ADJUSTMENT	STATUS OPEN LED	STATUS CLOSED LED
H608	1.25 - 50A	N.O. 1.0A@30VAC/DC	●	●	●
H606*	1.25 - 50A	N.C. .1A@30VDC	●	●	●
H609	1.25 - 50A	N.O. .2A@120VAC/DC	●	●	●

\*Hx06 Models require a constant source of 5-30VDC power to the status contacts

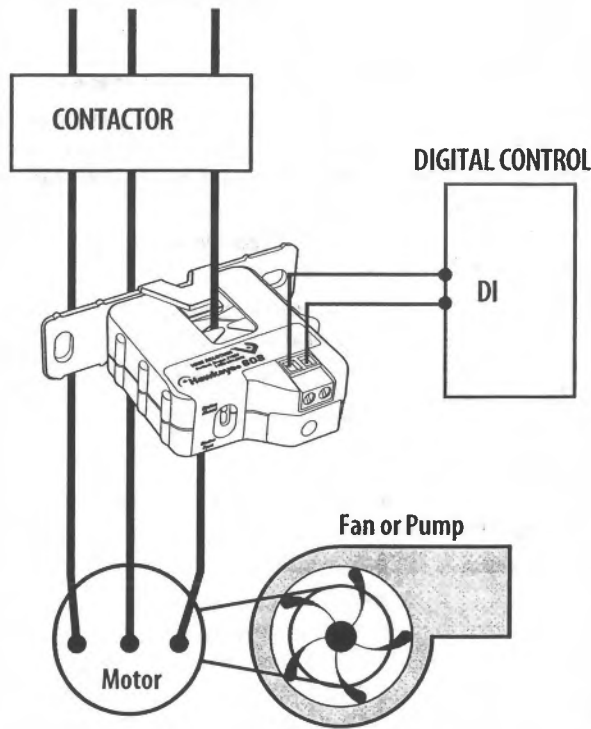


Do not use the LED indicators for evidence of applied voltage

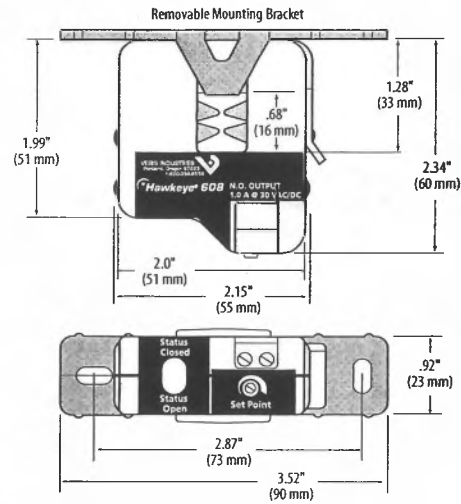
**ACCESSORIES**

MODEL	DESCRIPTION
AH01	DIN Rail Clip Set

APPLICATIONS/WIRING EXAMPLE



DIMENSIONAL DRAWINGS



NO!



YES!



**The H608 Won't Hang At the Bottom of the Box.**

The H608's self gripping teeth free up the installer's hands making it possible to perform a one hand calibration.

NO!



YES!



**The H608 Eliminates Extra Enclosures.**

The H608's small size (2.33" x 2.0") eliminates the need for extra electrical enclosures and saves you installation time.

NO!



YES!



**The H608 Does Not Require Extra Wraps.**

With a low 1.25 Amp turn-on, multiple wraps of wire through the sensor are eliminated even on loads as small as 1/5HP.

**SPECIFICATIONS**

Amperage Range	1.25 to 50A
Sensor Power	Induced
Output	Digital switch (see ordering table)
Insulation Class	600VAC rms
Frequency Range	50/60 Hz.
Temperature Range	15° to 60°C
Humidity Range	0 - 95% non-condensing
Hysteresis	10% (typical)
Trip Setpoint	Adjustable 1.25 to 50A
Dimensions... (L x W x H)	(2.34" x 2.0" x .92")
Sensor Opening Size... (L x W)	.52" x .68"
<i>Status Contacts (Hx06 Models)</i>	
Supply Voltage	5-30VDC, permanently connected
Off-state Leakage (max.)	24µA@30VDC
On-state Voltage Drop	1.7VDC (max.)@0.1A



# Installation Instructions

## H608

### Split-Core Adjustable Current Switch



H608



- *This product is not intended for life or safety applications. This product is not intended for installation in hazardous or classified locations.*
- *Potential electrocution hazard exists. Installing sensors in an energized motor control center or on any energized conductor can be hazardous.*
- *Read instructions thoroughly prior to installation.*

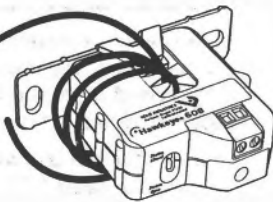
*Severe injury or death can result from electrical shock during contact with high voltage conductors or related equipment. Disconnect and lock-out all power sources during installation and service. Applications shown are suggested means of installing sensors, but it is the responsibility of the installer to ensure that the installation is in compliance with all national and local codes. Installation should be attempted only by individuals familiar with codes, standards, and proper safety procedures for high-voltage installations.*

#### INSTALLATION NOTES

**1. For currents less than 1.25 Amps:**

To provide adequate current, wrap the conductor through the center hole and around the sensor body to produce multiple passes and increase measured current.

- *Measured current = Actual current times the number of passes.*

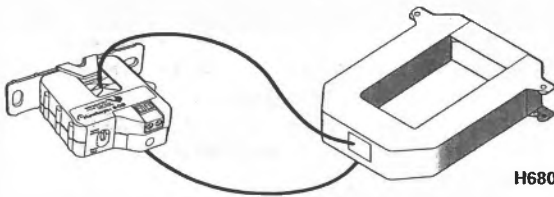


example: 4 passes

**2. For currents greater than 50 Amps:**

In order to monitor currents greater than 50 Amps, a 5 Amp current transformer may be used. Run the CT secondary wire through the current sensor. Terminate the two secondary wires of the 5 Amp CT to each other. Then install the 5 Amp CT (H6800 Series) on the conductor being monitored.

**CAUTION:** CT's can contain hazardous voltages. Install CT's in accordance to manufacturers specifications and instructions. (Terminate the secondary CT before applying current through it.)



H6800-5A CT

#### VERIS INDUSTRIES

10831 S.W. CASCADE BLVD.  
PORTLAND, OREGON 97223  
(503) 598-4564 FAX (503) 598-4664  
1-800-354-8556

<http://www.veris.com> email:sales@veris.com



#### INSTALLATION

1. Ensure power conductor to be monitored is disconnected and locked out from the power source!
2. Install the removable mounting bracket to the back of the electrical enclosure.
3. Snap the split core around the conductor being monitored and close until the core snaps shut.

**NOTES:**

- To monitor current under 1.25 Amps please see installation note #1.
- To monitor current above 50 Amps please see installation note #2.

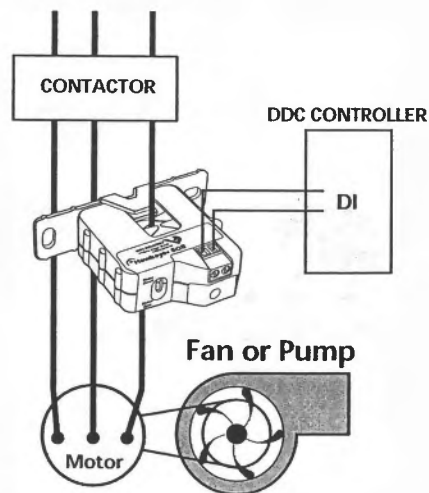
4. Connect current switch output to DDC controller or switched load.

**NOTE:**

- Contacts are solid state and work just like dry contacts. When the switch is closed 1 Ohm is present. When the switch is open more than 1 Meg Ohm is present.

5. Calibrate the sensor (see calibration section)

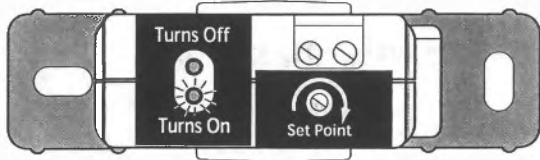
#### WIRING EXAMPLE



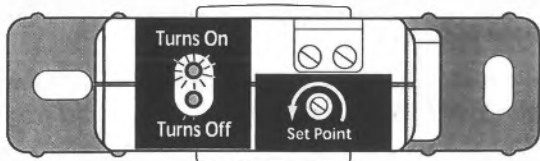
## CALIBRATION AFTER INSTALLATION

Orient the current switch so the status output terminal is facing you and follow method (A) (undercurrent) or (B) (over-current), below. The monitored motor must be running normally.

### A. For under current status indication: (Belt loss, coupling shear, fan & pump status)



**STEP 1:** Turn the setpoint screw clockwise until the Status Closed LED turns off and the Status Open LED turns on.



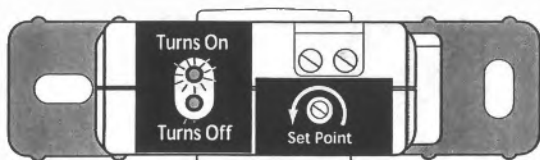
**STEP 2:** Slowly turn the setpoint screw counter-clockwise until the Status Closed LED turns on and the Status Open LED turns off.

**STEP 3:** Turn the setpoint screw 1/4 turn more counter-clockwise to create a grace margin.

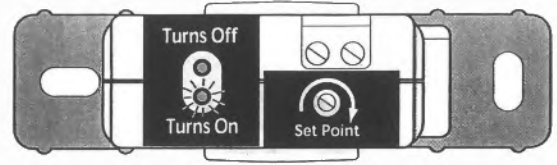
**STEP 4:** The sensor is now calibrated to provide indication of current flows below normal full load amps.

Output Status:  
Normal: Output Closed  
Alarm: Output Open

### B. For over current status indication: (Locked rotor, seized impeller)



**STEP 1:** Turn the setpoint screw counter-clockwise until the Status Open LED turns off and the Status Closed LED turns on. (Sensor should be in this state right out of the box.)



**STEP 2:** Slowly turn the setpoint screw clockwise until the Status Closed LED turns off and the Status Open LED turns on.

**STEP 3:** Turn the setpoint screw 1/4 turn more clockwise to create a grace margin.

**STEP 4:** The sensor is now calibrated to provide indication of current flows above normal full load amps.

Output Status:  
Normal: Output Open  
Alarm: Output Closed

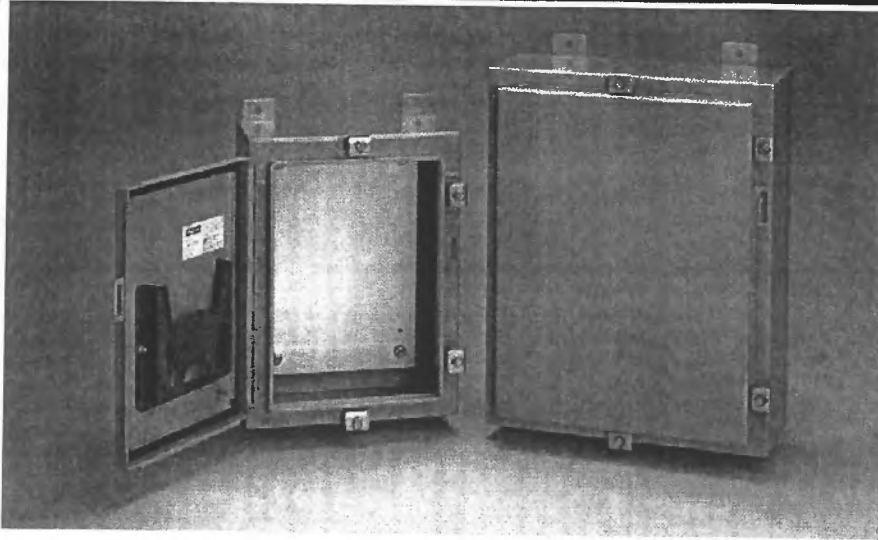
## SPECIFICATIONS

Amperage Range .....	1.25-50A Continuous
Sensor Supply Voltage .....	Induced from monitored conductor
Isolation .....	600VAC rms. (max. voltage when monitoring an uninsulated conductor)
Temperature Range .....	-15° to 60° C
Humidity Range .....	0-95% non-condensing
Status Output Ratings .....	N.O. 1.0A@30VAC/DC not polarity sensitive
Off-state Leakage .....	0 (open switch represents 1+ MEG ohms of resistance)
Listings .....	UL US UL508 E150462 CE

## TROUBLESHOOTING

1. **The unit will not come on at all.**
  - A. Check to be sure that no more than 30VAC/DC or 1.0A has passed through the contact. Voltages or currents above these levels will damage the unit.
  - B. Verify that the conductor you are monitoring is carrying at least 1.25 Amps. **If the sensor is monitoring less than 1.25 Amps, employ installation note #1 (pg. 1)**
  - C. Verify that the setpoint is not above operating amps by turning screw counter-clockwise (up to 20 full turns) until the contacts close (status closed LED turns on).
2. **Set-point screw has no stops. Keeps turning.**
  - A. The 20 turn set-point screw has a slip clutch which prevents damage at either end. To start the calibration process over again turn the screw 20 full turns counter-clockwise. This sets the device in its original and most sensitive position. Resume calibration from the beginning.
3. **Both LED's are lit.**
  - A. If the setpoint screw has been turned too far to the right the user will be notified that the current switch is out of calibration by seeing both LED's lit. To correct this, turn the set-point screw 20 full turns counter-clockwise and resume calibration from the beginning.

## Single-Door Type 4 Enclosures



### Application

For use in housing electrical and electronic controls, instruments, components, and associated wiring, these enclosures incorporate hinged doors that provide convenient access. Designed for indoor or outdoor use in protecting components from dust, dirt, oil, and hose-directed water.

### Construction

- 16 or 14 gauge steel (see table)
- Seams continuously welded and ground smooth, no holes or knockouts
- External wall-mounting brackets
- Rolled flanges exclude liquids and contaminants
- Stainless steel door clamps on three sides of door for watertight seal
- Removable heavy gauge stainless steel continuous hinge pin
- Hasp and staple provided for padlocking
- Data pocket is high-impact thermoplastic
- Oil-resistant door gasket attached with oil resistant adhesive
- Collar studs provided for mounting optional panels
- Bonding provision on door

### Finish

ANSI 61 gray polyester powder paint inside and out over phosphatized surfaces. Optional panels are white.

### Industry Standards

UL 508A, 508, File No. E61997: Type 4, Type 12, and Type 13  
 NEMA/EEMAC Type 3, Type 4, Type 12, and Type 13  
 JIC standard EGP-1-1967 (14 gauge only)  
 CSA, File No. LR42186, Type 4 and Type 12  
 IEC 60529, IP66

### Accessories

See Chapter 12, General Accessories.

Clamp Kit  
 Corrosion Inhibitors  
 Door Stop Kit  
 Drip Shield Kit  
 Electrical Interlocks  
 Enclosure Stabilizer  
 Fast Operating Clamp Assembly  
 Floor Stand Kit  
 Lighting Kit  
 Lock Kit  
 Panel Support Kit  
 Panels (see table)  
 Rack Mounting Angle Kit  
 Swing-Out Panel Kit  
 Terminal Block Kit Assembly  
 Touch-Up Paint (ATPPY61)  
 Window Kit  
 Wiring Duct

### Modification Services Program

You can customize this product to your unique requirements by specifying from these options:

- Enclosure height, width, depth
- Over 100 standard finish colors and textures
- Holes and cutouts in body, doors, subpanels
- Tapped holes, fasteners in enclosure or subpanel
- Mounting
- Doors
- Subpanels
- Structural changes
- Environmental control (louvers, fans, filters)
- Windows
- Standard accessories

For details, see Modification Services at [www.hoffmanonline.com](http://www.hoffmanonline.com).

To order, contact your local Hoffman sales representative.

**NOTE:** For information about modifications outside the scope of the Modification Services program, contact your Hoffman sales representative.



**Standard Sizes Single-Door Type 4 Enclosures**

Enclosure Catalog Number	Body Gauge	Enclosure Size A x B x C	* Panel Catalog Number	Panel Size D x E	F	Number of Clamps	Data Pocket
A16H12ALP	16	16.00 x 12.00 x 6.00 (406 x 305 x 152)	A16P12	13.00 x 9.00 (330 x 229)	1.25 (32)	4	Small
A16H16ALP	16	16.00 x 16.00 x 6.00 (406 x 406 x 152)	A16P16	13.00 x 13.00 (330 x 330)	3.00 (76)	4	Small
A16H20ALP	16	16.00 x 20.00 x 6.00 (406 x 508 x 152)	A20P16	17.00 x 13.00 (432 x 330)	3.00 (76)	4	Small
A20H16ALP	16	20.00 x 16.00 x 6.00 (508 x 406 x 152)	A20P16	17.00 x 13.00 (432 x 330)	3.00 (76)	4	Small
A20H20ALP	16	20.00 x 20.00 x 6.00 (508 x 508 x 152)	A20P20	17.00 x 17.00 (432 x 432)	3.00 (76)	4	Small
A24H12ALP	16	24.00 x 12.00 x 6.00 (610 x 305 x 152)	A12P24	9.00 x 21.00 (229 x 533)	1.25 (32)	5	Small
A24H16ALP	16	24.00 x 16.00 x 6.00 (610 x 406 x 152)	A24P16	21.00 x 13.00 (533 x 330)	3.00 (76)	5	Small
A24H20ALP	16	24.00 x 20.00 x 6.00 (610 x 508 x 152)	A24P20	21.00 x 17.00 (533 x 432)	3.00 (76)	5	Small
A24H24ALP	16	24.00 x 24.00 x 6.00 (610 x 610 x 152)	A24P24	21.00 x 21.00 (533 x 533)	3.00 (76)	5	Small
A30H20ALP	14	30.00 x 20.00 x 6.00 (762 x 508 x 152)	A30P20	27.00 x 17.00 (686 x 432)	3.00 (76)	5	Small
A30H24ALP	14	30.00 x 24.00 x 6.00 (762 x 610 x 152)	A30P24	27.00 x 21.00 (686 x 533)	3.00 (76)	5	Large
A36H24ALP	14	36.00 x 24.00 x 6.00 (914 x 610 x 152)	A36P24	33.00 x 21.00 (838 x 533)	3.00 (76)	5	Large
A16H12BLP	16	16.00 x 12.00 x 8.00 (406 x 305 x 203)	A16P12	13.00 x 9.00 (330 x 229)	1.25 (32)	4	Small
A20H16BLP	16	20.00 x 16.00 x 8.00 (508 x 406 x 203)	A20P16	17.00 x 13.00 (432 x 330)	3.00 (76)	4	Small
A20H20BLP	16	20.00 x 20.00 x 8.00 (508 x 508 x 203)	A20P20	17.00 x 17.00 (432 x 432)	3.00 (76)	4	Small
A20H24BLP	16	20.00 x 24.00 x 8.00 (508 x 610 x 203)	A24P20	21.00 x 17.00 (533 x 432)	3.00 (76)	4	Small
A24H20BLP	16	24.00 x 20.00 x 8.00 (610 x 508 x 203)	A24P20	21.00 x 17.00 (533 x 432)	3.00 (76)	5	Small
A24H24BLP	16	24.00 x 24.00 x 8.00 (610 x 610 x 203)	A24P24	21.00 x 21.00 (533 x 533)	3.00 (76)	5	Small
A24H30BLP	14	24.00 x 30.00 x 8.00 (610 x 762 x 203)	A30P24	27.00 x 21.00 (686 x 533)	3.00 (76)	7	Small
A30H20BLP	14	30.00 x 20.00 x 8.00 (762 x 508 x 203)	A30P20	27.00 x 17.00 (686 x 432)	3.00 (76)	5	Small
A30H24BLP	14	30.00 x 24.00 x 8.00 (762 x 610 x 203)	A30P24	27.00 x 21.00 (686 x 533)	3.00 (76)	5	Large

Continued on next page

# Single-Door Type 4 Enclosures

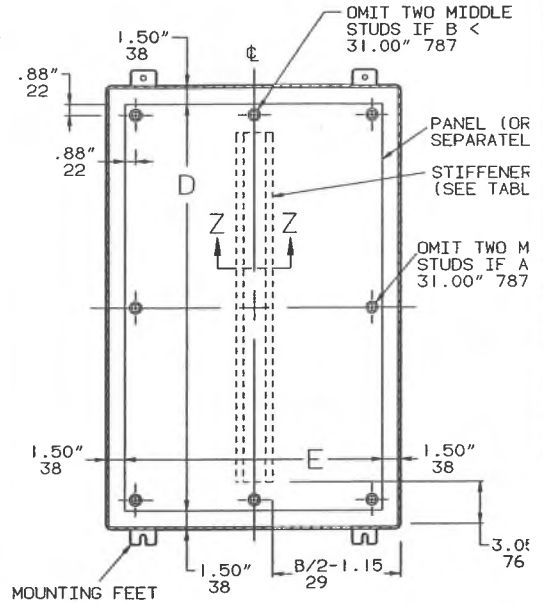
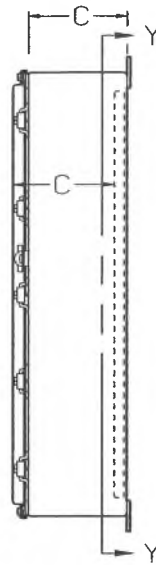
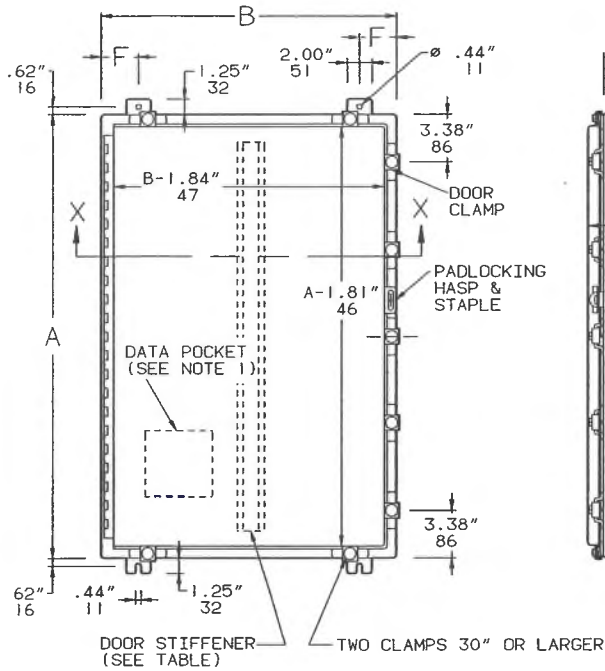
## Standard Sizes Single-Door Type 4 Enclosures (Cont.)

Enclosure Catalog Number	Body Gauge	Enclosure Size A x B x C	* Panel Catalog Number	Panel Size D x E	F	Number of Clamps	Data Pocket
A30H30BLP	14	30.00 x 30.00 x 8.00 (762 x 762 x 203)	A30P30	27.00 x 27.00 (686 x 686)	3.00 (76)	7	Large
A36H24BLP	14	36.00 x 24.00 x 8.00 (914 x 610 x 203)	A36P24	33.00 x 21.00 (838 x 533)	3.00 (76)	5	Large
A36H30BLP	14	36.00 x 30.00 x 8.00 (914 x 762 x 203)	A36P30	33.00 x 27.00 (838 x 686)	3.00 (76)	7	Large
A42H30BLP	14	42.00 x 30.00 x 8.00 (1067 x 762 x 203)	A42P30	39.00 x 27.00 (991 x 686)	3.00 (76)	8	Small
A42H36BLP	14	42.00 x 36.00 x 8.00 (1067 x 914 x 203)	A42P36	39.00 x 33.00 (991 x 838)	3.00 (76)	8	Large
A48H36BLP	14	48.00 x 36.00 x 8.00 (1219 x 914 x 203)	A48P36	45.00 x 33.00 (1143 x 838)	3.00 (76)	8	Large
A60H36BLP	14	60.00 x 36.00 x 8.00 (1524 x 914 x 203)	A60P36	57.00 x 33.00 (1448 x 838)	3.00 (76)	9	Large
A20H16CLP	14	20.00 x 16.00 x 10.00 (508 x 406 x 254)	A20P16	17.00 x 13.00 (432 x 330)	3.00 (76)	4	Small
A24H20CLP	14	24.00 x 20.00 x 10.00 (610 x 508 x 254)	A24P20	21.00 x 17.00 (533 x 432)	3.00 (76)	5	Small
A30H24CLP	14	30.00 x 24.00 x 10.00 (762 x 610 x 254)	A30P24	27.00 x 21.00 (686 x 533)	3.00 (76)	5	Large
A36H30CLP	14	36.00 x 30.00 x 10.00 (914 x 762 x 254)	A36P30	33.00 x 27.00 (838 x 686)	3.00 (76)	7	Large
A48H30CLP	14	48.00 x 30.00 x 10.00 (1219 x 762 x 254)	A48P30	45.00 x 27.00 (1143 x 686)	3.00 (76)	8	Small
A48H36CLP	14	48.00 x 36.00 x 10.00 (1219 x 914 x 254)	A48P36	45.00 x 33.00 (1143 x 838)	3.00 (76)	8	Large
A60H36CLP	14	60.00 x 36.00 x 10.00 (1524 x 914 x 254)	A60P36	57.00 x 33.00 (1448 x 838)	3.00 (76)	9	Large
A30H24DLP	14	30.00 x 24.00 x 12.00 (762 x 610 x 305)	A30P24	27.00 x 21.00 (686 x 533)	3.00 (76)	5	Large
A36H30DLP	14	36.00 x 30.00 x 12.00 (914 x 762 x 305)	A36P30	33.00 x 27.00 (838 x 686)	3.00 (76)	7	Large
A48H36DLP	14	48.00 x 36.00 x 12.00 (1219 x 914 x 305)	A48P36	45.00 x 33.00 (1143 x 838)	3.00 (76)	8	Large
A36H30FLP	14	36.00 x 30.00 x 16.00 (914 x 762 x 406)	A36P30	33.00 x 27.00 (838 x 686)	3.00 (76)	7	Large
A48H36FLP	14	48.00 x 36.00 x 16.00 (1219 x 914 x 406)	A48P36	45.00 x 33.00 (1143 x 838)	3.00 (76)	8	Large
A60H36FLP	14	60.00 x 36.00 x 16.00 (1524 x 914 x 406)	A60P36	57.00 x 33.00 (1448 x 838)	3.00 (76)	9	Large

Millimeter dimensions ( ) are for reference only; do not convert metric dimensions to inch.

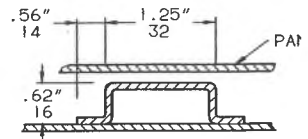
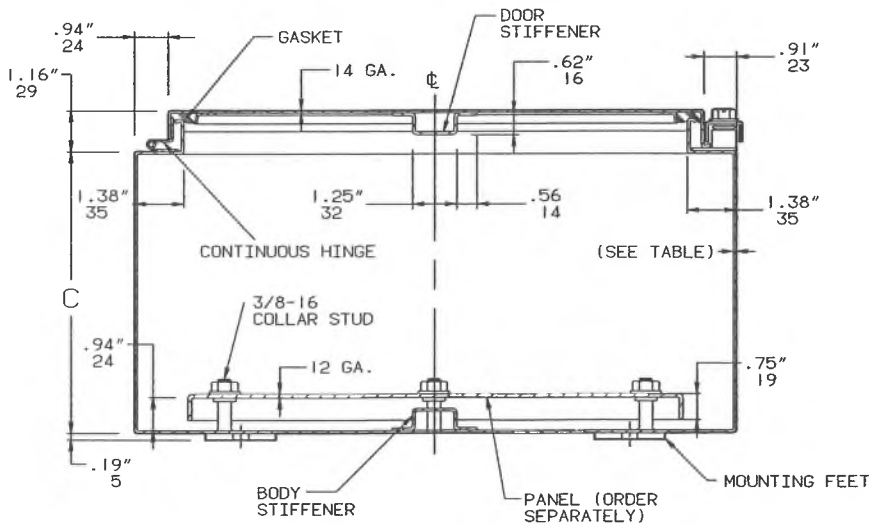
\* Panels must be ordered separately. Optional stainless steel, zinc-plated, composite, and aluminum panels are available for most sizes. See General Accessories.

NOTE: Panels have a formed flange on any side that is longer than 21.00 in. (533mm). Panel A24P20 has a flange on all four sides.



Number of Body Studs		
Enclosure Size A	Enclosure Size B	Qty of Studs
>31.00 (787)	Any	6
Any	>31.00 (787)	6

NOTE: Maximum spacing between door clamps is 15.00 in. (382mm).



C24E

**Wheeler Ops Bldg  
Room 103  
Lithonia Panel**

**WARNING**  
WARRANTY VOID IF CONTROLLER REMOVED WITH POWER APPLIED  
Power switch must be off for 5 seconds before removing controller  
Powered removal can cause memory failure  
SYSC MLLX COCLB00031

**LITHONIA LIGHTING**

MODE = STATIC  
MAC = 010.245.020.047  
IPXK = 255.255.000.000  
GATE = 010.245.030.001

NETWORK  
DMA  
LOCAL

1 2 3  
4 5 6  
7 8 9  
BACK 0 ENTER

▲  
▼  
+-

MB 8L  
12A 120V MAX BRKR LOAD  
12A 277V MAX BRKR LOAD  
12A 120V MAX BRKR LOAD  
12A 277V MAX BRKR LOAD  
12A 347V MAX BRKR LOAD  
12A 347V MAX BRKR LOAD

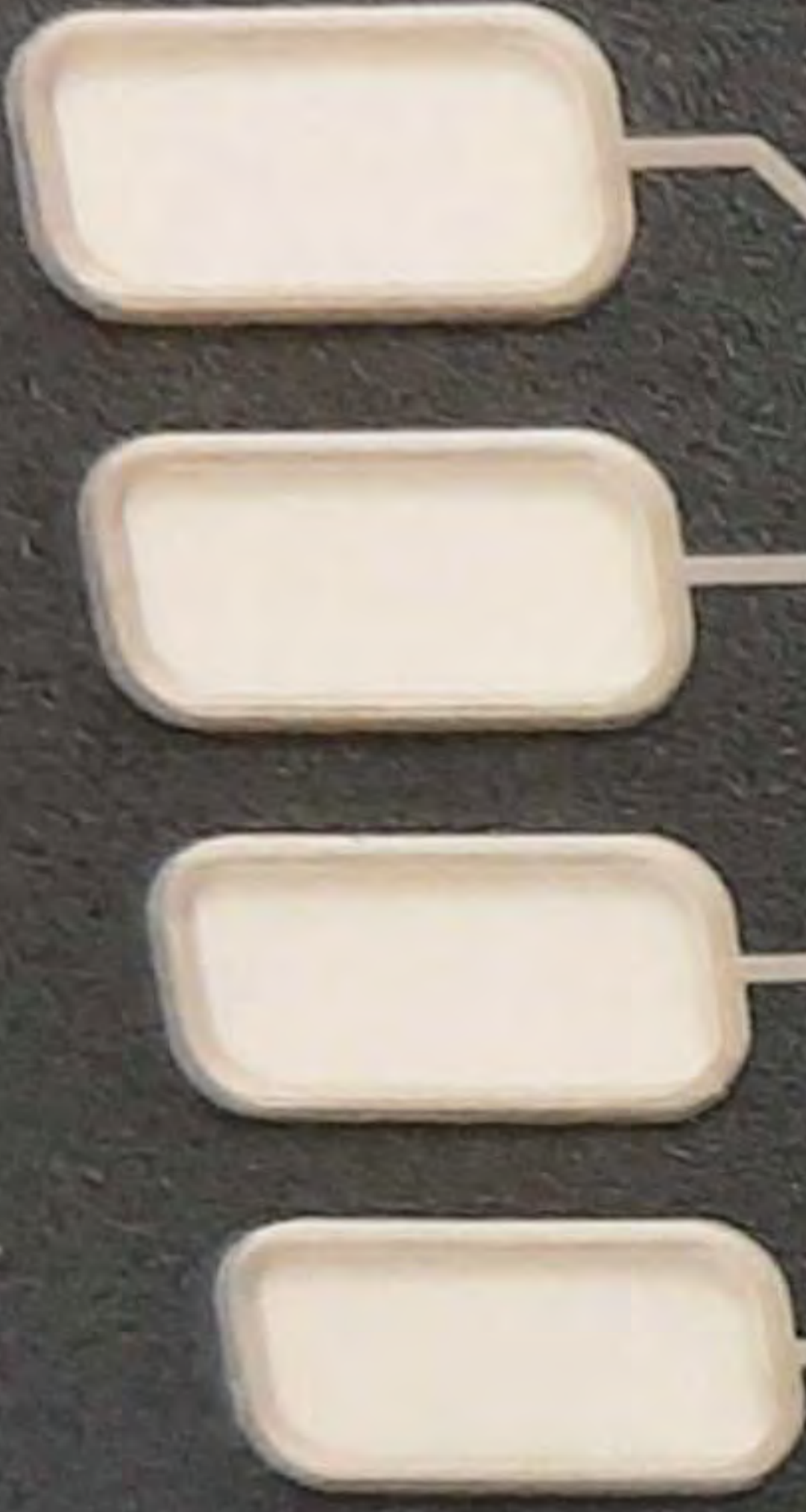
30A 277V  
1400VA  
1400VA  
1400VA  
1400VA

GROUND

120/230/277  
LITHONIA LIGHTING

GET CARD ABOVE TO ADDRESS "1"  
ADDRESS CARDS WITH POWER OFF  
AND BEFORE CONNECTING RIBBON CABLE  
GET CARD BELOW TO ADDRESS "2"





```

TYPE = Static
ADDR=010.245.020.047
MASK=255.255.000.000
GATE=010.245.030.001

```

- NETWORK
- DMX
- LOCAL

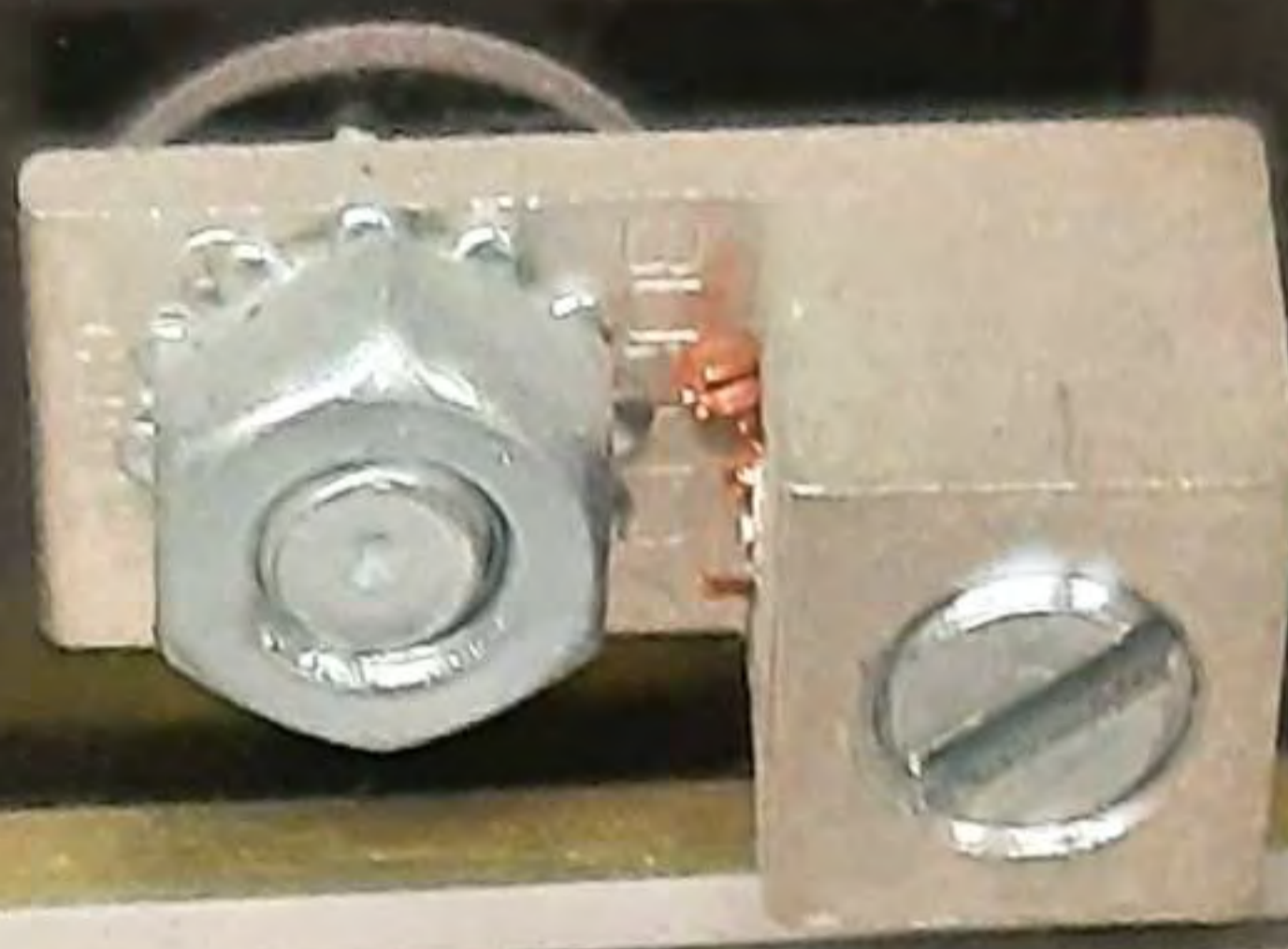
1	2	3
4	5	6
7	8	9
BACK	0	ENTER

Navigation buttons: Up arrow, Down arrow, Left arrow, Right arrow, and a central cross button.



**Wheeler Ops Bldg  
Room 123  
Lithonia Panel**

**GROUND**



**SYNERGY**

MADE IN U.S.A.  
LISTED **C**  
ENCLOSED ENERGY MANAGEMENT EQUIPMENT 48E4

SYE  S  
 M  
 L

120/230/277  
**SLP-2**

FA  
 FE

# **8** ↗

SYA NKIT RATING: 150 AMPS MAX  
POWER SUPPLY INPUT: 120/230/277 @ 50/60HZ 300VA MAX  
Max Ambient: 104°F/40°C. Use minimum 90°C, Copper Conductors Only  
Input Terminal Torque Rating – 4.5 inch-pounds

WARNING – To Reduce The Risk of Fire or Electric Shock,  
Install in a Controlled Environment Relatively Free of Contaminants

CAUTION – RISK OF ELECTRIC SHOCK – MORE THAN ONE DISCONNECT SWITCH  
MAY BE REQUIRED TO DE-ENERGIZE THE EQUIPMENT BEFORE SERVICING  
ATTENTION: RISQUE DE CHOC ELECTRIQUE. IL Y AURAIT DES SECTIONNEURS  
MULTIPLES OU UNE COUPURE DU BRANCHMENT PARTICULIER EXTERIEUR.  
CHAQUE COUPURE DOIT ETRE FERMEE AVANT DE FAIRE LE DEPENNAGE.

**LITHONIA LIGHTING**

ONE LITHONIA WAY, DECATUR, GEORGIA 30035, TELEPHONE 770-987-4200  
FAX 770-987-1002, A DIV. OF LITHONIA LIGHTING • IN CANADA: 110 50TH AVE.  
LACHINE, QUEBEC H8T 2V3, A DIV. OF ACUITY BRANDS, INC.

0703S1  
CDCUBO

**SYNERGY**  
LIGHTING CONTROL  
Air-MultiTouch Group

YPMBL  
 YPMBL

16A 120V MAX BRKR LO  
 16A 277V MAX BRKR LO  
 12A 120V MAX BRKR LO  
 12A 277V MAX BRKR LO  
 16A 347V MAX BRKR LO  
 12A 347V MAX BRKR LO

0 27  
CARD ADDRESS  
See section 57C, Circuit  
Inductors City, PCB Ter  
nique Rating - 18 inch p  
inch 21 - 1/8 inch dia  
Made in  
U.S.A.  
Energy Management E  
404

30A 277V  
HID Ballast  
18,000 Hours  
Energy Management  
1/2" Dia. 1/8" Dia. 1/8" Dia.  
1/2" Dia. 1/8" Dia. 1/8" Dia.

SET CARD ABOVE TO ADDRESS  
ADDRESS CARDS WITH POWER OFF  
AND BEFORE CONNECTING BRICK CABLE

SET CARD BELOW TO ADDRESS '2'

**SYNERGY**  
SYE 120/230/277  
SLP-2  
FA  
FE  
8

27A 120V MAX  
POWER SUPPLY INPUT 100/200/277V 50/60HZ 300VA MAX  
Risk Reduction - 100% Efficacy One program per 100' Control Conduits Only  
Input Terminal Torque Rating - 4.5 Inch-pounds  
Warning - To Reduce The Risk of Fire or Electric Shock  
Install in a Controlled Environment (Indoors) Free of Combustibles  
CAUTION - RISK OF ELECTRIC SHOCK - MORE THAN ONE DISCONNECT SWITCH  
MAY BE REQUIRED TO DE-ENERGIZE THE EQUIPMENT BEFORE SERVICING  
ATTENTION - RISQUE DE CHOC ELECTRIQUE - IL Y AURA DES DISCONNECTEURS  
MULTIPLES OU UNE COUPEURE DU BRANCHEMENT PARTICULIER EXTERIEUR  
CHACQUE COUPEURE DOIT ETRE PRIME AVANT DE FAIRE LE DEBRAYAGE

**LITHONIA LIGHTING**

**WARRANTY VOID IF CONTROLLER REMOVED WITH POWER APPLIED**  
Power switches must be off for 5 seconds before removing controller  
Power removal can cause damage  
SYNERGY  
ALX  
CCCL000031

START...  
DISPLAY...  
10/26/2021 12:46

1 2 3  
4 5 6  
7 8 9  
BACK 0 ENTER

NETWORK  
DIMX  
LOCAL

GROUND

**Wheeler Ops Bldg  
Room 134  
Lithonia Panel**

42

10

14 6

7

15

LINE

8

Load 14 15

BY 15A 120V MAX BREAK LOAD  
 BY 20A 120V MAX BREAK LOAD  
 BY 30A 120V MAX BREAK LOAD  
 BY 40A 120V MAX BREAK LOAD  
 BY 50A 120V MAX BREAK LOAD  
 BY 60A 120V MAX BREAK LOAD  
 BY 75A 120V MAX BREAK LOAD  
 BY 100A 120V MAX BREAK LOAD  
 BY 15A 240V MAX BREAK LOAD

Due to minimum 80°C Copper  
 Conductors Only, PCB Terminal  
 Temperature Rating: 140°C possible  
 Terminals T1 - T48 are Class 2

MADE IN U.S.A.

UL LISTED  
 Energy Management Equipment  
 Model: 1000000000

... TO ADDRESS ...  
 ... POWER UP ...  
 ... BEEN CABLE ...  
 ... TO ADDRESS ...

E107081

FT1 - RoHS - 05/25/06 - 14124 (C050C2)

LL50550

14124 (C050C2)

14124 (C050C2)

14124 (C050C2)

Blue Ethernet cable bundle

SYNERGY  
 SYE 120/230/277 FA FE

LITHONIA LIGHTING

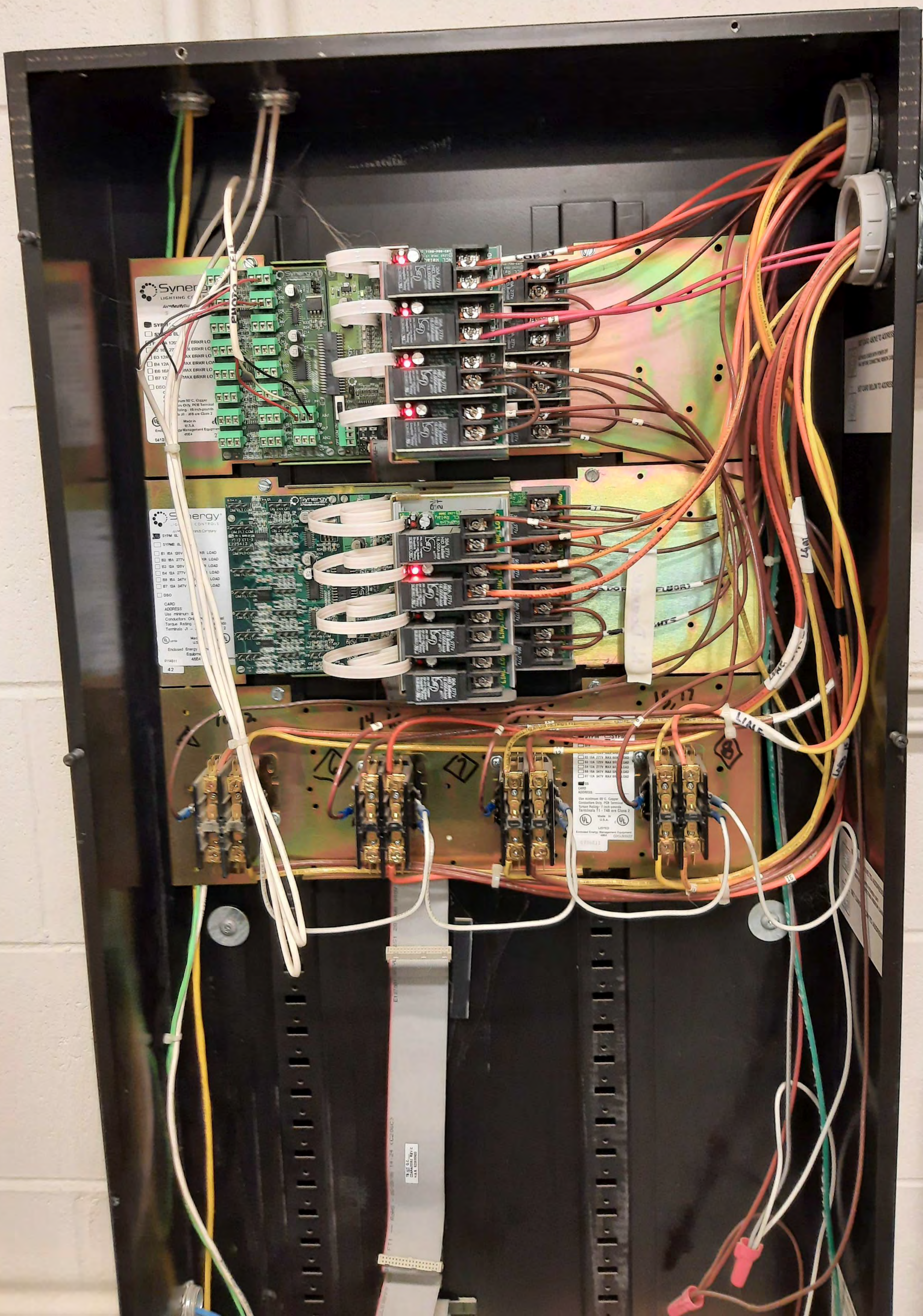
START...  
 DISPLAY...  
 10-22-2021 8:29

1 2 3  
 4 5 6  
 7 8 9  
 0 ENTER  
 BACK

NETWORK  
 DIMS  
 LOCAL

Installation Instructions - SYPR 8L  
 Three Phase Four Wire Load Details

GROUND



**Synergy Lighting Controls**

**SYN-EL**

<input type="checkbox"/>	SYN-EL
<input type="checkbox"/>	120V
<input type="checkbox"/>	120V
<input type="checkbox"/>	120V
<input type="checkbox"/>	120V
<input type="checkbox"/>	120V

MAX ERRR LO  
MAX ERRR LO  
MAX ERRR LO  
MAX ERRR LO  
MAX ERRR LO

Use maximum 90°C Copper  
Use Only PCB Terminal  
Rating: 18 inch spools  
to J1 - J18 are Class 2

Made in U.S.A.  
Synergy Management Equipment  
1884

**Synergy Controls**

**SYN-EL**

<input type="checkbox"/>	SYN-EL
<input type="checkbox"/>	120V
<input type="checkbox"/>	120V
<input type="checkbox"/>	120V
<input type="checkbox"/>	120V
<input type="checkbox"/>	120V

MAX ERRR LO  
MAX ERRR LO  
MAX ERRR LO  
MAX ERRR LO  
MAX ERRR LO

Use maximum 90°C Copper  
Use Only PCB Terminal  
Rating: 18 inch spools  
to J1 - J18 are Class 2

Made in U.S.A.  
Synergy Management Equipment  
1884

**Synergy Controls**

<input type="checkbox"/>	120V	10A LOAD
<input type="checkbox"/>	120V	10A LOAD
<input type="checkbox"/>	120V	10A LOAD
<input type="checkbox"/>	120V	10A LOAD
<input type="checkbox"/>	120V	10A LOAD
<input type="checkbox"/>	120V	10A LOAD
<input type="checkbox"/>	120V	10A LOAD
<input type="checkbox"/>	120V	10A LOAD

CARD ADDRESS: Use minimum 8 Connectors One Terminal Rating Terminal J1 -

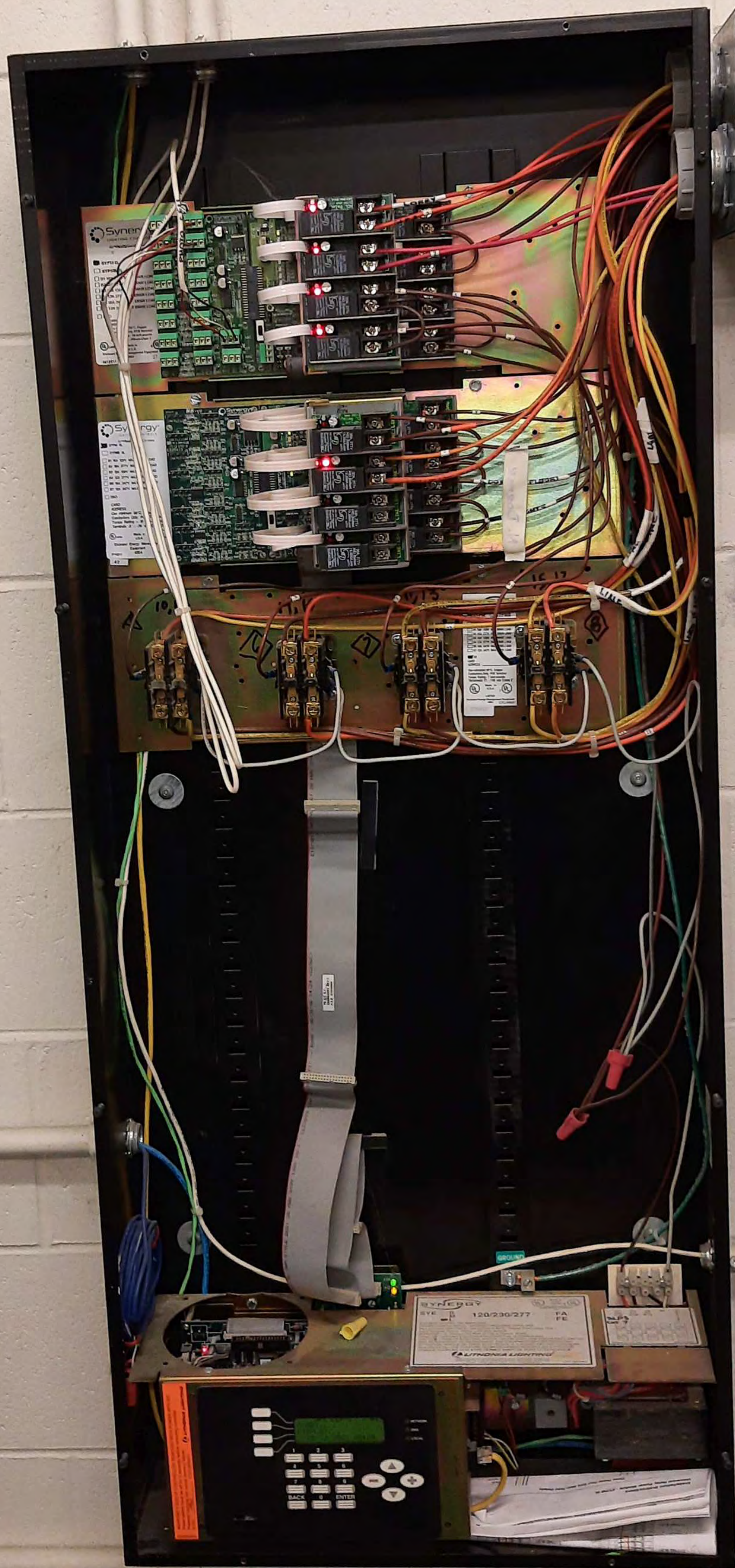
Made in U.S.A.  
Enclosed Energy Equipment  
E8664

42

Use maximum 90°C Copper  
Distribution Only PCB Terminal  
Rating: 18 inch spools  
to J1 - J18 are Class 2

Made in U.S.A.  
Synergy Management Equipment  
1884

**UL**  
LISTED  
Enclosed Energy Equipment





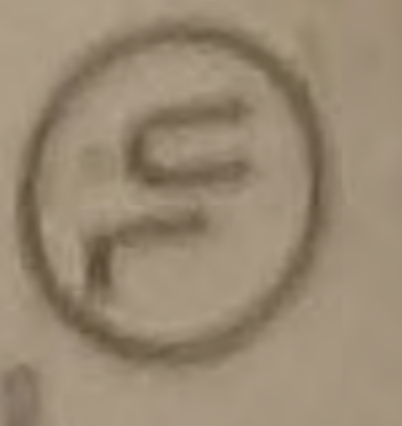
**SYNERGY**

SYE

S  
 M  
 L

120/230/277

FA  
 FE



MADE IN U.S.A.  
LISTED cUL



SYA NKIT RATING: 150 AMPS MAX

POWER SUPPLY INPUT: 120/230/277 @50/60HZ 300VA MAX

Max Ambient: 104°F/40°C. Use minimum 90°C, Copper Conductors Only

Input Terminal Torque Rating - 4.5 inch-pounds

WARNING - To Reduce The Risk of Fire or Electric Shock,

Install in a Controlled Environment Relatively Free of Contaminants

CAUTION - RISK OF ELECTRIC SHOCK - MORE THAN ONE DISCONNECT SWITCH

MAY BE REQUIRED TO DE-ENERGIZE THE EQUIPMENT BEFORE SERVICING.

ATTENTION: RISQUE DE CHOC ELECTRIQUE. IL Y AURAIT DES SECTIONNEURS

MULTIPLES OU UNE COUPURE DU BRANCHMENT PARTICULIER EXTERIEUR.

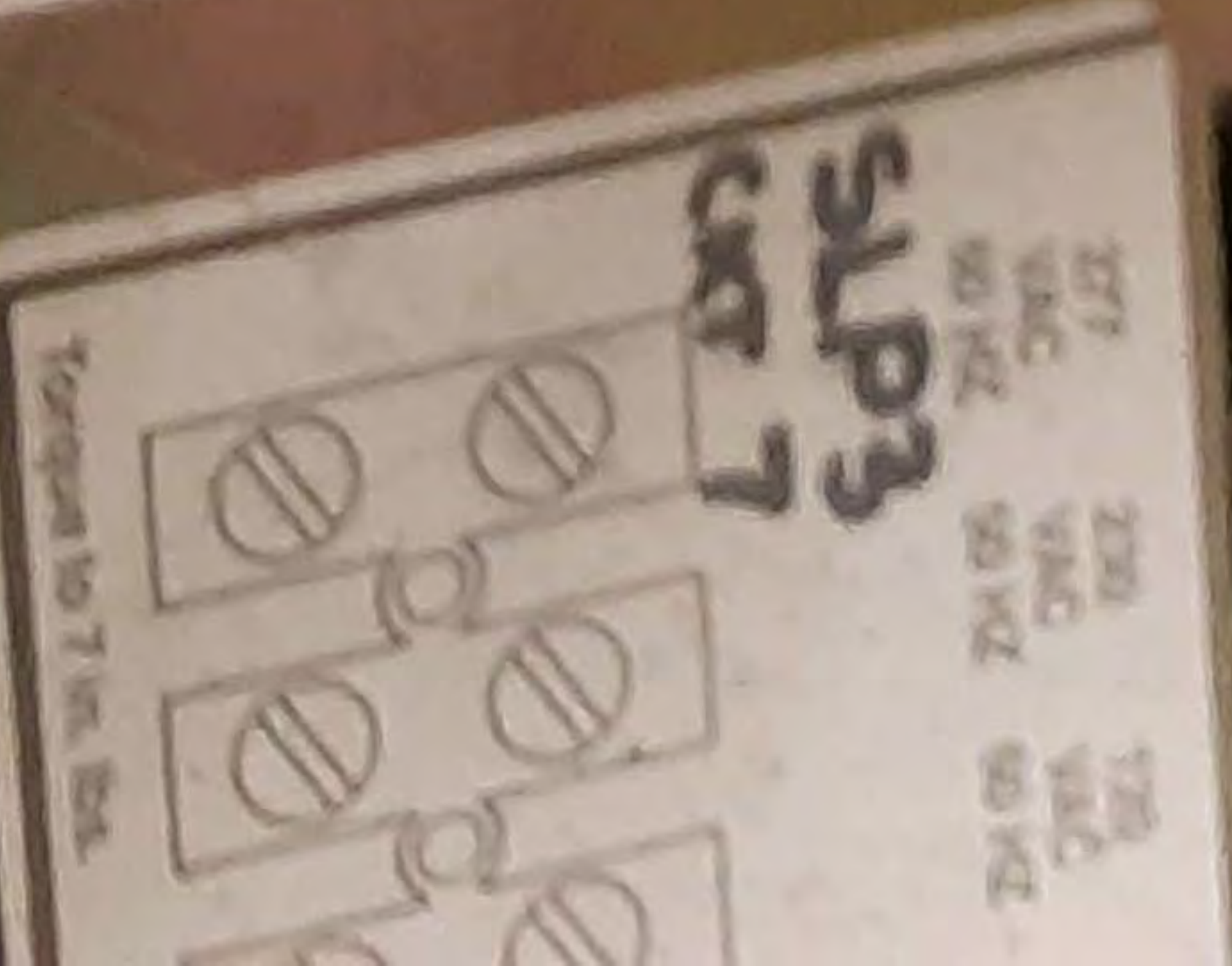
CHAQUE COUPURE DOIT ETRE FERMEE AVANT DE FAIRE LE DEPENDNAGE.



0704S11

CCCU800005

ONE LITHONIA WAY, DECATUR, GEORGIA 30033, TELEPHONE 770-987-4200  
FAX 770-987-1002, A DIV. OF LITHONIA LIGHTING, IN CANADA, 110 SOUTH AVE.  
LACHINE, QUEBEC H8T 2V3, A DIV. OF ACUTY BRANDS, INC.



GROUND

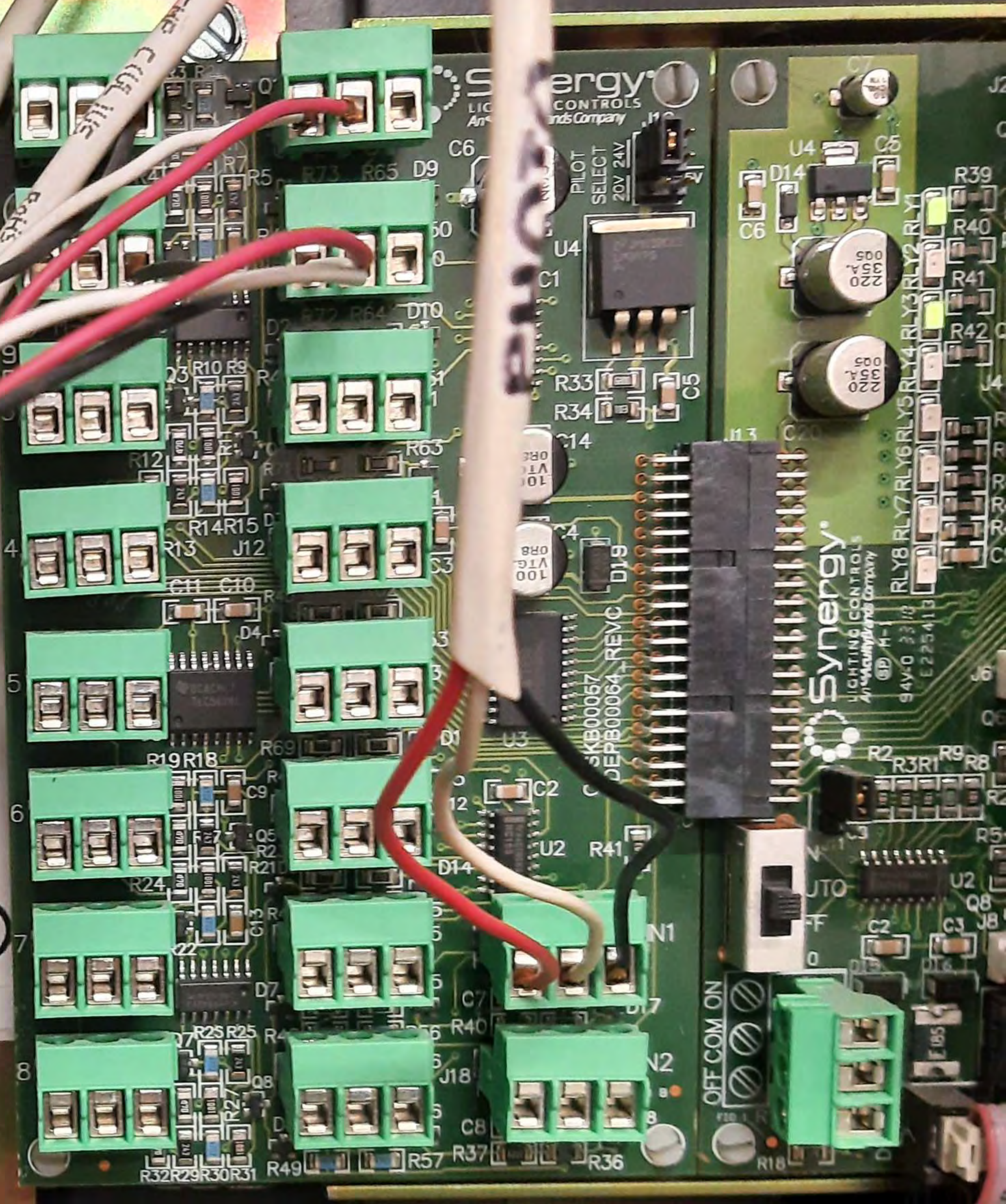
**Synergy**  
LIGHTING CONTROLS  
An AcuityBrands Company

- SYPM 8L
- SYPMB 8L
- B1 16A 120V MAX LOAD
- B2 16A 277V MAX LOAD
- B3 12A 120V MAX LOAD
- B4 12A 277V MAX LOAD
- B6 16A 347V MAX LOAD
- B7 12A 347V MAX LOAD

CARD ADDRESS:  
Use minimum 90°C, Copper  
Conductors Only, PCB Terminal  
Torque Rating - 16 inch-pounds  
Terminals J1 - J18 are Class 2



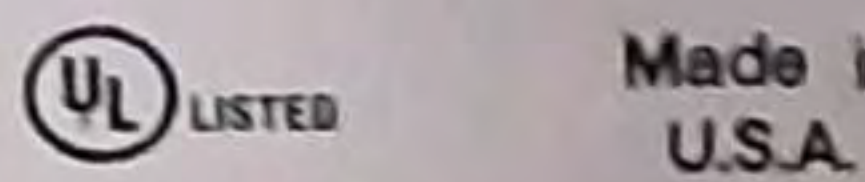
Enclosed Energy Management Equipment  
0412S11 27



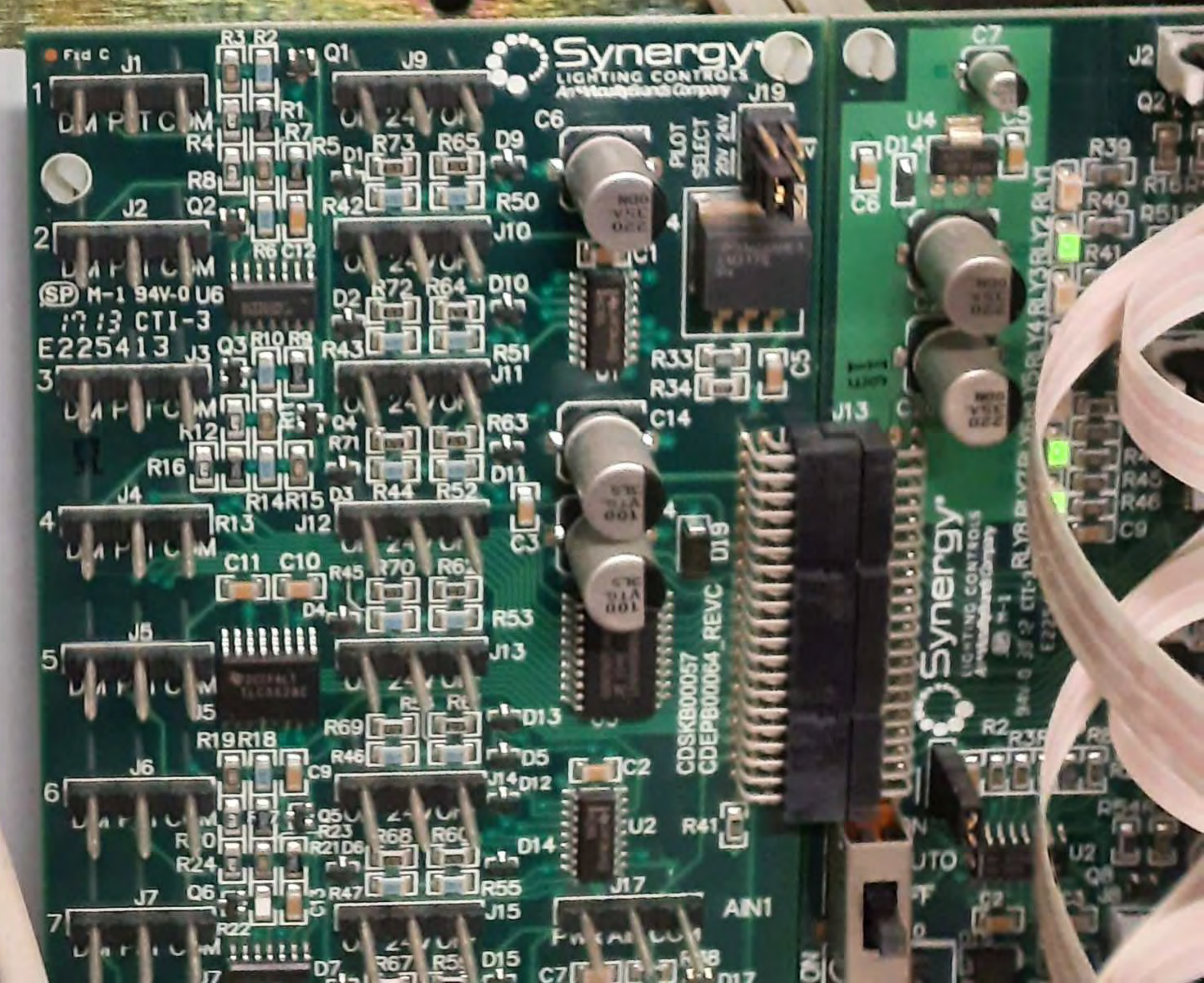
**Synergy**  
LIGHTING CONTROLS  
An AcuityBrands Company

- SYPM 8L
- SYPMB 8L
- B1 16A 120V MAX LOAD
- B2 16A 277V MAX LOAD
- B3 12A 120V MAX LOAD
- B4 12A 277V MAX LOAD
- B6 16A 347V MAX LOAD
- B7 12A 347V MAX LOAD
- DSO

CARD ADDRESS:  
Use minimum 90°C, Copper  
Conductors Only, PCB Terminal  
Torque Rating - 16 inch-pounds  
Terminals J1 - J18 are Class 2



Enclosed Energy Management Equipment  
48F4



30A, 277V  
HID, Ballast  
18,000A sCCR  
@ 277V

30A, 277V  
HID, Ballast  
18,000A sCCR  
@ 277V

15, 17

15, 13

ES15B3 G (UL) AWG 10

SYPMB SYPMB

- B1 16A 120V MAX BRKR LOAD
- B2 16A 277V MAX BRKR LOAD
- B3 12A 120V MAX BRKR LOAD
- B4 12A 277V MAX BRKR LOAD
- B6 16A 347V MAX BRKR LOAD
- B7 12A 347V MAX BRKR LOAD

OS  
CARD  
ADDRESS:

Use minimum 90°C, Copper  
Conductors Only, PCB Terminal  
Torque Rating- 7 inch-pounds  
Terminals T1 - T46 are Class 2

Made in U.S.A.



LISTED  
Enclosed Energy Management Equipment  
48E4 CDCLB00037

0706S11



**Wheeler  
Vehicle Storage Bldg  
Lithonia Panel  
SLP 1**

PANEL: SLP-1  
VOLTAGE: 277/480V  
PANEL SIZE: 100A  
FEEDER SIZE: #1  
FEEDER LOC: SPP-1

NEST  
NEST  
NEST

OUTS NEW  
BREAK 5/1/13  
S.W. EXTENSION  
CUT BACK 4-5' NEW FEED

1 2  
3 4  
5 6  
7 8  
9 10  
11 12  
13 14  
15 16  
17 18  
19 20  
21 22  
23 24  
25 26  
27 28

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

27

28

29

30

TYPE = Static ↓  
 ADDR=010.245.020.055  
 MASK=255.255.000.000  
 GATE=010.245.030.001

NETWORK  
 DMX  
 LOCAL

1 2 3  
 4 5 6  
 7 8 9  
 BACK 0 ENTER

▲  
 - +  
 ▼

Order To Listing On Year  
 (A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X) (Y) (Z)

City	STATE	Zip	222
Phone	Area	Code	222
Phone	Area	Code	222
Phone	Area	Code	222

**WARNING**

Warning: Read and follow  
 the instructions carefully.  
 Failure to do so may result  
 in injury or death.

27

28

29

30

TYPE = Static ↓  
ADDR=010.245.020.055  
MASK=255.255.000.000  
GATE=010.245.030.001

NETWORK  
DMX  
LOCAL

1 2 3  
4 5 6  
7 8 9  
BACK 0 ENTER

29

30

The control panel features a green LCD display showing the following text:

```
VEH SLP-1 EAST #55  
START...  
DISPLAY...  
10/27/2021 13:20
```

To the right of the display are three indicator lights labeled NETWORK, DMX, and LOCAL. Below the display is a numeric keypad with buttons for digits 1-9, 0, BACK, and ENTER. To the right of the keypad are four directional arrow buttons (up, down, left, right). On the left side of the panel, there are four white rectangular buttons connected to the display by thin lines. A small rectangular slot is visible in the bottom left corner of the panel.



**Wheeler  
Vehicle Storage Bldg  
Lithonia Panel  
SLP 2**

PANEL: SLP-2  
VOLTAGE: 277/480V  
PANEL SIZE: 100A  
FEEDER SIZE: #1  
FEEDER LOC: SPP-1

2 Hour on override



AUTO



23	24
25	26
27	28
29	30

Controller not found  
 Check ON/OFF switch  
 on power supply  
 board in cabinet.

NETWORK  
 DMX  
 LOCAL

1	2	3	<input type="button" value="▲"/> <input type="button" value="−"/> <input type="button" value="+"/> <input type="button" value="▼"/>
4	5	6	
7	8	9	
BACK	0	ENTER	

SYNERGY  
 Lighting Control System  
 SYBP30

UL LISTED CLASS CTL PANELBOARD  
 File E195267

WARNING

**Lithonia Control Systems**  
**BILL of MATERIALS**

**NEED MORE  
INFORMATION  
"CUT SHEETS"**

Date: November 30, 2005

Section: **Lighting Controls**

QUOTE NUMBER

Project: **Operation and Maintenance Facility  
City of Ann Arbor**

Location: **Ann Arbor, Michigan**

447-051130-11A

Agency: **Dèveaux Gauger, Gasser & Bush Inc., Livonia MI (A447)**

REVISION: A

Prepare by: **David Thurow - Specification Sales Manager Tel: 512-263-2613**

Qty.	Description	Cut Sheet
<p>Notes: 1.) Catalog specification sheets can be found at: <a href="http://lithonia.com/controls/default.asp">http://lithonia.com/controls/default.asp</a></p> <p>2.) This proposal is for all materials and services listed below only.</p> <p>3.) F.O.B. factory, full freight allowed to U.S. mainland address. Price acceptance is 90 days. Lithonia Lighting standard terms and conditions apply.</p> <p>4.) This proposal includes two Controllable breaker panels with controllable breakers per the schedule. The exceptions are the two Chain Host breakers are not controlled and the back road circuit has a contactor and 125 amp 3 pole breaker.</p> <p>5.) Communication to building management system (Temperature Control Interface) is via BACnet over ARCnet or MSTP. Ethernet connection is available at additional cost.</p>		
<p><b>ONE LIGHTING CONTROL SYSTEM TO CONSIST OF:</b></p>		
	<b>LIGHTING CONTROL BREAKER CABINET WITH CONTROLLABLE BREAKERS:</b>	<b>SY 100</b>
	<b>277 VOLT CONTROLLABLE BREAKER ENCLOSURES</b>	
1	SYBP30 P2 100 ML T SS - Enclosure (NEMA 1) with space for **30 - 1 pole controllable breakers, 277/480V, 100 Amp / 3 Phase bussing, *Main Lugs Only, *Top feed, *Standard Surface mounting with hinged locking door.	SY 200
1	SYBP30 P2 225 ML T SS - Enclosure (NEMA 1) with space for **30 - 1 pole controllable breakers, 277/480V, 225 Amp / 3 Phase bussing, *Main Lugs Only, *Top feed, *Standard Surface mounting with hinged locking door.	SY 200
	<b>277 Volt CONTROLLABLE BREAKERS:</b>	
16	SYBPB GHBS1020D - Controllable Circuit Breaker, 20 amp / 1 Pole / 277 Volt, 14 KAIC	SYBP
1	SYBPB GHBS2020D - Controllable Circuit Breaker, 20 amp / 2 Pole / 277 Volt, 14 KAIC	SYBP
1	SYBPB GHBS2030D - Controllable Circuit Breaker, 30 amp / 2 Pole / 277 Volt, 14 KAIC	SYBP
2	SYBPB GHBS3020D - Circuit Breaker, 20 amp / 3 Pole / 277 Volt, 14 KAIC	SYBP
1	SYBPB GHBS3125D - Circuit Breaker, 125 amp / 3 Pole / 277 Volt, 14 KAIC	SYBP
1	P2/MB100 - Main Circuit breaker 100 Amp / 3 pole / 277/480 volts	SYBP
1	P2/MB225 - Main Circuit breaker 225 Amp / 3 pole / 277/480 volts	SYBP
	SS - Mounting option include: DS - Door in Door (surface) & SF - Standard Flush.	
2	DS - (Option) Change cover to DOOR IN DOOR T - Top feed or B - Bottom Feed (NC).	SYBP
	<b>SYSTEM CONTROLLERS</b>	
2	SYSC MLX - Network system controller and programmer with: Astronomic time clock, seven day and calendar date scheduling, up to 96 programmable switch inputs, timed switch overrides, analog sensor monitoring, controls up to 96 relays or 60 dimmers, RS-232 Input, supports Digital and Sequel Control Stations, lamp burn and start counters, automatic system event log, BACnet protocol for system network and interoperation with building management system.	SYCO120

# Lithonia Control Systems BILL of MATERIALS

Date: November 30, 2005

Section: **Lighting Controls**

QUOTE NUMBER

Project: **Operation and Maintenance Facility  
City of Ann Arbor**

Location: **Ann Arbor, Michigan**

447-051130-11A

Agency: **Deveaux Gauger, Gasser & Bush Inc., Livonia MI (A447)**

REVISION: A

Prepare by: **David Thurow - Specification Sales Manager Tel: 512-283-2613**

Qty.	Description	Cut Sheet
<b>ACCESSORIES</b>		
1	SYA CABLES2 250 - 250 ft of MLX System Network Plenum Rated Cable (Link panels) Note: Cable length is estimate only. Installer shall verify length and buy more wire if needed.	
1	LSA.APS OL - Photo Cell outside (0-100 FC)	LSA 400
1	SYSW CONFIG - Synergy Network Software	SYU100
2	SYSW PROG - Initial programming of system per approved drawings	Tech Support
<b>FACTORY SERVICES</b>		
1	Job site check-out and equipment commissioning	Tech Support
3	LSA DOC - Submittal and installation documents	Tech Support



Catalog Number		SYSC MLX	
Notes		Type	
CONTROLLER FOR CPA			

## FEATURES

The Synergy® MLX system controller adds programming, automation and networking capabilities to a Synergy system. Capabilities include individual circuit switching control of lighting functions for a wide variety of applications. System outputs respond to time-of-day schedules via the internal time clock. Additionally, inputs can be accepted from external devices such as simple switches, photocells, occupancy sensors, telephones and other control systems to directly control lighting or override scheduled events. Over 4,000,000 Synergy MLX controllers may be interconnected to provide access to more than 500,000,000 control outputs from a single switch or schedule.

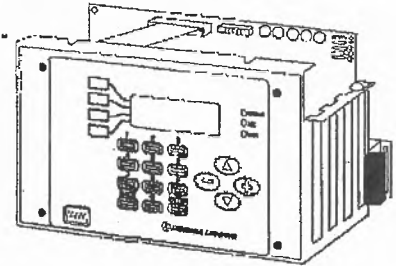
- Supports all Synergy power modules
- Seven-day scheduling with astronomic clock
- Holiday schedule dates
- Load prioritization setup
- Exclusive Script Application Language
- Programmable switches with interpanel linking
- Support for SEQUEL® Dimming Control Stations
- Support for digital remote stations
- Timed switch overrides
- Analog source monitoring with multiple set points
- Integral keypad with backlit display
- Control up to 128 outputs
- Automatic system event logging
- Integral lamp burn hours and start counters
- BACnet™ compliant network
- Integral RS232 ports
- Optional PC software
- Optional touch-tone telephone interface for voice-prompted overrides.
- Optional support for legacy MiniPac, Sequel, and MaxStar dimmer cabinets.
- English, Spanish or French operation
- UL and C-UL listed; CEC certified

Lighting Control System  
Network System Controller

# SYSC MLX



**BACnet™**  
BACnet™ is an exclusive trademark of ASHRAE.



### Synergy Controller Features

System Functions	MLC Controller	MLS Controller	MLX Controller
Relay Capacity (No Breakers)	48	48	48
Relay Capacity (With Breakers)	40	40	40
Dimmer Capacity	30	30	30
DMX512 Input	DMX Channel-to-Output Configured via hardware settings	DMX Channel-to-Output Configured via controller software	DMX Channel-to-Output Configured via controller software
Scheduling	11 schedules/99 events	100 schedules/unlimited events	100 schedules/unlimited events
Analog Input	YES	YES	YES
PC Support	YES	YES	YES
Script Logic	NO	YES	YES
Logging	NO	YES	YES
Priority Logic	NO	YES	YES
Network	NO	NO	YES
Telephone Override	NO	YES, optional	YES, optional
BACnet®	NO	NO	YES
RS232	YES	YES	YES
Modem	YES, optional	YES, optional	YES, optional
Sequel Stations	YES	YES	YES
Legacy Dimmers	NO	YES, optional	YES, optional
Digital Remotes	YES	YES	YES

## ORDERING INFORMATION

Example: SYSC MLX

SYSC	MLX	Options	
Series	Controller type		
	MLX Network system controller with programmer	<b>ISA</b>	Three 16-bit ISA expansion slots
		<b>PHONE</b>	Telephone interface for voice-prompted override and remote modem access (requires ISA option)
		<b>DMX</b>	Dimming interface, required for connection to DMX512 control signal
		<b>LEGACY</b>	Allows control of one complete network (255 dimmers) of legacy MiniPac, Sequel, and MaxStar dimmer cabinets. Replaces master controller on existing systems.

### Accessories

Order as a separate item.	
<b>SYA SKIT</b>	Permits two SYE enclosures to operate with a single MLX controller
<b>SYSW CONFIG</b>	Windows™ configuration software and cable
<b>SYA CABLES2</b>	Lithonia plenum rated RS485 network cable (Specify length: 250', 500' or 1000')

# SYSC MLX Network System Controller

## SPECIFICATIONS

### MECHANICAL

- Chassis: plug-in assembly with locking screws, field-installable in SYE enclosure.

### ENVIRONMENTAL

- Operation and storage temperature: 32-104°F (0-40°C).
- Humidity: 10-90% non-condensing.

### ELECTRICAL

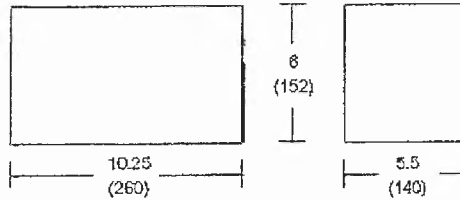
- Power input: 24VDC maximum, supplied by enclosure power supply.
- Data port: front-mounted DB9 RS232 serial communications connector accessible without removal of cover.
- Internal RS232 Port for connection to AV systems.
- Internal RS485 Port for connection to SEQUEL control stations and digital remote stations.
- Internal RS485 ARCNET™ (ANSI 878.1) Port for connection to other Synergy controllers and BACnet™ systems.

### FUNCTIONAL

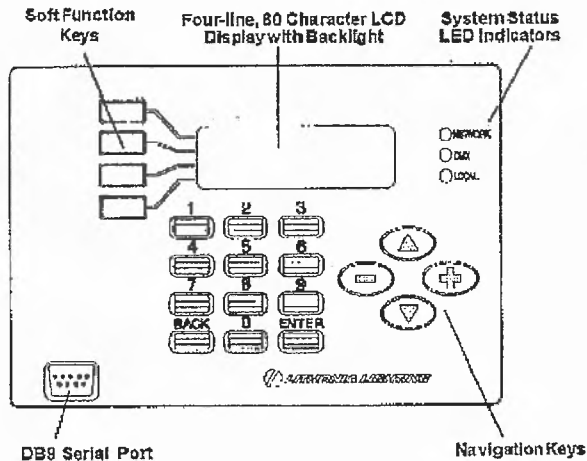
- Program entry: numeric keypad (0-9, back and enter), "soft" function keys, navigation key cluster (up, down, + and -) for menu navigation and logical entry selections.
- LCD display: four-line, 80-character with back light.
- LED indicators: network status, local status and DMX true indication.
- Outputs: 128 maximum per controller in typical configurations; map inputs and schedules to any combination of connected relays, dimmers or controllable circuit breakers.
- Groups: map output relays and dimmers into logical groups (zones) for association to inputs and schedules.
- Switch inputs: 128 maximum per controller, soft-linked through the program to control any combination of outputs; one minute to 100 hour time-out function per switch.
- Analog input: maximum of 48, each capable of multiple set-point operation or tracking operation.
- *Priority on switch*: switch input set to *priority on* cannot be overridden off by any other source until the *priority on* condition is removed.
- *Priority off switch*: switch input set to *priority off* cannot be overridden on by any other source until the *priority off* condition is removed.
- Four levels of priority provide for layering of manual and automatic functions, supports all 16 BACnet™ priority levels via network commands.
- Schedules: Maximum of 100 independent schedules of time events, number of events per schedule limited only by system resources. Schedules may be assigned to days of the week, days of the year, or recurring holiday dates through 12/31/2200.
- *Warn off*: automatic flash of lights at scheduled off to warn occupants of impending off; user selectable from one to 99 minutes.
- Logging: automatic logging of system events including on events, off events, relay run time, relay starts, alarms, power up, power down, override on and override off; 10,000 event maximum storage with automatic overwrite of oldest data, view log data on LCD display or printout.
- Telephone Override: override selected loads via touch-tone phone using programmable four-digit codes and voice prompts using optional PHONE interface.
- DMX Control: control connected loads with DMX control signal using optional DMX input card. May be configured via hardware settings or through controller software to provide prioritized and conditional control of loads along with other input devices and schedules.
- Legacy Dimmer Control: control up to 255 legacy MiniPac, Sequel, and MaxStar dimmers with optional LEGACY card. Synergy controller replaces function of M2, M3, or M9 master controller in existing systems. Legacy dimmers may be controlled by any input or schedule in the Synergy system.
- PC software: program the controller, download data, upload data and monitor status using optional Windows 95/98™, XP, 2000 or NT software via front-mounted DB-9 RS232 port, network connection or optional modem connection.

## DIMENSIONS

All dimensions are inches (millimeters).  
Controller weight = 5.5 lbs. (2.5 kg)



## FUNCTIONAL



## NETWORK

- Hardware: RS485 ARCNET™ (ANSI 878.1) token passing, 156 Kbps transmission speed. Approved cables include Lithonia SYA CABLES2 (plenum-rated) or Belden 3105A.
- Protocol: BACnet™ (ANSI / ASHRAE 135-1995) used for network communications.



**WARRANTY**

Lithonia Lighting warrants all equipment to be free from defects in manufacturing, under normal and proper storage, installation, and use, for a period of 1 year, unless noted differently below:

SYPM 8R electrically held relays are warranted for ten years.

SYPM 8H 347V relays are warranted for five years.

Litronic occupancy sensors are warranted for 5 years

Our guarantee liability extends only to the repair or replacement of the defective part and no labor charges for the correction of the defect by repair or replacement will be honored by Lithonia Lighting unless prior written authority has been granted by our Customer Service Department.

**FACTORY START-UP REQUIREMENTS**

If noted below the lighting control system for this project will be completely field tested by a factory based service person within the time as allotted below. Factory Start-Up will be performed only after notification from the Contractor that the installation is complete, that all loads have been tested for continuity and freedom of short circuits, and that all control wiring is connected and terminated. Scheduling of Factory Start-Up requires that this form be completed and transmitted to LCS, that Start-Up appears as a line item on the bill of materials page, and a minimum notice of three weeks be provided.

**Contact factory for the possibility and premiums for FAST TRACK START-UP if 3 weeks notice is not available.**

Start-Up time estimated for this project is 1 site visit and 1 total working day.

TO: Lithonia Control Systems  
Field Service Department  
One Lithonia Way, Decatur, GA 30035  
Phone: (800) 533-2719 Fax:(770) 987-1002

DATE: \_\_\_\_\_

FROM: \_\_\_\_\_ (Electrical Contractor)

RE: Factory Start Up

In accordance with Lithonia Control Systems' terms and conditions this letter serves as written notification requesting a Field Service Engineer to perform a system start-up beginning on the following date: \_\_\_\_\_

The job is or will be completely installed by the date above. If the installation is not complete at that time, I understand that I will incur additional expenses from Lithonia Control Systems for additional trips that may be required.

Printed Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

**LITHONIA  
CONTROL SYSTEMS**

447-800-AQ2

**Warranty and  
Start-Up Details**

JOB NAME: Ann Arbor O&M Ops - New  
ORDER NUMBER: 447-45087A

262



# Ann Arbor Operations & Maintenance: Maintenance Building Bill of Materials

Type	Qty	Div	Description	Line Comment
	1	CTRL	SYEM 120/277	Medium Enclosure and power supply
	3	CTRL	SYPM 8R OS	8-relay module with sensor inputs
	1	CTRL	SYSC MLS	Enhanced controller for stand alone panel
	1	CTRL	SYSW CONFIG	Synergy Configuration PC software
	1	CTRL	LSA DOC	Submittals and manuals
	16	CTRL	LVMS PILOT WH	Low voltage switch w/pilot
	1	CTRL	WPM 8G 16MS BS LE	Wallplate-8 gang for 16 switch
	1	CTRL	CONTROLS FACTORY STARTUP	System Startup
	1	CTRL	SYSW PROG	Initial factory programming
	1	CTRL	LSA APS OH	Analog photosensor

## Ann Arbor Operations & Maintenance: Operations Building Bill of Materials

Type	Qty	Div	Description	Line Comment
	1	CTRL	SYEL 120/277	Large enclosure
	3	CTRL	SYPM 8R OS	w/power supply
	1	CTRL	SYSC MLX	8-relay module
	3	CTRL	SYRS 1G 1BT BJ4	w/sensor input
	2	CTRL	SYRS 1G 2BT BJ4	Network system controller
	4	CTRL	SYRS 1G 3BT BJ4	single button
	1	CTRL	SYRS 1G 4BT BJ4	digital switch
	1	CTRL	LSA APS OH	2-button
	1	CTRL	SYSW CONFIG	digital switch
	2	CTRL	SYA 2POLE 277	3-button
	1	CTRL	SYA CABLES2 1000FT	digital switch
	1	CTRL	SYA CABLEA4 1000FT	4-button
	1	CTRL	LSA DOC	digital switch
	1	CTRL	CONTROLS FACTORY START UP	Analog photosensor
	1	CTRL	SYSW PROG	Synergy configuration
				PC software
				2-pole relay
				Synergy Panel
				Network Cable
				Synergy Station
				Network Cable
				Submittals and manuals
				System Startup

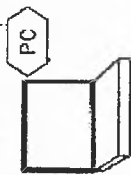
This key provides catalog series, summarizes installation information, and cross references to the Bill of Materials, Product Data Sheets, and specific schedules contained in these drawings. See Installation Instructions for additional information. Not all symbols are used on every project.

- PC** **LSA PC MON Series Personal Computer**  
 Desk mounted personal computer, peripherals and SYSW CONFIG software for remote programming and control of Synergy control panels. Electrically connects directly to Synergy cabinets via RS-232 port or modem or to the "S2" Control Panel network via SYA NIC. Requires a dedicated 120 volt receptacle and suitable conditions/workspace.
- CS #** **SQCS Series Control Station (Sheet SQ100, Control Station Switch Settings)**  
 Mounts flush with wall to Lithonia supplied SQCS 6GB (4/6 channel stations) or SQCS 8GB (12/16 channel stations) backbox, or approved equal. Electrically connects to the Control Station "A4" Network. Terminals provided for connections to "SQRS#" Remote Stations, accessories, and/or momentary dry contact enclosures from AV or other systems. Set dip switches per "SQCS Switch Settings" detail in the As Built documentation.
- DS #** **SYRS Series Digital Remote Station. (LSA 2030)**  
 Mounts flush to a Lithonia SYRS 1GR or Steel City 52C13 one gang plaster ring attached to a grounded 4" square, 2.5" deep outlet box (preferred) or to a grounded Lithonia SQRS 1GB or Steel City GW-125-G one gang masonry box (1.875" minimum inside width, 3" minimum inside depth). Electrically connects to the Control Station "A4" Network. Stations with 'EXT' option may also electrically connect to LSA APS photosensor, Ltronic occupancy sensor, 0-10 VDC dimmable fluorescent ballasts, or LPCS power pack as shown on the One Line Diagram. See the Digital Remote Station installation instructions or SYRS wiring details in the As Built documentation for point-to-point wire termination details.
- RS #** **LVR8 series Remote Station. (LSA 2020)**  
 Mounts flush to a Lithonia SYRS 1GR or Steel City 52C13 one gang plaster ring attached to a grounded 4" square, 2.5" deep outlet box (preferred) or to a grounded Lithonia SQRS 1GB or Steel City GW-125-G one gang masonry box (1.875" min. inside width, 2.5" min. inside depth). Electrically connects to the low voltage switch inputs on Synergy SYPM power module. Multiple Remotes may wired in be paralleled if button functions are identical, or may be home run individually. See the Remote Station installation instructions or "LVR8 Wiring Details" in As Built documentation for wire termination details.
- S#** **LVMS & WPM Series Low Voltage Switch (Sheets LSA2000, LSA2010)**  
 Mounts flush to wall in a multigang backbox. Electrically connects to the low voltage switch inputs on Synergy SYPM power modules. "X" position on the One Line Diagram is the gang size of the backbox (furnished by others) "Y" position indicates the number of switches on this station. See the installation instructions or "Switch Input Wiring Detail" in As Built documentation for wire termination details.
- PAZ** **LSA APS Low Voltage Analog Photosensor (LSA 400)**  
 Mounting type is indicated on One Line Diagram where "I" is indoor (0-100 FC), "O" is outdoor (0-100 FC), "OH" is outdoor (0-1000 FC), and "S" is Skylight/Atrium (0-10,000 FC). Electrically connects to analog input on Synergy SYPM power module or SYRS digital remote station with 'EXT' option as shown on the One Line Diagram. See Installation Instructions or input wiring detail(s) in the As Built Drawings for wire termination details.
- OSz** **Ltronic Low Voltage Occupancy Sensor (Sheets LIT2000, LIT3000, LIT4000, LIT5000, LIT6000)**  
 Surface mounts to wall or to ceiling as indicated on datasheet.; locate per the sensor installation instructions. Sensor technology is as indicated on the One Line Diagram where "M" is Multi-Technology, "I" is Infrared, and "U" is Ultrasonic. Contractor to set sensitivity and time out as required for the application. Electrically connects to analog input on Synergy SYPM power module, SYRS digital remote station with 'EXT' option, or LPCS power pack as shown on the One Line Diagram. See the input wiring detail(s) furnished in the As Built Drawings for wire termination details.
- CP #** **SY Series Control Panel (Sheet SY100)**  
 Surface mounts to, or optionally recess mounts in the wall of electrical closet. Assembly consists of SYE series enclosure, SYPM power modules, SYSC controller, & accessories as indicated on the Bill of Material. Requires a dedicated 15A or 20A 120V, 230V, or 277V circuit for control electronics. Electrically connects between 15 or 20 amp branch circuit breakers and loads. Breakers may be external or part of the SYPM Power Module (optional). SYSC MLX and SYSC MLS Controllers support digital "A4" control station network for connection of SQCS and SYRS stations. SYSC MLX Controllers support native BACnet inter-cabinet networking as designated by "S2" Network Wire. Panels with "DMX" option may be connected to and controlled by a single DMX universe via "DM" Network Wire.

**WIRING SYMBOLS AND NOTES**

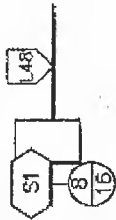
- S2** Control Panel Network Cable. Class 2 low voltage; do not install in high voltage conduit or raceway. Multiple Control Panels with "MLX" option must be connected in a daisy chain. "T" taps or branches or splices in the network are not permitted. The numerical order in which devices are connected is not important. The network wire shall be either EIA-485 approved Belden 3105A or for plenum applications Lithonia Control Systems SYA CABLES2 (optional - contact LCS if cable is needed and not included as a separate line item in the Bill of Material on the previous page). Contact LCS if the total length of the network exceeds 2000 feet.
- A4** Control Station Network Cable. Class 2 low voltage; do not install in high voltage conduit or raceway. All devices connecting to network must be wired in a daisy chain (in and out); "T" taps or branches in the network are not permitted. The numerical order in which devices are connected is not important. The network wire shall be two #18 AWG wires for power plus one EIA-485 approved twisted and shielded pair for data. Acceptable cables are either Lithonia Control Systems plenum-rated SYA CABLEA4 (optional - contact LCS if cable is needed and not included as a separate line item on the Bill of Material) or (1) Belden 3105A pulled with (2) #18 AWG conductors. Contact LCS if the total length of the network exceeds 2000 feet.
- DM** DMX Network Cable. Class 2 low voltage; do not install in high voltage conduit or raceway. The network wire shall be either EIA-485 approved Belden 3105A or for plenum applications Lithonia Control Systems SYA CABLES2 (optional - contact LCS if cable is needed and not included as a separate line item in the Bill of Material on the previous page).
- D #** Synergy Cabinet main feed conductors, quantity of conductors as indicated in the symbol (count does not include ground). Conductors sized per Specification/Requirements. Per NEC 520-27(a), the neutral must be regarded as a current carrying conductor in a 3 phase, 4 wire application.
- L #** Quantity of Low Voltage Class 2 conductors as indicated in the symbol. Do not install in high voltage conduit or raceway. Conductors may be #18 AWG for runs up to 500 feet. Furnished connectors accept up to #18 AWG for runs up to 1200 feet.
- E #** Contactor Control Leads, quantity of conductors as indicated in the symbol to control external contactors. Conductors shall have 600V insulation and may be #14 AWG for runs up to 500 feet and #12 AWG for runs up to 1000 feet.
- F #** Quantity of Duplex Fiber Optic cables as indicated in the symbol. Cables are furnished by others and may have a fiber size of 50/125, 62.5/125, or 100/140 microns. See SYA M1 ARCFST or SYA M1 ARCFST2 datasheets for further information on optical budgets and maximum cable lengths for different cable sizes.

LAPTOP COMPUTER  
FURNISHED BY OTHERS  
FOR USE WITH SYNERGY  
CONFIGURATION SOFTWARE



SEE THE ENCLOSED  
SOFTWARE INTERFACE  
STATEMENT FOR HARDWARE  
AND O.S. REQUIREMENTS

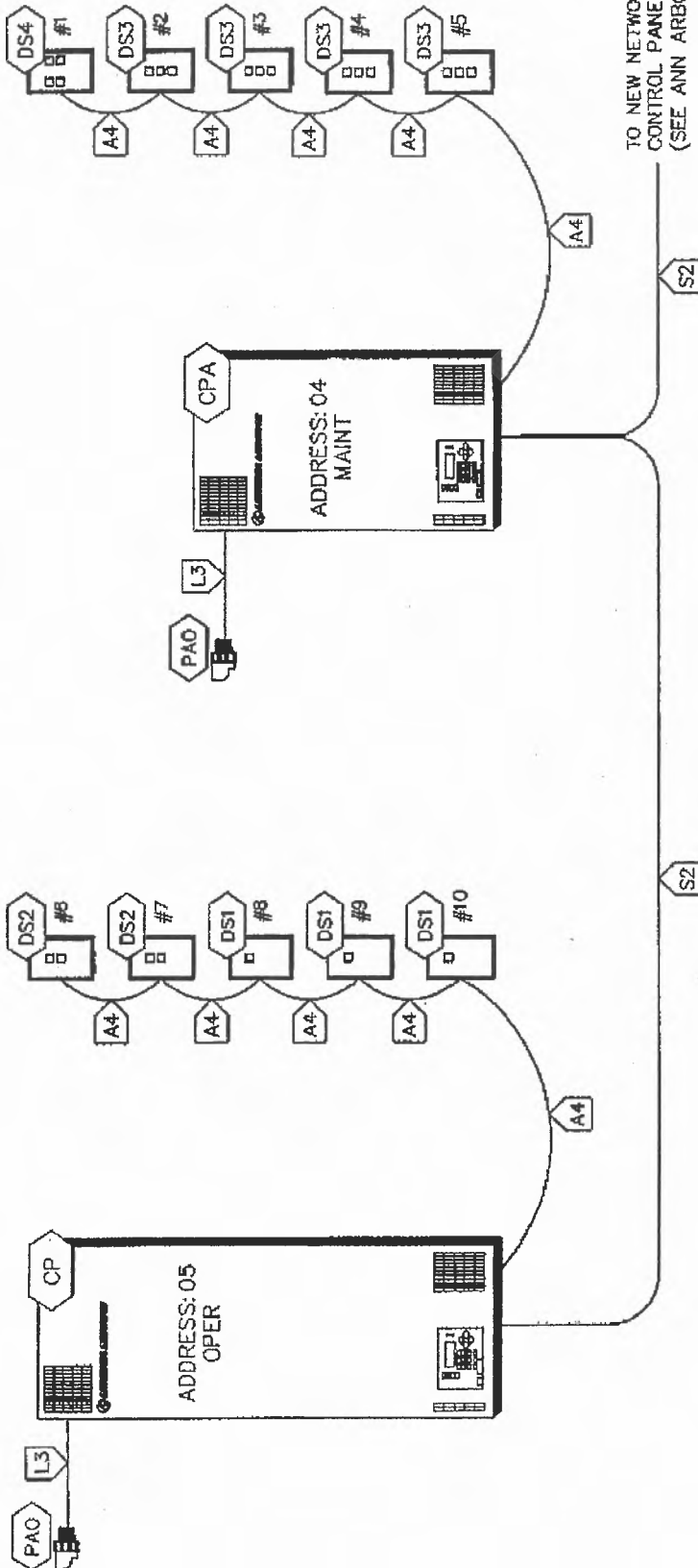
TYPICAL OF 16



LVS HOA (KS1) AND LVMS PILOT (S1) SHALL  
CONNECT TO SYNERGY CABINETS PER LOAD  
REQUIREMENTS. MAXIMUM 3 PER INPUT.

NOTES:

1. DIGITAL REMOTES (DS1 THRU DS4) MAY BE CONNECTED TO ANY SYNERGY CABINET BY MEANS OF A4 CABLE IN A DAISY CHAIN CONFIGURATION NOT EXCEEDING 60 UNITS.
2. LOW VOLTAGE SWITCHES (S1) SHALL CONNECT TO ANY SYNERGY CABINETS PER LOAD REQUIREMENTS. MAXIMUM 3 PER INPUT.



EACH SYNERGY PANEL REQUIRES A 120V (60HZ), 277V (60HZ), OR 230V (50HZ), 15A OR 20A DEDICATED CIRCUIT FOR THE SYNERGY CABINET POWER SUPPLY.

NOT FOR CONSTRUCTION - WIRE PER INSTALLATION INSTRUCTIONS AND APPROVED AS BUILT DOCUMENTS ONLY.

LITHONIA  
CONTROL SYSTEMS

SYNERGY LIGHTING CONTROL SYSTEM  
ONE LINE DIAGRAM

PROJECT NAME:  
ANN ARBOR MAINT & OPS FACILITIES

ORDER NUMBER:  
447-45062A

04/09/ 17

1 2 3 4 5 6 7 8 9 10

OVERALL


OPERATIONS BUILDING

MAINTENANCE BUILDING

VEHICLE EQUIPMENT STORAGE

SITE STRUCTURES

NO.	DESCRIPTION	STATUS	DATE	BY	CHECKED BY
1-1	GENERAL NOTES				
1-2	GENERAL NOTES				
1-3	GENERAL NOTES				
1-4	GENERAL NOTES				
1-5	GENERAL NOTES				
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1-98	GENERAL NOTES				
1-99	GENERAL NOTES				
1-100	GENERAL NOTES				




PARSONS BRINCKERHOFF  
 QUADE & DOUGLAS, INC.  
 Fleet & Facilities Division

11575 Katy Freeway #600,  
 Houston, (281) 558-7273

1831 Chestnut Street #700,  
 St. Louis, (314) 421-1476

1034 North Street  
 Ann Arbor, Michigan 48104  
 P 734.463.1770  
 F 734.463.1700  
 E info@hobbs-black.com

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CITY OF ANN ARBOR  
 OPERATIONS AND  
 MAINTENANCE FACILITY  
 STONE SCHOOL ROAD  
 ANN ARBOR, MICHIGAN 48108

PROJECT

CONSULTANT

INDEX  
 OF  
 DRAWINGS  
 SHEET TITLE

05-309  
 PROJECT NUMBER

A-001  
 SHEET NUMBER

CONTRACT SET  
 2-4-2005

DESIGN #1  
 11-1-2005

CONSTRUCTION  
 8-29-2005

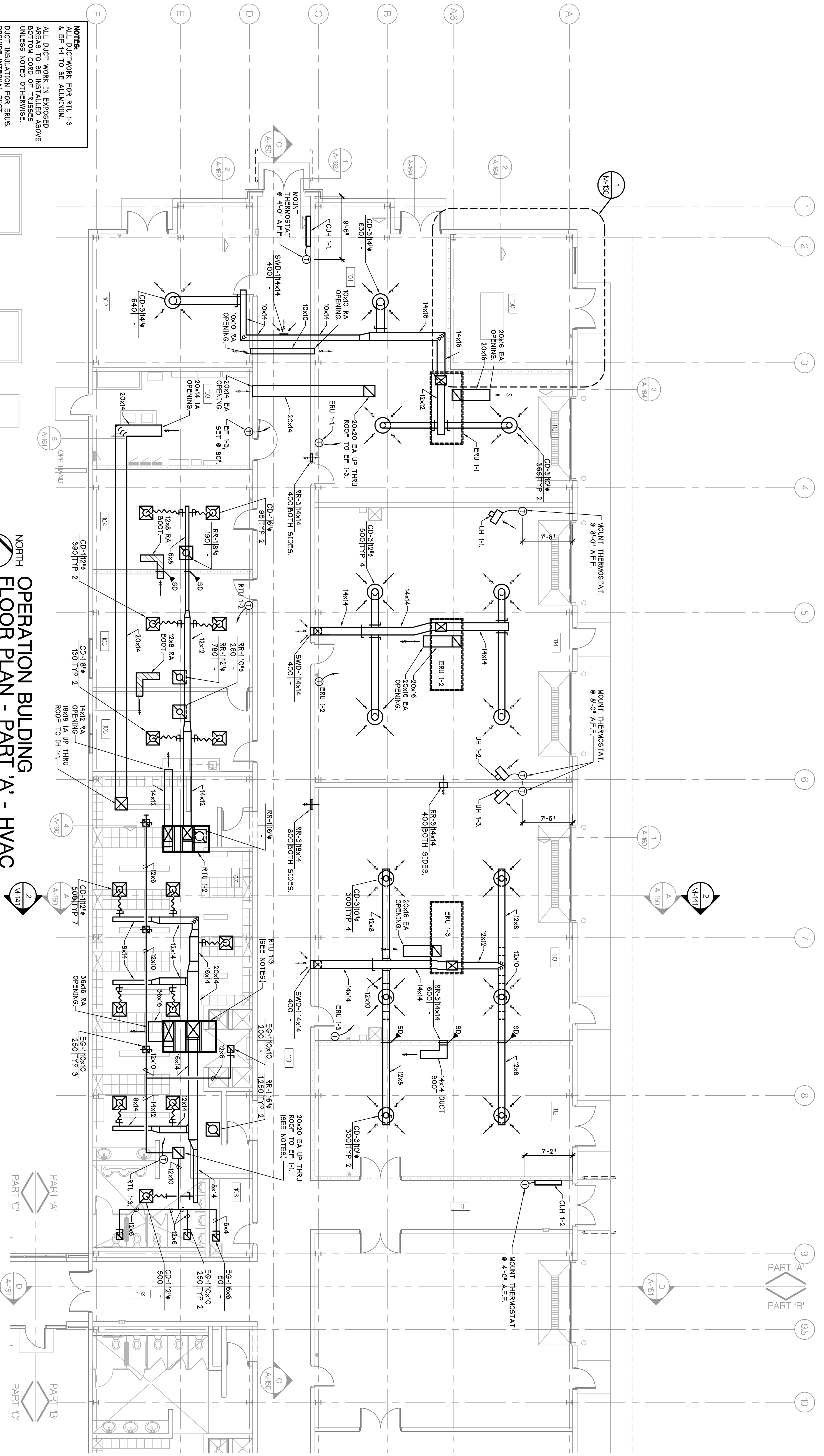
60X OWNER REVIEW  
 7-19-2005

DD OWNER REVIEW  
 5-27-2005

DATE ISSUED  
 OME

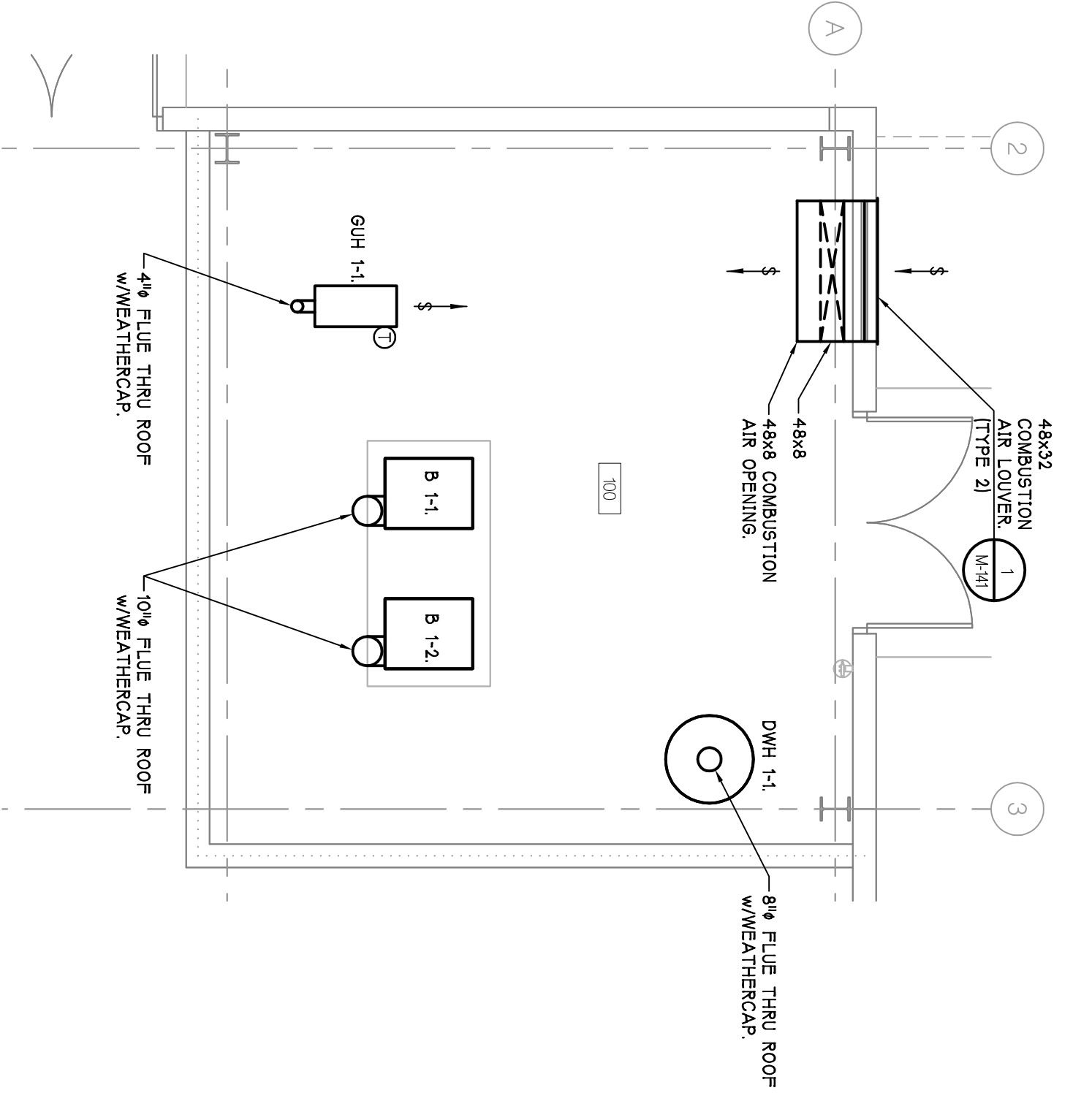
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CHECKED BY  
 OME

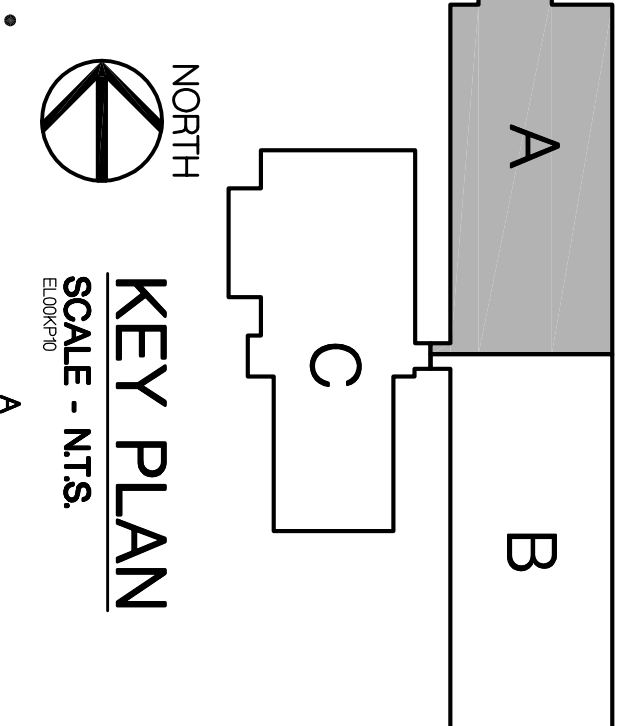


**NOTES:**  
 ALL DUCTWORK FOR RTU-1-3 & EF-1-1 TO BE ALUMINUM.  
 ALL DUCT WORK IN EXPOSED BOTTOM CAB OF TRUSSES UNLESS NOTED OTHERWISE.  
 DUCT INSULATION FOR ENUS PROVIDE INTERNAL DUCT FLEXIBLE AND THE 1ST 4'-0" ON THE EXTERIOR DUCT WORK HAVE FITTERMAN INSULATION.

**NORTH OPERATION BUILDING**  
**FLOOR PLAN - PART 'A' - HVAC**  
 SCALE - 1/8" = 1'-0"



**1 ENLARGED PLAN - HVAC**  
 SCALE - 1/4" = 1'-0"



**KEY PLAN**  
 SCALE - NTS

AS BUILTS	8-10-2008
SUPP. INSTR. 12	1-8-2007
REVISIONAL REQUEST 3	6-3-2006
CONTRACT SET	1-4-2006
POS. BID. 200.1	12-12-2005
CONSTRUCTION	11-12-2005
50% OWNER REVIEW	8-29-2005
50% OWNER REVIEW	7-18-2005
DD OWNER REVIEW	5-27-2005
DATE ISSUED	
DRAWN BY	MAE
CHECKED BY	PAH, BK

<p>11757 Katy Freeway #600, Houston, (281) 558-7273</p> <p>1831 Chestnut Street #700, St. Louis, (314) 421-1478</p>	<p>100 N. State Street Ann Arbor, Michigan 48104 P. 734.463.1170 F. 734.463.1770 www.hobbsblack.com</p>	<p>© Copyright 2008, Hobbs + Black, Inc.                  ALL RIGHTS RESERVED.</p>
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<p>CITY OF ANN ARBOR                  OPERATIONS AND                  MAINTENANCE FACILITY                  STONE SCHOOL ROAD                  ANN ARBOR, MICHIGAN 48108</p>	<p>PROJECT</p>
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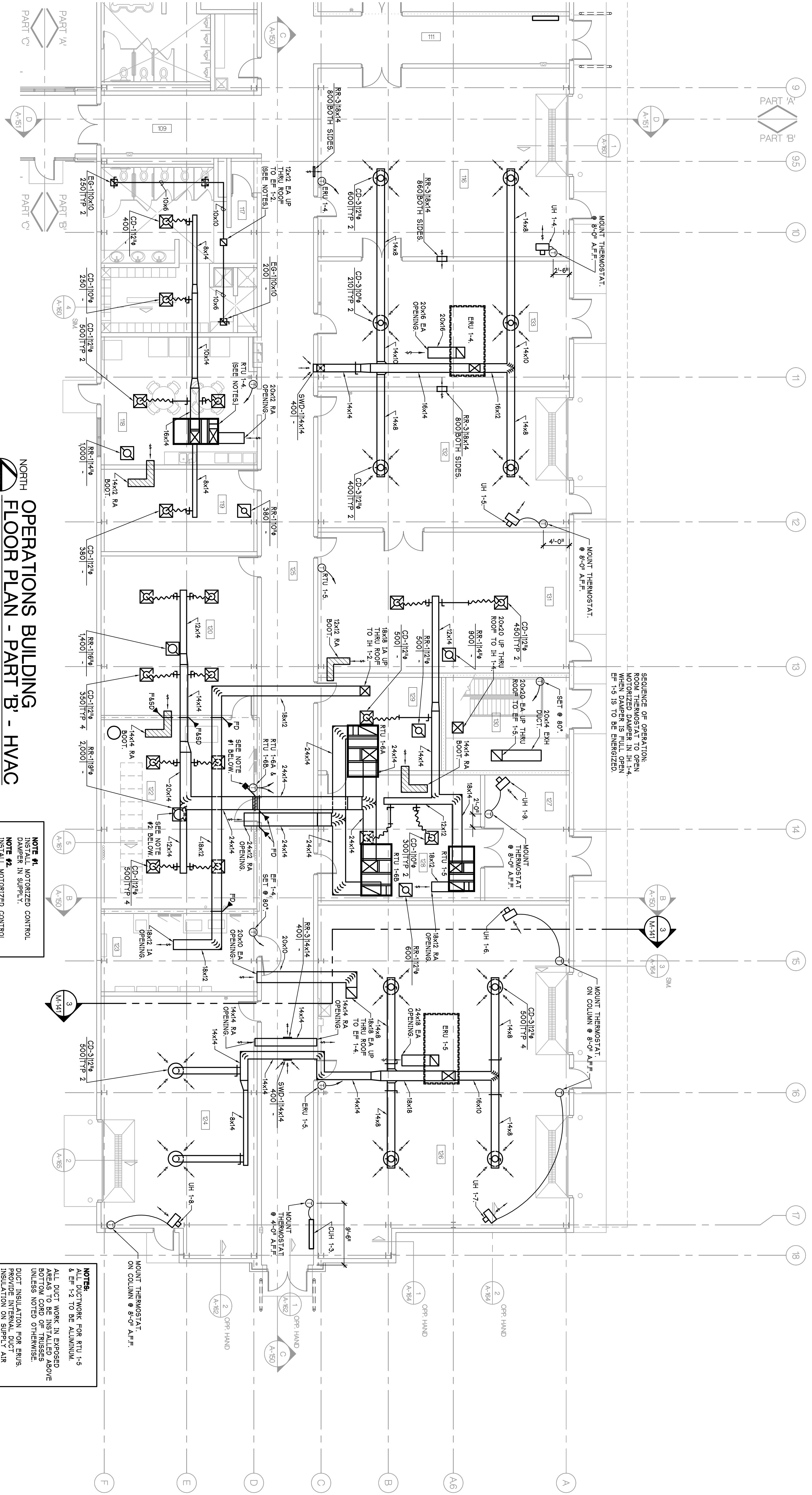
<p>CONSULTANT</p>	<p>OPERATIONS BUILDING                  FLOOR PLAN                  PART 'A'                  HVAC</p>
-------------------	--

<p>PROJECT NUMBER</p>	<p>05-309</p>
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<p>SHEET TITLE</p>	<p>M-130</p>
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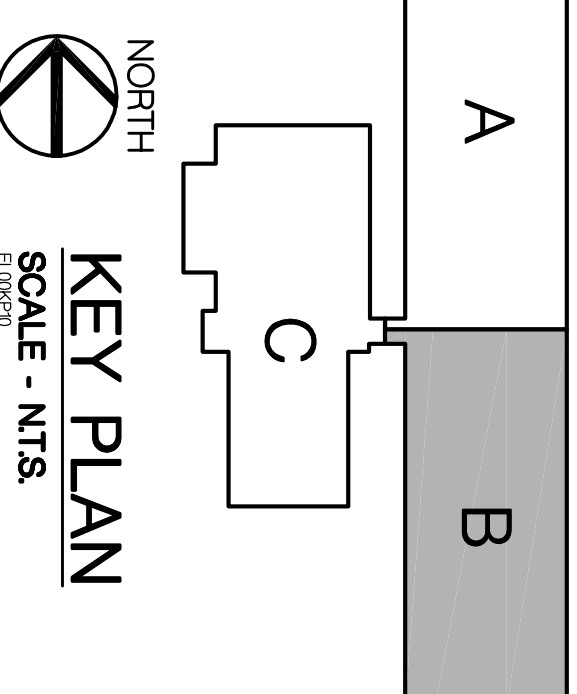
**NORTH**  
**OPERATIONS BUILDING**  
**FLOOR PLAN - PART 'B' - HVAC**

SCALE - 1/8" = 1'-0"

**NOTE #1:** WOTERGED CONTROL. ALL DAMPERS SHALL BE RISKIN MODEL CP-515. PROVIDE W/VOY ELECTRIC ACTUATOR. DAMPERS TO BE LARGED CLOSEME.

**NOTES:**  
 ALL DUCTWORK FOR RTU 1-5 & EP 1-3 TO BE ALUMINUM.  
 ALL DUCT WORK IN EXPOSED ABOVE BOTTOM COAD OF TRUSSES, UNLESS NOTED OTHERWISE.  
 PROVIDE INTERNAL DUCT INSULATION FOR ENUS, PRENUM AND THE 1ST 4'-0" OF THE EXPOSED DUCT WORK.  
 ALL RETURN AIR ROOF STON HAVE INTERNAL INSULATION.

SEQUENCE OF OPERATION:  
 ROOM THERMOSTAT TO OPEN WHEN DAMPER IS FULL OPEN EP 1-5 IS TO BE ENERGIZED.



**NORTH**  
**KEY PLAN**  
 SCALE - N.T.S.

AS BUILTS	8-10-2008
FROM REQ 15	4-9-2007
FROM REQ 12	1-8-2007
FROM REQ 9	1-3-2006
CONTRACT SET	2-4-2006
ISSUE NO. 1	12-13-2005
ISSUE NO. 2	11-1-2005
CONSTRUCTION	11-1-2005
50% OWNER REVIEW	8-29-2005
90% OWNER REVIEW	7-18-2005
DD OWNER REVIEW	5-27-2005
DATE ISSUED	

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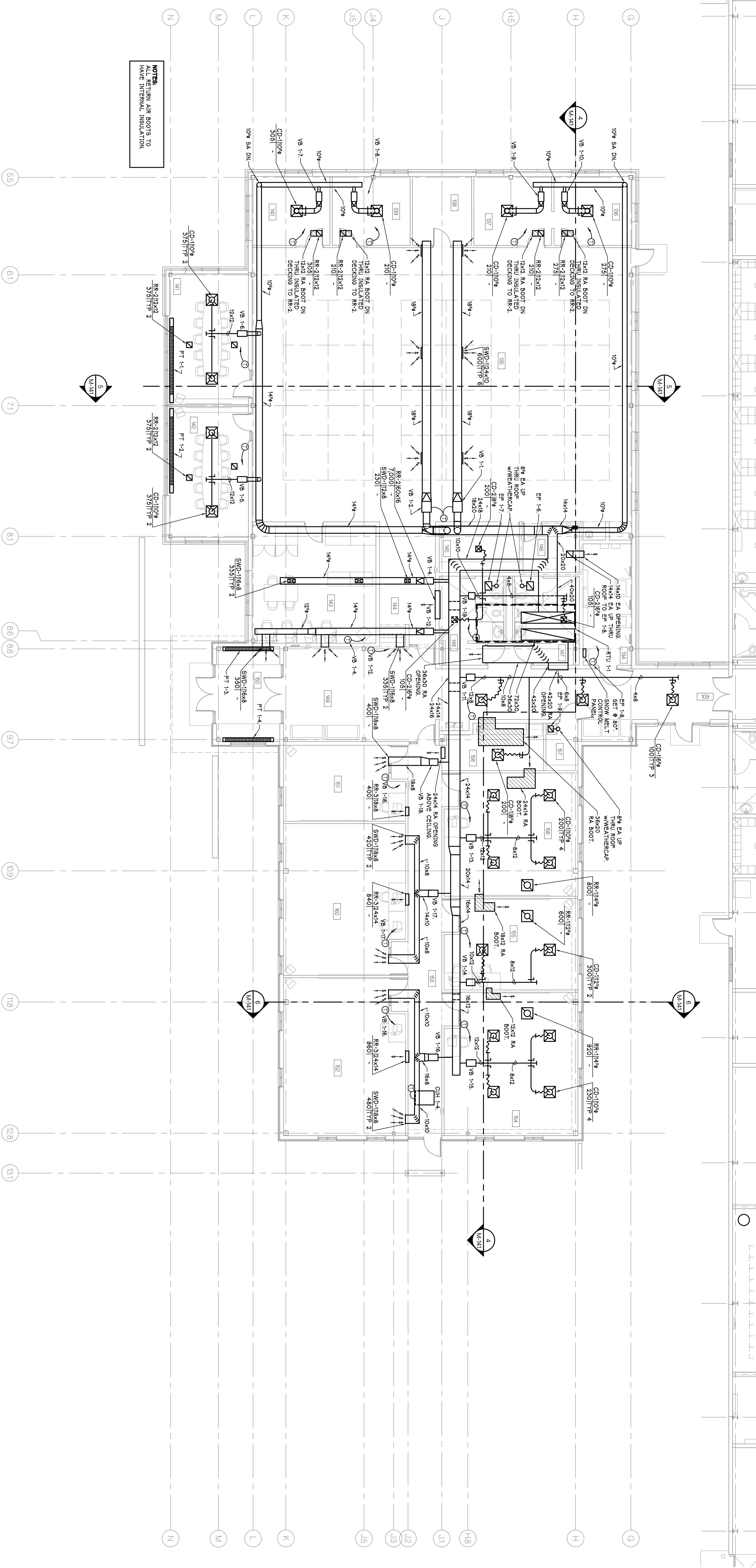
**CITY OF ANN ARBOR**  
 OPERATIONS AND  
 MAINTENANCE FACILITY  
 STONE SCHOOL ROAD  
 ANN ARBOR, MICHIGAN 48108

PROJECT  
 CONSULTANT

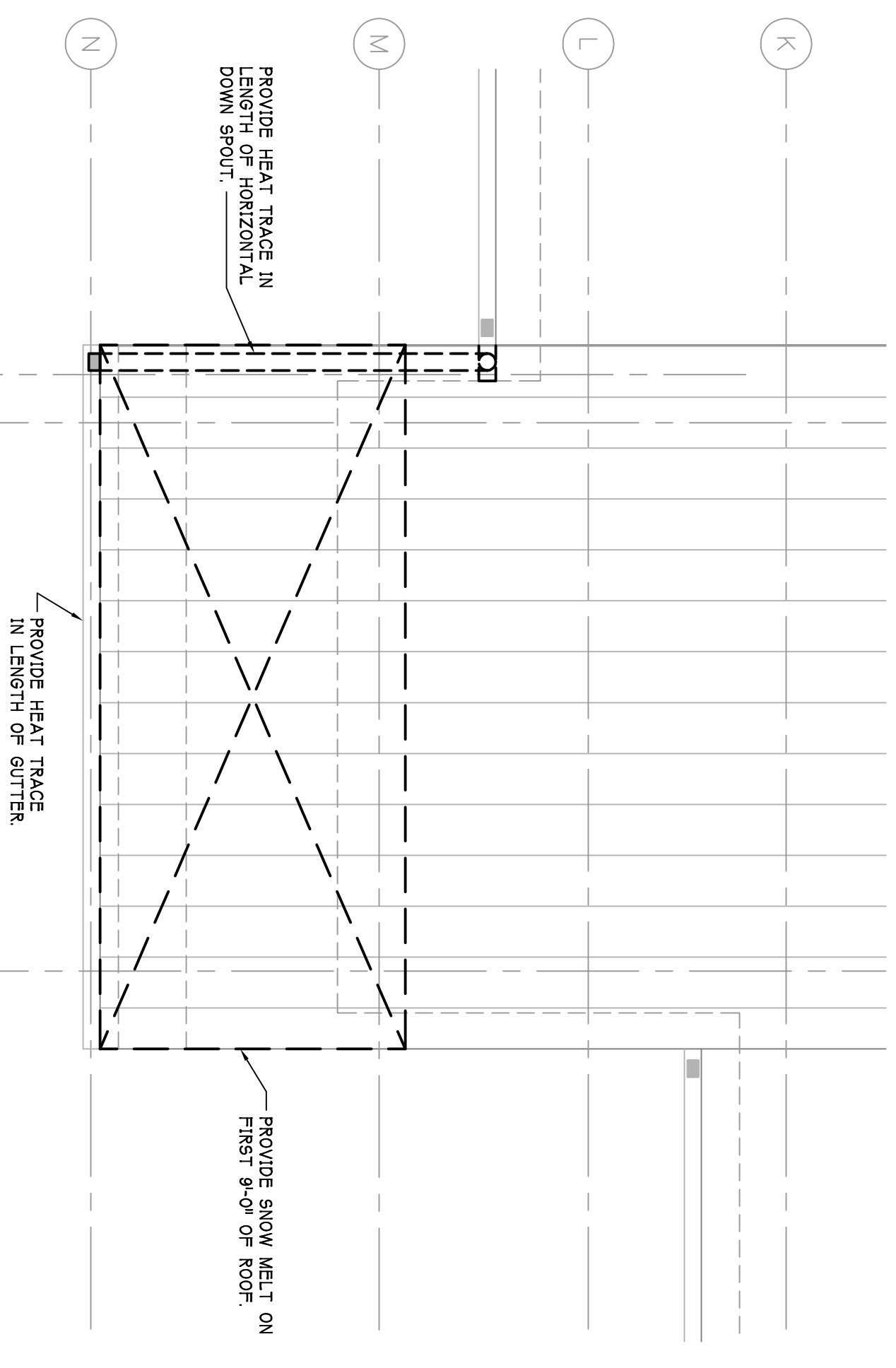
OPERATIONS BUILDING  
 FLOOR PLAN  
 PART 'B'  
 HVAC  
 SHEET TITLE

05-309  
 PROJECT NUMBER

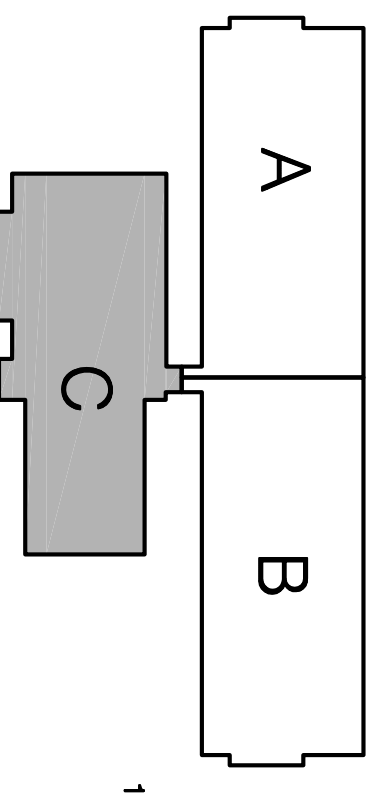
M-131  
 SHEET NUMBER



NORTH  
**FLOOR PLAN - PART 'C' - HVAC**  
 SCALE - 7/8" = 1'-0"



**1 SNOW MELT SYSTEM**  
 SCALE - 1/4" = 1'-0"



NORTH  
**KEY PLAN**  
 SCALE - NTS

AS BUILTS	8-9-2006
CONTRACT SET	2-4-2006
REVISION 1	11-1-2006
CONSTRUCTION	11-2-2006
60% OWNER REVIEW	8-29-2006
50% OWNER REVIEW	7-18-2006
DD OWNER REVIEW	5-27-2006
DATE ISSUED	

DRAWN BY  
 P.M. BE  
 CHECKED BY

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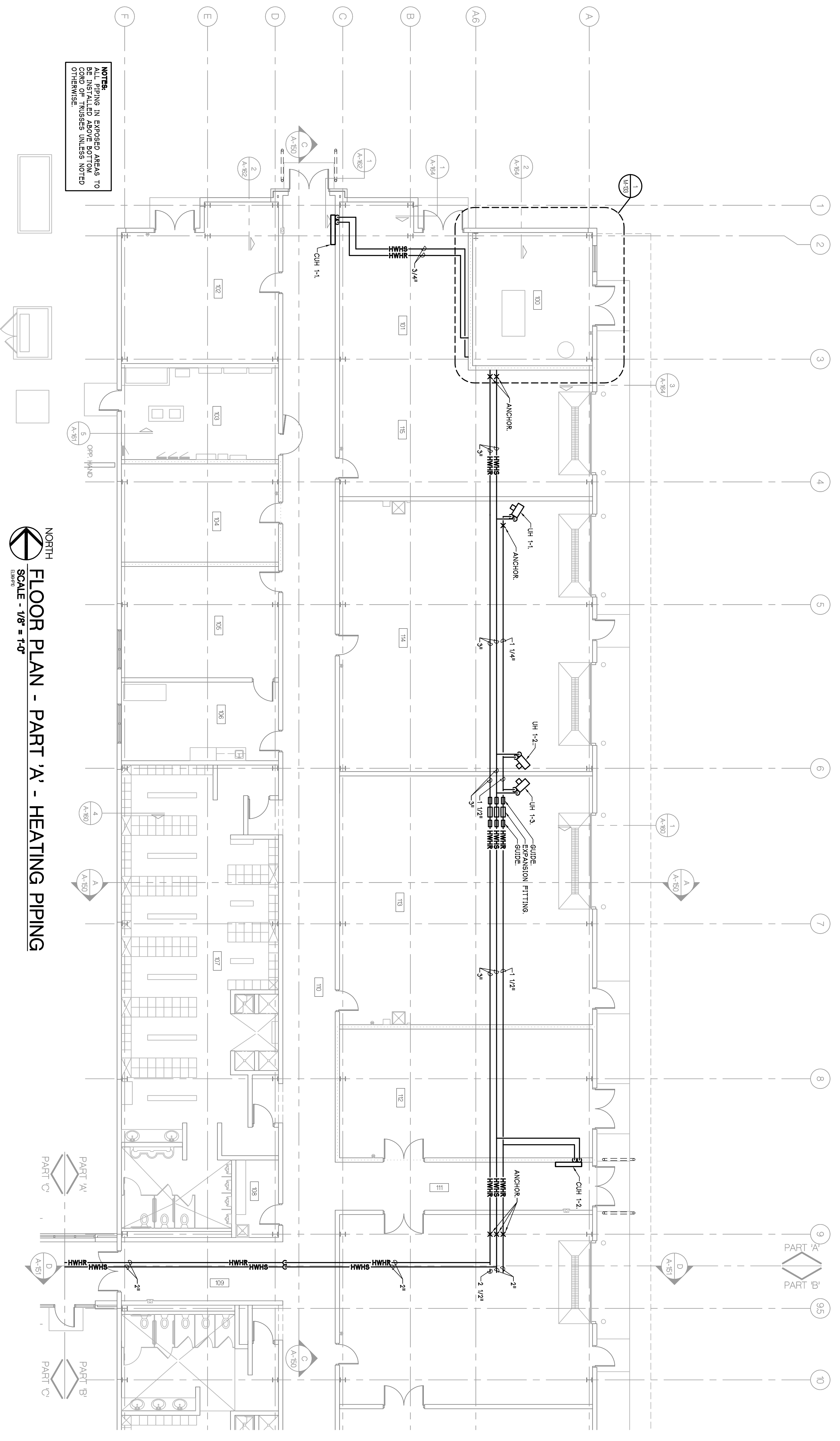
PROJECT  
 CONSULTANT

OPERATIONS BUILDING  
 FLOOR PLAN  
 PART 'C'  
 HVAC  
 SHEET TITLE

**05-309**  
 PROJECT NUMBER

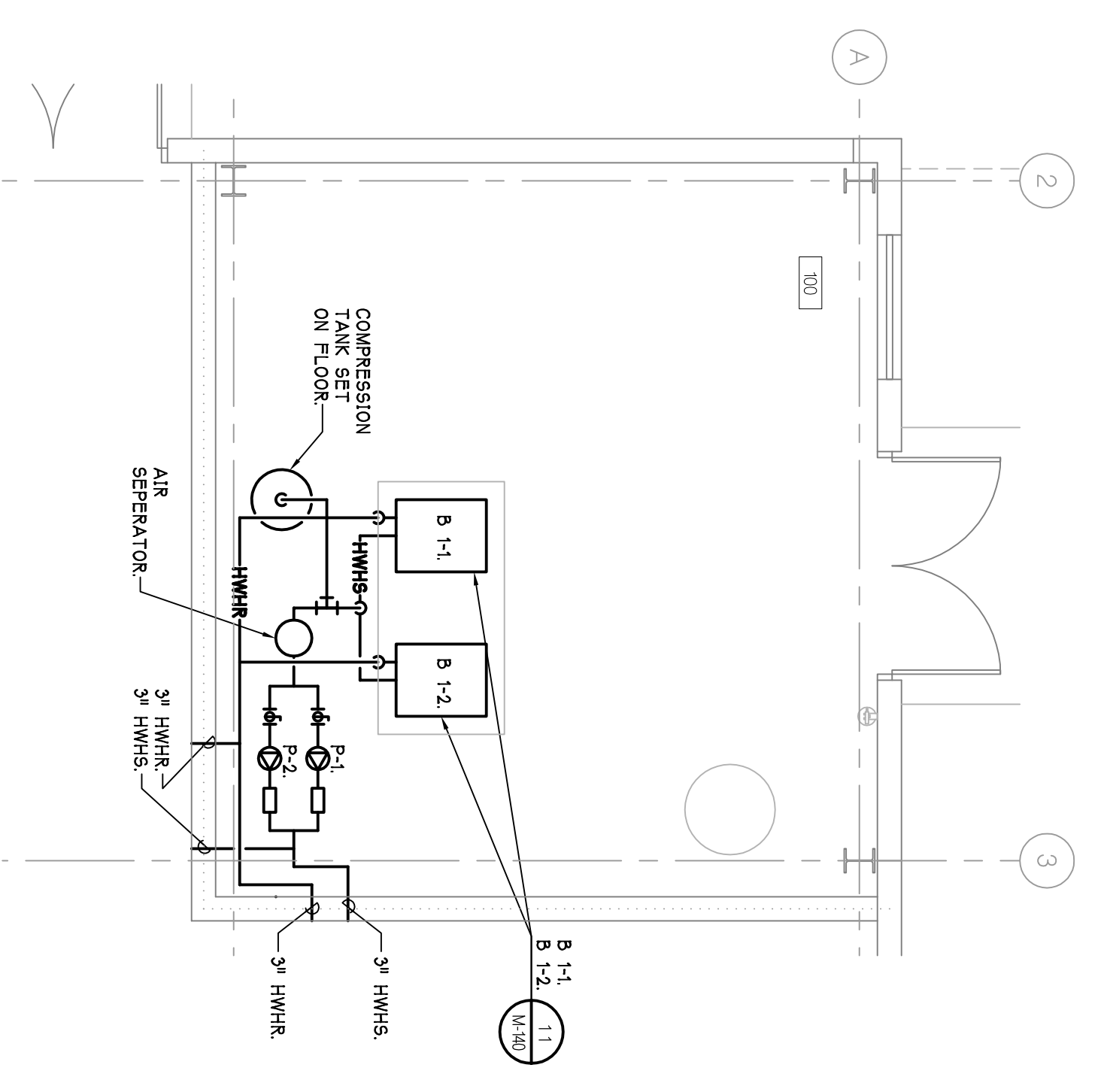
**M-132**  
 SHEET NUMBER



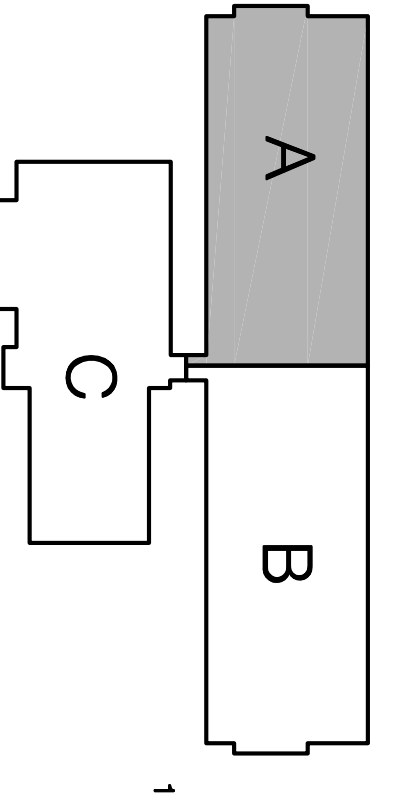


**NOTES:**  
 ALL PIPING IN EXPOSED AREAS TO BE INSTALLED ABOVE BOTTOM OF CEILING UNLESS NOTED OTHERWISE.

NORTH  
**FLOOR PLAN - PART 'A' - HEATING PIPING**  
 SCALE - 1/8" = 1'-0"



1  
**ENLARGED PLAN - HEATING PIPING**  
 SCALE - 1/4" = 1'-0"



NORTH  
**KEY PLAN**  
 SCALE - N.T.S.

AS NOTED	8-10-2006
SUPP. INSTR. 13	2-23-2007
SUPP. INSTR. 10	12-19-2006
CONTRACT SET	2-23-2006
CONSTRUCTION	11-12-2005
60% OWNER REVIEW	8-29-2005
50% OWNER REVIEW	7-18-2005
DD OWNER REVIEW	5-27-2005
DATE ISSUED	
MAE	
DRAWN BY	
CHECKED BY	

**PAR**  
 100 YEARS

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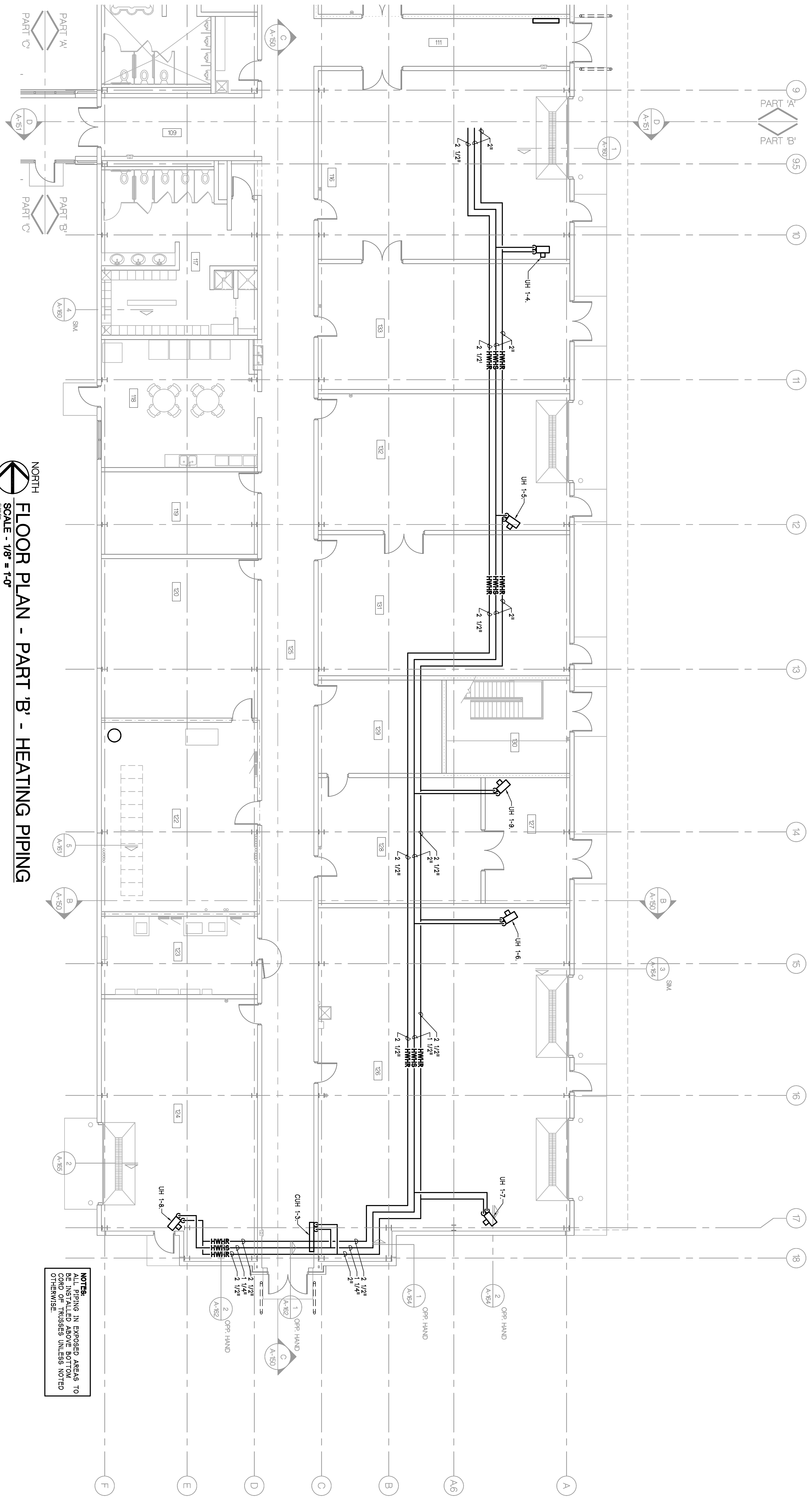
PROJECT

CONSULTANT

OPERATIONS BUILDING  
 FLOOR PLAN  
 PART 'A'  
 HEATING PIPING  
 SHEET TITLE

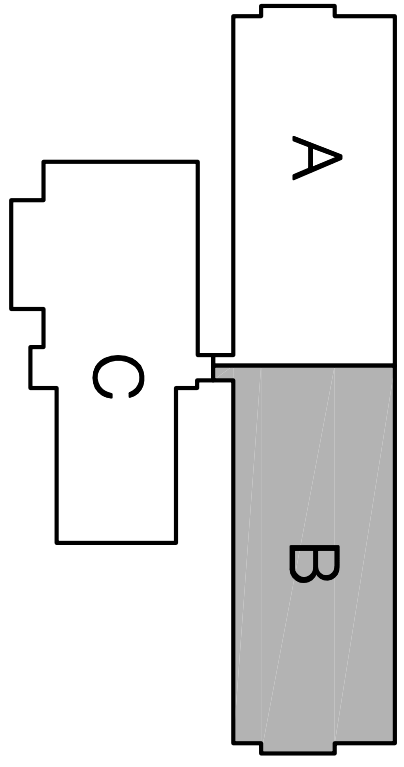
05-309  
 PROJECT NUMBER

M-133  
 SHEET NUMBER



NORTH  
 FLOOR PLAN - PART 'B' - HEATING PIPING  
 SCALE - 1/8" = 1'-0"

NOTES:  
 1. PIPING IN EXPOSED AREAS TO BE INSTALLED ABOVE BOTTOM CHIMNEYS UNLESS NOTED OTHERWISE.



NORTH  
 KEY PLAN  
 SCALE - N.T.S.

AS BUILTS	8-10-2006
DATE	2-4-2007
CONTRACT SET	2-4-2006
CONSTRUCTION	11-2-2005
60% OWNER REVIEW	8-29-2005
90% OWNER REVIEW	7-18-2005
DD OWNER REVIEW	5-27-2005
DATE ISSUED	
MAE	
DRAWN BY	PAH, SKB
CHECKED BY	

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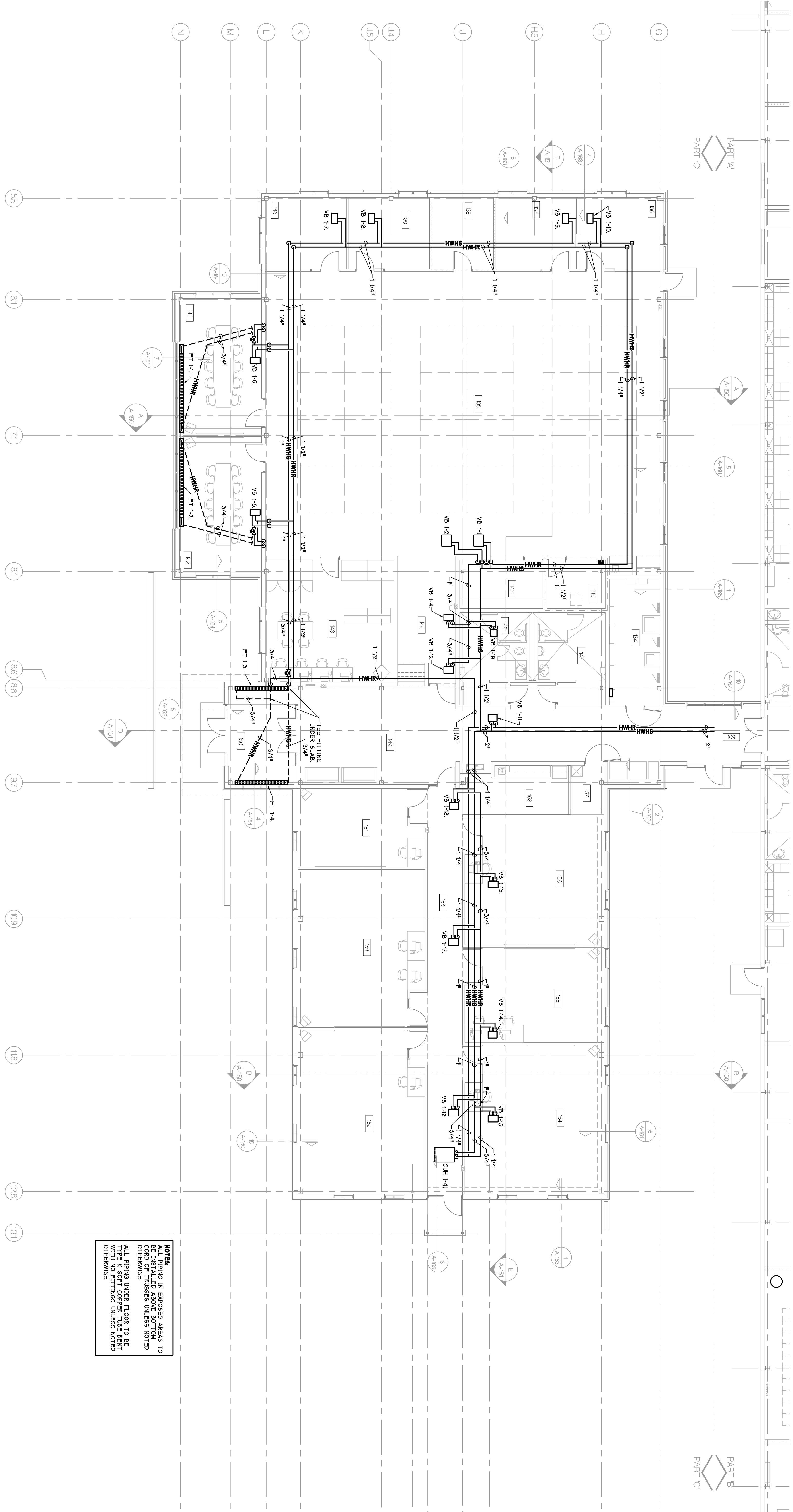
<p>CONSULTANT</p>	<p>OPERATIONS BUILDING          FLOOR PLAN          PART 'B'          HEATING PIPING          SHEET TITLE</p>
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<p>PROJECT NUMBER</p>	<p>05-309</p>
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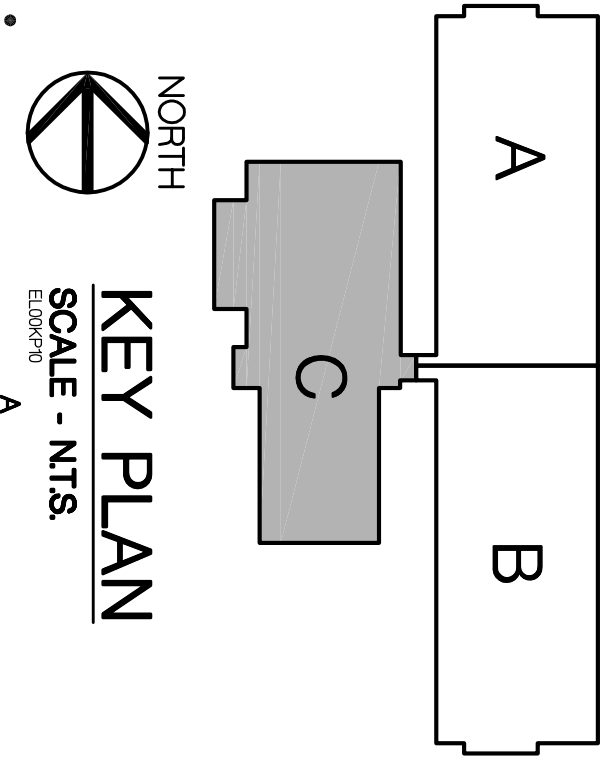
  

<p>SHEET NUMBER</p>	<p>M-134</p>
---------------------	--------------



NORTH  
 FLOOR PLAN - PART 'C' - HEATING PIPING  
 SCALE - 1/8" = 1'-0"

**NOTES:**  
 1. PIPING IN REDUCED AREAS TO BE INSTALLED IN ABOVE BOTTOM CORNER OF TRISSES UNLESS NOTED OTHERWISE.  
 2. ALL PIPING UNDER FLOOR TO BE INSTALLED IN CHASES UNLESS NOTED OTHERWISE.



AS BUILTS	8-10-2006
DATE	2-4-2007
CONTRACT SET	2-8-2006
CONSTRUCTION	11-2-2006
60% OWNER REVIEW	8-29-2006
DD OWNER REVIEW	7-18-2006
DATE ISSUED	5-27-2006
DRAWN BY	MAE
CHECKED BY	PAH, BJC

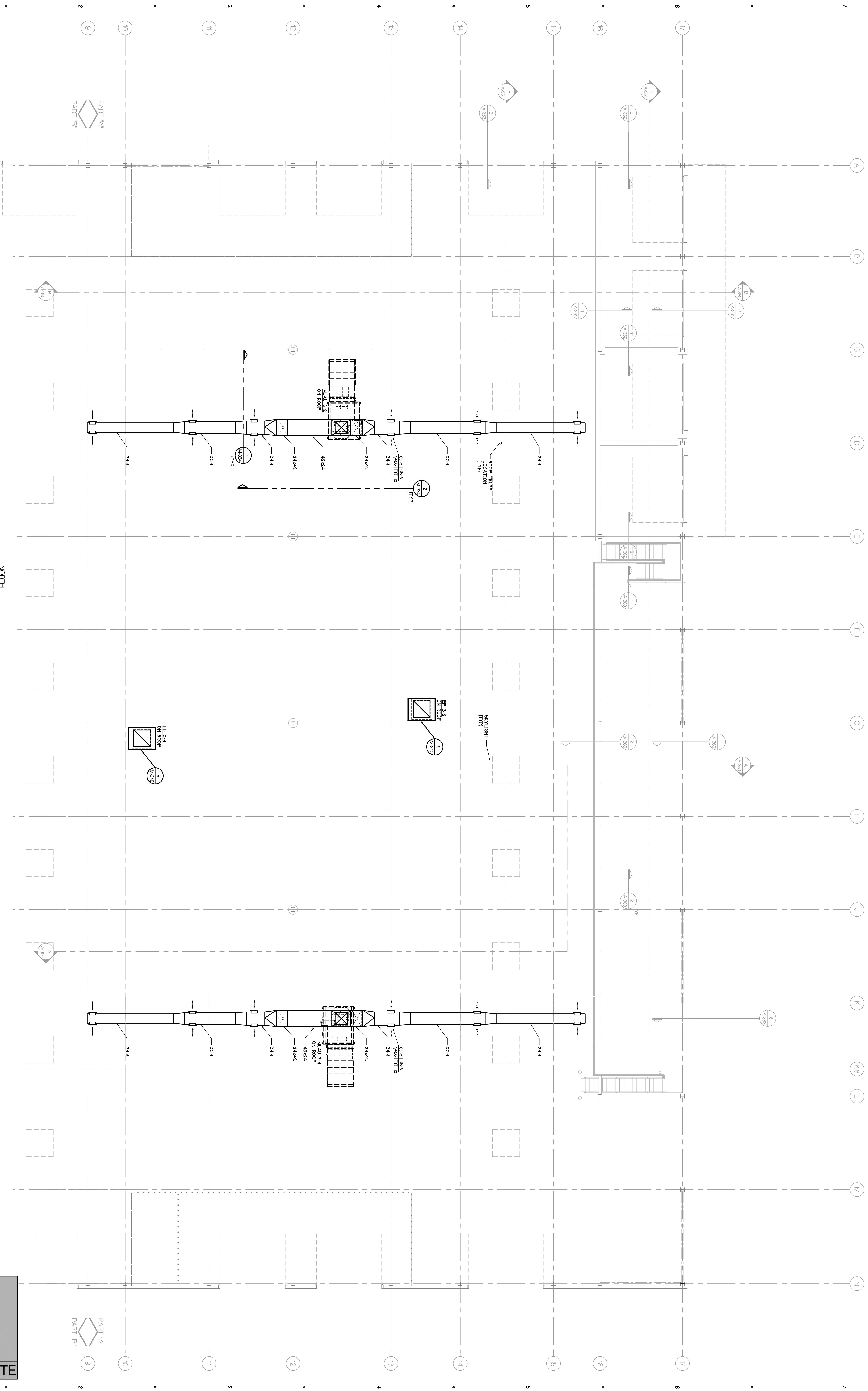
<p>11757 Katy Freeway #600, Houston, (281) 558-7273</p> <p>1831 Chestnut Street #700, St. Louis, (314) 421-1476</p>	<p>10311 South Blvd. Ann Arbor, Michigan 48104 P. 734.463.4189 F. 734.463.1770 www.hobbsblack.com</p>	<p>CITY OF ANN ARBOR                  OPERATIONS AND                  MAINTENANCE FACILITY                  STONE SCHOOL ROAD                  ANN ARBOR, MICHIGAN 48108</p>
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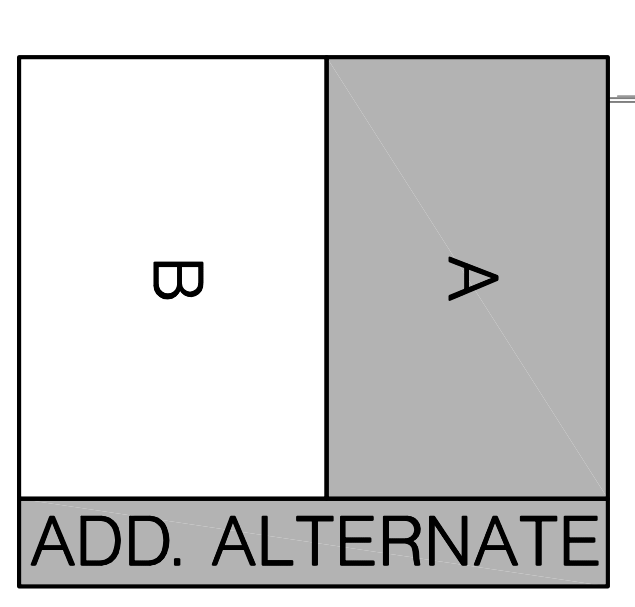
CONSULTANT	
PROJECT	
PROJECT NUMBER	05-309
SHEET NUMBER	M-135





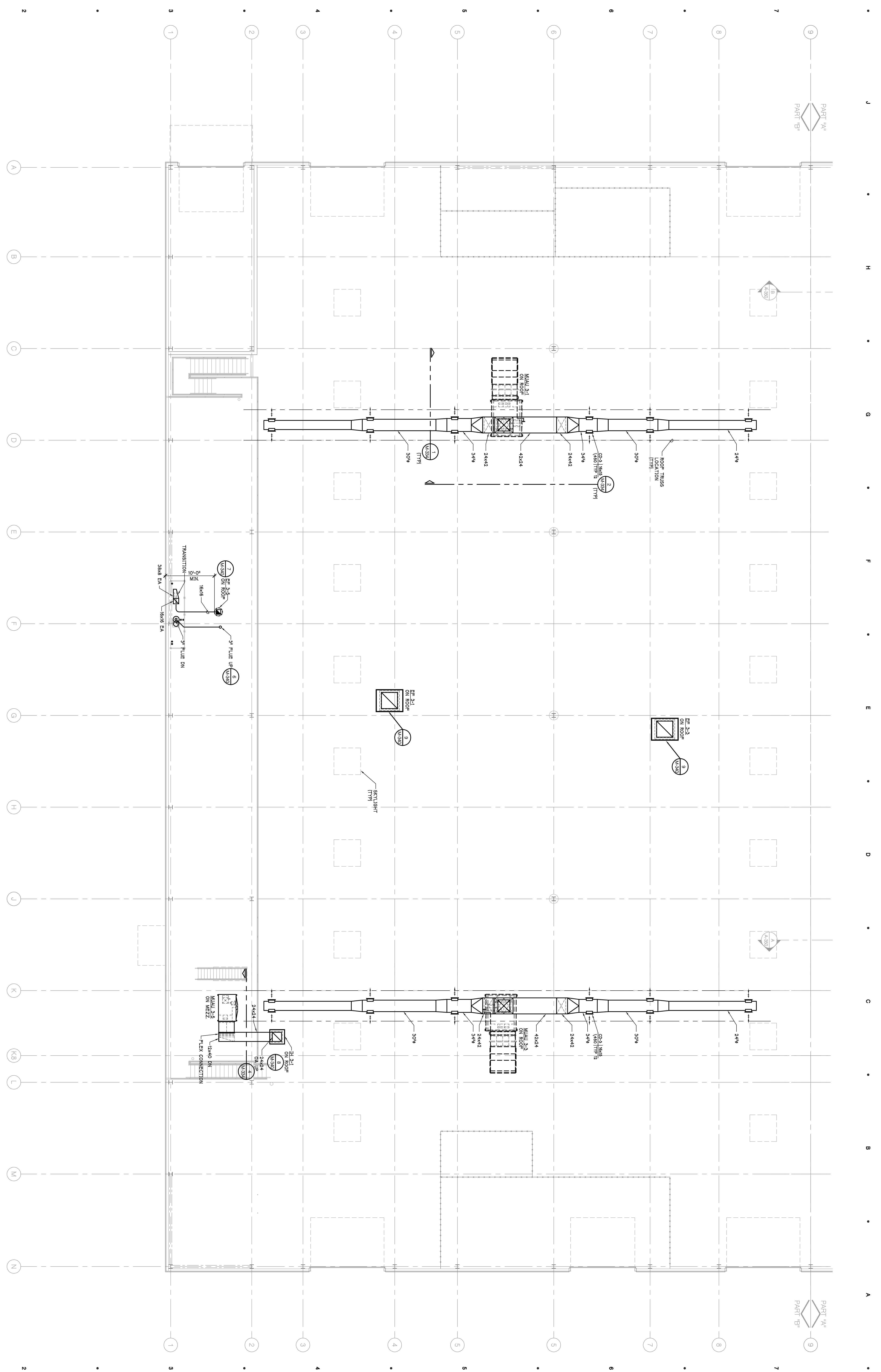


**MEZZANINE PLAN - PART "A" - HVAC ALTERNATE**  
 SCALE - 1/8" = 1'-0" (SEE ALTERNATE)

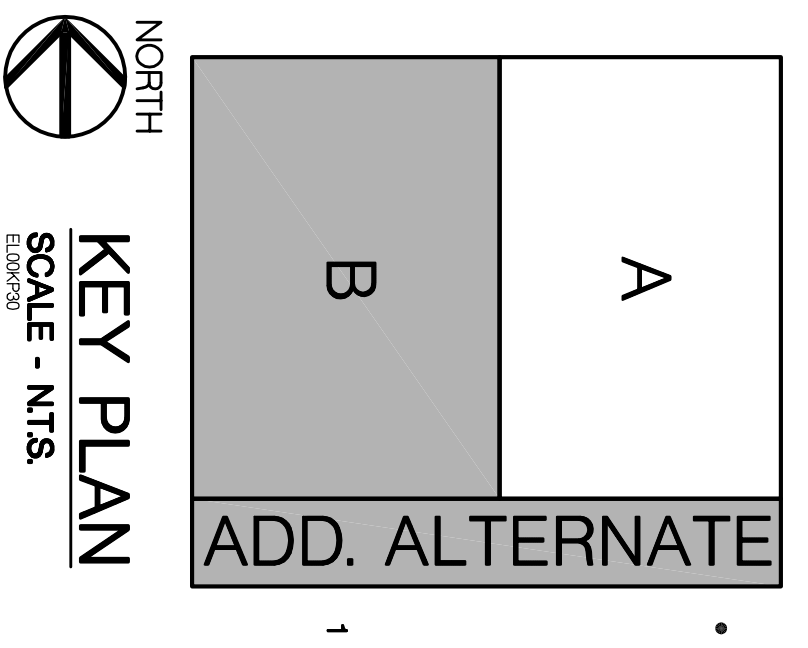


**KEY PLAN**  
 SCALE - NTS

<p>CITY OF ANN ARBOR                  OPERATIONS AND MAINTENANCE FACILITY                  STONE SCHOOL ROAD                  ANN ARBOR, MICHIGAN 48108</p>	<p>PROJECT</p>	<p>CONSULTANT</p>	<p>VEHICLE BUILDING                  MEZ. PART "A"                  HVAC</p> <p>SHEET TITLE</p>	<p>05-309</p> <p>PROJECT NUMBER</p>	<p>M-386</p> <p>SHEET NUMBER</p>	<p>AS BUILTS 8-10-2008                  CONTRACT SET 2-8-2006                  CONSTRUCTION 1-11-2005                  90% OWNER REVIEW 8-29-2005</p> <p>DATE ISSUED</p>	<p>DRAWN BY                  RUC, RAA, GJM                  CHECKED BY</p>	<p>100 YEARS</p>	<p>PARSONS BRINCKERHOFF                  QUADE &amp; DOUGLAS, INC.                  Fleet &amp; Facilities Division</p> <p>11757 Katy Freeway #600,                  Houston, (281) 558-7273</p> <p>1831 Chestnut Street #700,                  St. Louis, (314) 421-1478</p>	<p>HOBBS+BLACK ARCHITECTS</p> <p>100 N. State Street                  Ann Arbor, Michigan 48104                  P: 734.463.4189                  F: 734.463.1770                  www.hobbsblack.com</p>	<p>©Copyright 2005, HOBBS + BLACK, INC.                  ALL RIGHTS RESERVED</p>



**MEZZANINE PLAN - PART "B" - HVAC ALTERNATE**  
 SCALE - 1/8" = 1'-0" (THIS ALTERNATE WAS BUILT)



AS BUILT	8-10-2008
CONTRACT SET	2-8-2008
CONSTRUCTION	1-11-2009
90% OWNER REVIEW	8-29-2009
DATE ISSUED	
DRAWN BY	GRK
CHECKED BY	RUC, PAA, GWB

**100 YEARS**

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PROJECT

CONSULTANT

VEHICLE BUILDING  
 MEZ PART B  
 HVAC

SHEET TITLE

05-309

PROJECT NUMBER

M-387

SHEET NUMBER





**MEC 25 / TCP 25**  
**Panel Pictures**

MEC-25

TCP-25



SIEMENS

APOGEE Automation

DI1:  
DI2:  
DI3:  
DI4:

DI5:  
DI6:  
DI7:  
DI8:

A09  
A10  
A11  
A12

A013  
A014  
A015  
A016

0  
0  
0  
0  
0  
0  
0  
0

D025  
D026  
D027  
D028  
D029  
D030  
D031  
D032

C 57  
NO 58  
NC 59  
C 60  
NO 61  
NC 62  
C 63  
NO 64  
NC 65  
C 66  
NO 67  
NC 68  
C 69  
NO 70  
NC 71  
C 72  
NO 73  
NC 74  
C 75  
NO 76  
NC 77  
C 78  
NO 79  
NC 80

POWER MEC

49  
50  
51  
52

SHIELD

AI17  
AI18  
AI19  
AI20

AI21  
AI22  
AI23  
AI24

BLN EXP  
BK TX BK  
MODEM STATUS  
BATT

Warning: Do not touch the terminals or components inside the enclosure when the power is on. The enclosure is not to be opened when the power is on. The enclosure is not to be opened when the power is on.

Model PDH and Model PDH  
Installation/Operation Manual  
PREVA  
REZTOR Thomas/Botts  
Model PDH and Model PDH  
Installation/Operation Manual  
PREVA  
Model PDH  
CQS  
FOR YOUR SAFETY  
If you smell gas:  
(Open windows.  
Do not touch any electrical switches.  
Do not use any open flame.  
Immediately call your gas supplier.  
FOR YOUR SAFETY  
The use and storage of gas:  
liquids in open containers.  
hazardous.  
WARNING: Improper  
service, or maintenance  
instructions from  
equipment.  
WARNING: Improper  
handling of  
components can  
cause fire, explosion,  
death, or other  
injury.

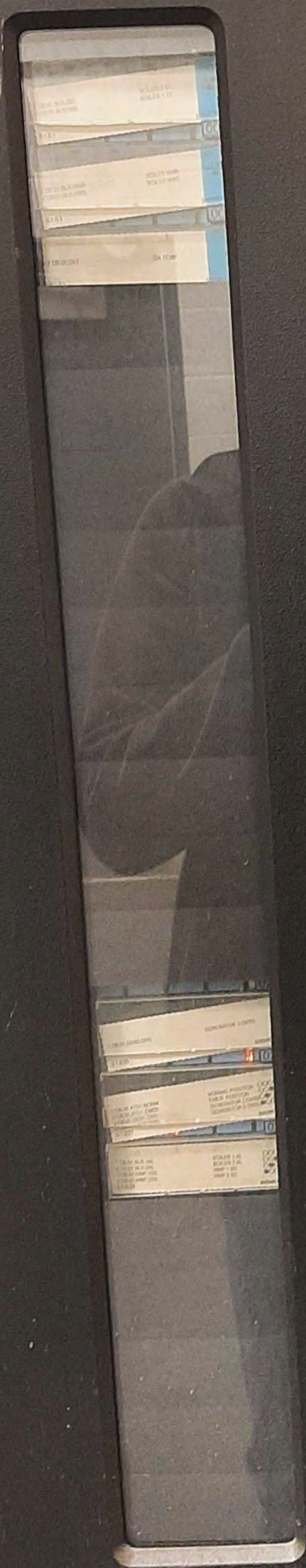
Table 2:  
Tempera  
Time  
Time

Wheeler Ops Bldg  
Rm 100  
MBC 1

APOGEE Automation

SIEMENS

MBC-1



⚠️ Shut power off prior to installation or removal of Open Processor or Power Module. Power switch may not disconnect all hazardous voltages due to the presence of high voltage I/O modules. Any high voltage I/O modules should incorporate a readily accessible disconnect device outside the panel.  
Couper l'alimentation avant d'installer ou d'enlever le module d'alimentation ou les processeurs universels. Un interrupteur de courant ne coupe pas les tensions sur les modules I/O. Pour les tensions dangereuses, installer un interrupteur facilement accessible à l'extérieur.

001 003 005

002

2B 3B 4B 5B 6B 7B 8B 9B 10B 11B 12B 13B

4A 5A 6A 7A 8A 9A 10A 11A 12A

025 027 029

17A 17B

028 030

001 002

003 005

025 027 029

17A 17B

028 030

0 OFF

0-1  
1-1  
2-0/0

NON-A-WARD  
PLUS DE SURETÉ ET D'EFFICACITÉ

SIEMENS P/N: 545-714  
Power Module

SIEMENS P/N: 802-001  
Power Open Processor

SIEMENS P/N: 802-002  
Power Open Processor

APOGEE Automation

SIEMENS  
Modbus Driver and Modbus 250 0

These installation instructions cover the operation of the Modbus Driver and Modbus 250 0. They are to be used in conjunction with the Modbus Driver and Modbus 250 0. For further information, see the Modbus Driver and Modbus 250 0. For further information, see the Modbus Driver and Modbus 250 0.

Product Description  
The Modbus Driver and Modbus 250 0 is a...  
Product Numbers  
Modbus Driver, Open Processor, 802-001, 802-002, 802-003, 802-004, 802-005, 802-006, 802-007, 802-008, 802-009, 802-010, 802-011, 802-012, 802-013, 802-014, 802-015, 802-016, 802-017, 802-018, 802-019, 802-020, 802-021, 802-022, 802-023, 802-024, 802-025, 802-026, 802-027, 802-028, 802-029, 802-030, 802-031, 802-032, 802-033, 802-034, 802-035, 802-036, 802-037, 802-038, 802-039, 802-040, 802-041, 802-042, 802-043, 802-044, 802-045, 802-046, 802-047, 802-048, 802-049, 802-050, 802-051, 802-052, 802-053, 802-054, 802-055, 802-056, 802-057, 802-058, 802-059, 802-060, 802-061, 802-062, 802-063, 802-064, 802-065, 802-066, 802-067, 802-068, 802-069, 802-070, 802-071, 802-072, 802-073, 802-074, 802-075, 802-076, 802-077, 802-078, 802-079, 802-080, 802-081, 802-082, 802-083, 802-084, 802-085, 802-086, 802-087, 802-088, 802-089, 802-090, 802-091, 802-092, 802-093, 802-094, 802-095, 802-096, 802-097, 802-098, 802-099, 802-100.

SIEMENS

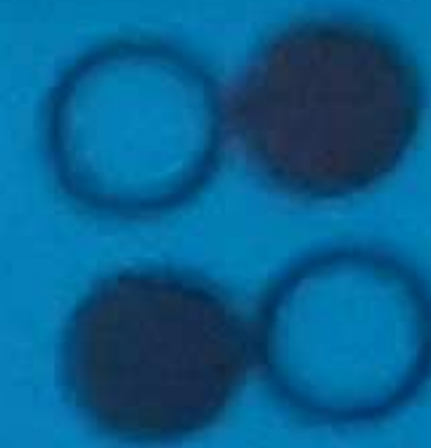
CAUTION

001

1 OB.01.BLR.2BS  
2 OB.01.BLR.1BS

BOILER 2 ST  
BOILER 1 ST

2P1K



SIEMENS

0.1.0.1

003

1 OB.01.BLR.HWR  
2 OB.01.BLR.HWS

BOILER HWR  
BOILER HWS

2P1K



SIEMENS

0.1.0.3

005

1 OB.01.OAT

OA TEMP

2P1K



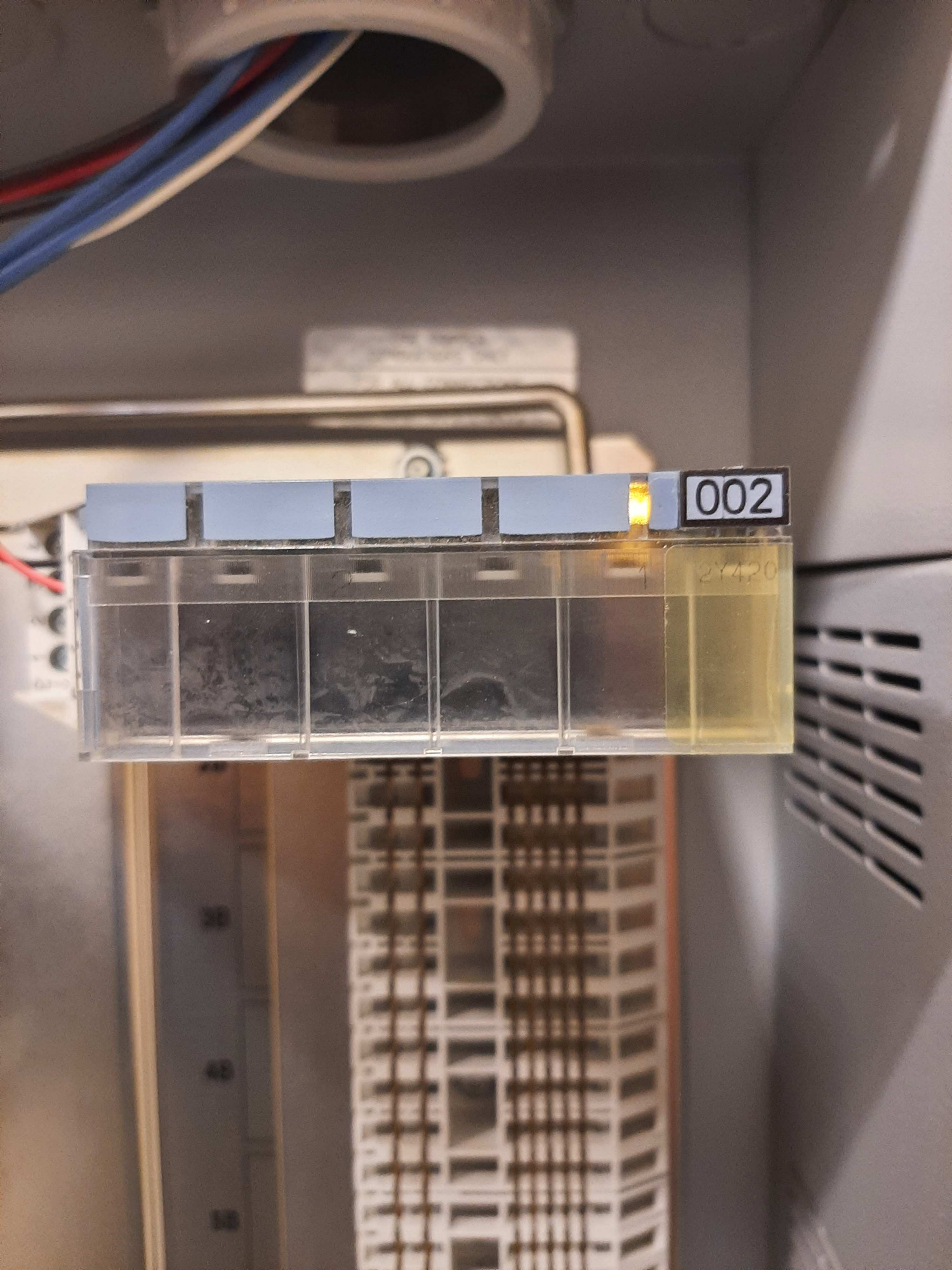
SIEMENS

0.1.0.5

002

2Y420

1





12B

13B

028

HOA 2

HOA 1

2Q250-M

1 OB.01.HWP.2SS

HWP 2 SS

⊗  
0.1.0.28

SIEMENS

030

HOA 2

HOA 1

2Q250-M

1 OB.01.BLR.ENB  
2 OB.01.HWP.1SS

BOILER ENABLE  
HWP 1 SS

⊗  
0.1.0.30

SIEMENS

11A

12A

025

1 OB.01.GEN3.OVD

GENERATOR 3 OVRD

SIEMENS

0.1.0.25

027

1 OB.01.ATS1.NORM  
2 OB.01.ATS1.EMER  
3 OB.01.GEN1.OVD  
4 OB.01.GEN2.OVD

NORMAL POSITION  
EMER. POSITION  
GENERATOR 1 OVRD  
GENERATOR 2 OVRD

●○○○  
○○●○  
○●○○  
●○○○

SIEMENS

0.1.0.27

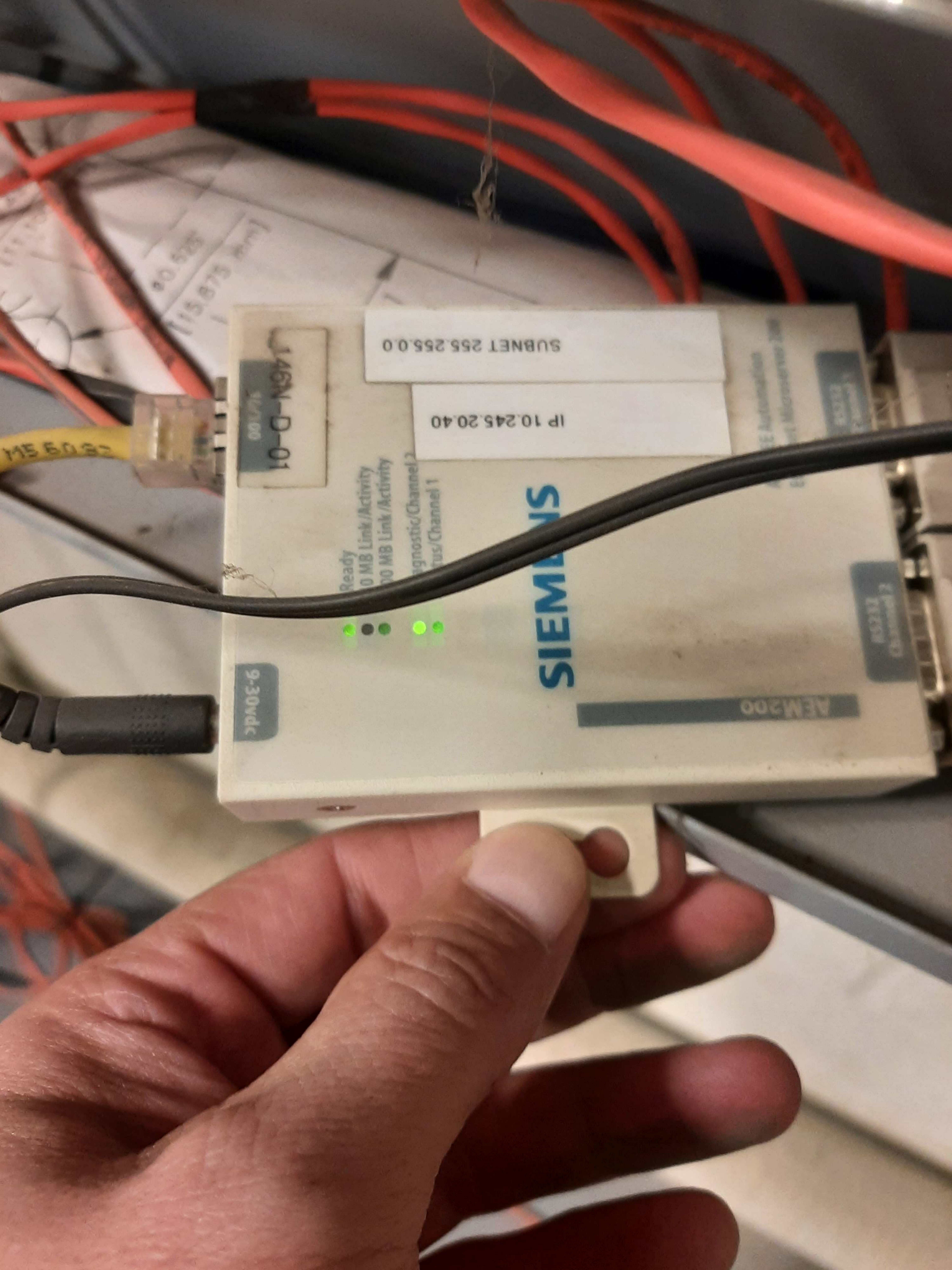
029

1 OB.01.BLR.1AL  
2 OB.01.BLR.2AL  
3 OB.01.HWP.1SS  
4 OB.01.HWP.2SS  
0.1.0.29

BOILER 1 AL  
BOILER 2 AL  
HWP 1 SS  
HWP 2 SS

○○○●  
○○●○  
○●○○  
●○○○

SIEMENS



1A6N-D-01  
10/100

SUBNET 255.255.0.0

IP 10.245.20.40

Ready  
10 MB Link/Activity  
100 MB Link/Activity  
Diagnostic/Channel 2  
Status/Channel 1



9-30Vdc

SIEMENS

AEM200

RJ45 Channel 2

825 02  
115875

**Wheeler Vehicle Storage**

**Rm 308**

**PP2**

**MEC 24**

**EXP 24**

SIEMENS

MEC-24

EXP-24

APOGEE Automation



⚠️ Do not power up prior to installation or removal of Open Processors or Power Module. Power switch may not disconnect all hazardous voltages due to the presence of high voltage I/O modules. Any high voltage I/O modules should incorporate a readily accessible disconnect device outside the cabinet.  
Ne pas alimenter avant d'installer ou d'enlever le module d'alimentation ou les processeurs ouverts. L'interrupteur de courant ne coupe pas les tensions dangereuses des modules I/O. Pour les dangers d'électrocution, installez un interrupteur facilement accessible à l'extérieur.

**SIEMENS APOGEE Automation**

DI1: DI5  
DI2: DI6  
DI3: DI7  
DI4: DI8

A09 A013  
A10 A14  
A11 A15  
A12 A16

D025 C 57  
          NO 58  
          NC 59  
D026 C 60  
          NO 61  
          NC 62  
D027 C 63  
          NO 64  
          NC 65  
D028 C 66  
          NO 67  
          NC 68  
D029 C 69  
          NO 70  
          NC 71  
D030 C 72  
          NO 73  
          NC 74  
D031 C 75  
          NO 76  
          NC 77  
D032 C 78  
          NO 79  
          NC 80

**POWER MEC**

48 53 +24Vdc  
50 54 SENSOR  
51 55 SUPPLY  
52 56

SHIELD

AI17 AI21  
AI18 AI22  
AI19 AI23  
AI20 AI24

LOW BAT.   BLM   EXP   STATS   BATT

SDP4- CRT 11

240VAC  
120VAC  
120VDC

100-1000W

120VDC

120VDC

**SIEMENS APOGEE Automation**

DI1: DI5  
DI2: DI6  
DI3: DI7  
DI4: DI8

D05 C 9  
      NO 10  
      NC 11  
D06 C 12  
      NO 13  
      NC 14  
D07 C 15  
      NO 16  
      NC 17  
D08 C 18  
      NO 19  
      NC 20

STATS   FLA   EXP  
      TX   RX

**SIEMENS APOGEE Automation**

DI1: DI5  
DI2: DI6  
DI3: DI7  
DI4: DI8

D05 C 9  
      NO 10  
      NC 11  
D06 C 12  
      NO 13  
      NC 14  
D07 C 15  
      NO 16  
      NC 17  
D08 C 18  
      NO 19  
      NC 20

STATS   FLA   EXP  
      TX   RX

DOB

C  
NO  
NC

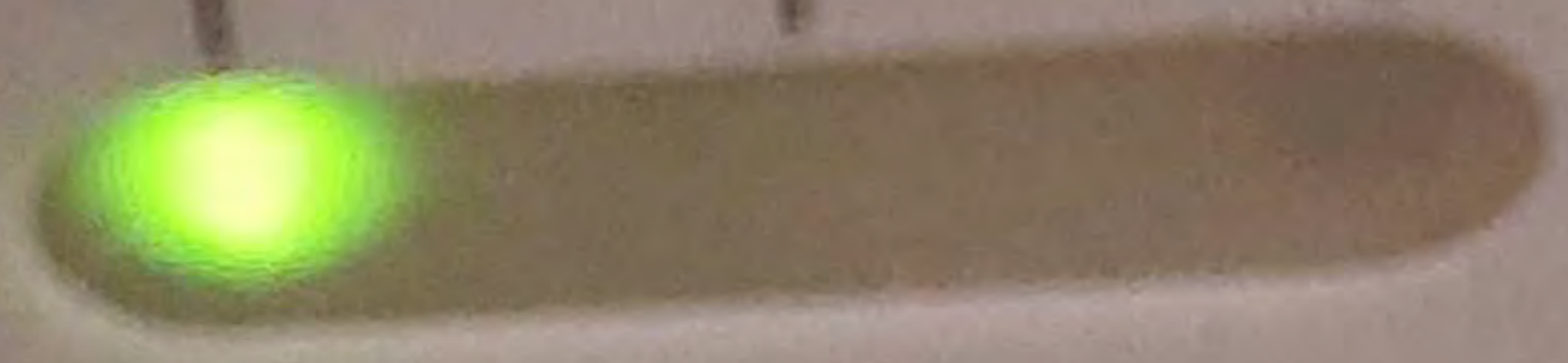
18  
19  
20

STATUS

FLN/EXP

TX

RX



SIEMENS

K5232  
Channel 2

K5232  
Channel 1

Automation  
Microserver 200

IP 10.245.20.50

SUBNET 255.255.0.0

Ready  
1 MB Link  
1 MB Link  
Status  
Channel 1

