



Invitation To Bid

Louisville/Jefferson Co Metro Government

ORIGINAL

Bid Number: 1882

Revision: 0
Date: 21-AUG-09

Sealed bids will be received until 3:00 PM and publicly opened and all bid prices read aloud at that hour on date specified and under following conditions:

Bids received after 3:00 PM on Reply By Date will not be opened.

Bids must be signed by individuals or firms making bid. Samples to be submitted if requested. The right is reserved to select the lowest and best bid, also to reject any or all bids or any part thereof.

On proposals amounting to \$2000.00 or over, successful bidder may be required to execute and give performance bond for full amount of same by a Surety Company authorized to do business in the Commonwealth of Kentucky before order is issued.

All items quoted are considered F.O.B. Delivered, unless otherwise stated.

Mark envelope with Bid Number, Reply By Date and Address to:
Office for Management & Budget - Division of Purchasing
611 West Jefferson Street
Mezzanine Level
Louisville, KY 40202

Reply By: 03-SEP-09

- | # | Description |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | A Price Contract to provide a protion of Louisville Metro Government's need for Type 170 Traffic Signal Controllers, Cabinets and Miscellaneous Equipment for a period of twelve (12) months, as per the attached specifications. |

DELIVERY TIME: 60-90 Days, ARO
(# of days A.R.O.)

We guarantee all the above named goods to be first-class and equal in every particular to above specification. Delivery to be made immediately on advice of acceptance unless otherwise specified.

UNSIGNED BIDS WILL NOT BE CONSIDERED

FIRM NAME: Path Master, Inc.
OFFICIAL'S SIGNATURE: *Randall [Signature]*
ADDRESS: 1960 Midway Dr.
Twinsburg, OH 44087
PHONE: 330-425-4994
DATE: September 2, 2009



Invitation To Bid

Louisville/Jefferson Co Metro Government

Bid#: 1882

Standard Text

Please submit all factory literature and supporting documentation with each submitted copy of your Bid/RFP.

Any Kentucky Public Procurement Agency will have the option of making purchases using this bid / contract by issuing a separate Purchase Order.

If you have any questions concerning the Purchasing Requirements of this solicitation please call Senora Ford at (502) 574-5767.

RENEWAL OPTION:

Metro Government reserves the right to renew & extend contracts for a period of one (1) year and from year to year thereafter, upon the same terms and conditions, if such renewal or extension is agreed to by the contractor. Total contract period cannot exceed five (5) years. Written notice of Metro Government's intention to renew/extend will be sent prior to the expiration date.

Metro Government reserves the right to issue a separate bid for this product / service when it is in it's best interest.

Any Kentucky Public Procurement Agency will have the option of making purchases or establishing a Price Contract under the terms and conditions of this bid.

Contractor shall notify Louisville-Jefferson County Metro Purchasing of any change in their status within 30 days of the change.

The prices on the resulting contract shall be the maximum that will be charged for the covered products and/or services. Any requested increase of these prices shall be requested in writing to the Metro Division of Purchasing. The Division of Purchasing will either accept or decline the request. Increases shall not be effective until approval is received in writing.

Metro Government will accept no price increases for the first year of the annual price contract. All price increase requests after the first year must be submitted in writing to the Purchasing Division, 611 West Jefferson Street, Mezzanine Level, Louisville, KY 40202. Upon notification by the vendor of documented market increases, Purchasing may either accept the price change or cancel the contract.

Any inquiries on this Bid/RFP after the opening date shall be addressed in writing to:

Director of Purchasing
Office for Management & Budget - Division of Purchasing
611 West Jefferson Street - Mezzanine Level
Louisville, KY 40202



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Louisville/Jefferson Co Metro Government

The Successful Bidder will be required to furnish insurance coverage as stated in the specifications.

If you do not plan to sub-contract any of this work, you must complete and sign Form GFE-1 to indicate work will be self-performed.

SUBMIT BIDS WITH A COMPLETE UNBOUND ORIGINAL (please mark original) AND ONE COPY. The copy should be a complete copy of your original bid. Failure to submit ALL forms and information required in specifications may be reason for disqualification.

If the successful vendor agrees to extend the pricing for a twelve month period the Purchasing Department may purchase additional items from this bid by issuing a separate purchase order. The pricing and specifications for the new purchase shall be the same as those in the original bid and original purchase order.

STANDARD TEXT

Please indicate your Louisville/Jefferson County Metro Government Revenue Commission Number [REDACTED] and your Federal Tax Identification Number [REDACTED]. If you are a Metro Government vendor or you are doing business in Metro Louisville, you should already be registered with the Revenue Commission and have all of your required taxes paid. If you become the successful vendor, you must be properly registered with the Revenue Commission and have all of your required taxes paid prior to the award of this contract. For further information please call Lisa Finegan of the Revenue Commission at (502) 574-4860.

Ordinance #214, Series 2005, concerning the requirement for an Affirmative Action Plan for contractors and vendors doing business with Louisville/Jefferson County Metro Government, shall apply to this Notice for Bids. Any questions concerning the ordinance should be directed to the Human Relations Commission at (502) 574-3631.

All parties hereto acknowledge any agreement is subject to Metro Government Ordinances, relating to the requirement of an affirmative action plan or other equal employment criteria for contractors and vendors to do business with the Metro Government. Failure to comply with the terms of said ordinances will be cause for suspension, termination or cancellation of any agreement.

All prices quoted are to be F.O.B. Delivered to Destination.

BID PRICES ARE TO BE FIRM FOR A MINIMUM OF Ninty (90) DAYS FROM BID/RFP OPENING DATE

Please include your FAX number 330-425-9338.

Time discounts or cash discounts shall not be considered in award evaluation. Delivery time may be an evaluation factor in award of the Invitation for Bid/Price Inquiry/Proposal.

Metro Government is not responsible for any cost incurred by bidders/proposers in the preparation of bids/proposals.

(1) It shall be a breach of ethical standards for any employee with procurement authority to participate directly in any proceeding or application; request for ruling or other determination; claim or controversy; or other particular matter pertaining to any contract, or subcontract, and any solicitation or proposal therefore, in which to his knowledge:

- a. He, or any member of his immediate family has a financial interest therein; or
- b. A business or organization in which he or any member of his immediate family has a financial interest as an officer, director, trustee, partner, or employee, is a party; or
- c. Any other person, business or organization with whom he or any member of his immediate family is negotiating or has an arrangement concerning prospective employment is a party. Direct or indirect participation shall include but not be limited to involvement through decision, approval, disapproval, recommendation, preparation, of any purchase request, influencing the content of any specification or purchase standard, rendering of advice, investigation, auditing, or in any other advisory capacity.

(2) It shall be a breach of ethical standards for any person to offer, give, or agree to give any employee or former employee, to solicit, demand, accept, or agree to accept from another person, a gratuity or an offer of employment, in connection with any decision, approval, disapproval, recommendation, preparation of any part of a purchase request, influencing the content of any specification or purchase standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any proceeding or application, request for ruling or other determination, claim or controversy, or other particular matter, pertaining to any contract or subcontract and any solicitation or proposal therefore.

(3) It is a breach of ethical standards for any payment, gratuity, or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier

subcontractor or any person associated therewith, as an inducement for the award of a subcontract or order.

(4) The prohibition against conflicts of interest and gratuities and kickbacks shall be conspicuously set forth in every local public agency written contract and solicitation therefore.

(5) It shall be a breach of ethical standards for any public employee or former employee knowingly to use confidential information for his actual or anticipated personal gain, or the actual or anticipated personal gain of any other person.

The mentioned manufacturer's names and model numbers are used only to indicate type and quality of merchandise needed and are in no way intended to limit bidding

Assignment of Contract: The bidder shall not assign or subcontract any portion of the contract without the express written consent of the Louisville/Jefferson County Metro Government. Any purported assignment or subcontract in violation hereof shall be void. It is expressly acknowledged that the Metro Government shall never be required or obligated to consent to any request for assignment or subcontract; and further that such refusal to consent can be for any or no reason, fully within the sole discretion of the Metro Government.

Payment Terms will be Net 30. Metro Government does not pay late fees or finance charges.

Submitted bids shall be for a firm, fixed price.

If the successful vendor agrees to extend the pricing for a twelve (12) month period additional items may be purchased from this bid by issuing a separate purchase order. The bid specifications must be met.

Inquiries on this Bid/RFP after the opening date shall be directed in writing to:

Director of Purchasing
611 West Jefferson Street - Mezzanine Level
Louisville, KY 40202

Louisville/Jefferson Co Metro Government CONDITIONS

1. Unless otherwise stated in the specifications, no bidder will be permitted to withdraw their bid until sixty calendar days after the opening date of this proposal.
2. Where this invitation covers two or more items for which unit prices are quoted, the Metro Government reserves the right to accept or reject any portion of the bid and to award purchase orders to the Metro Government's best advantage.
3. Prices quoted are to be exclusive of the State and Federal Excise Tax from which the Metro Government are exempt.
4. Explanation: Should a prospective bidder find discrepancy in or omissions from the specifications, or be in doubt as to their meanings, he/she shall at once notify the Metro Purchasing Director who shall send written instructions to all prospective bidders. The Metro Government will not be responsible for any oral instructions.
5. All commodities furnished are subject to inspection at the point of delivery by a representative of the Metro Government. All rejected supplies will be returned at vendor's expense.
6. By signature on the face of this bid the bidder expressly states that no fee/attorney's fee, commission, allowance, gratuity, reward, gift, promise or compensation of any kind has been made or paid or will be made or paid in connections with this transaction or any matters arising out of or pertaining to same.
7. The Bidder is requested to show both unit prices and lot prices. In the event of any error the unit price Bid shall prevail.
8. The Metro Purchasing Director reserves the right to waive any formality and/or technicality in any Bid if such waiver is to the Metro Government's advantage.
9. Bids shall be submitted on the forms provided and must be signed by the bidder or an authorized representative. Any corrections to entries made on bid forms should be initiated by the person signing the bid.
10. Bids must be submitted as directed in the Invitation for Bids.
11. Bids shall be submitted prior to the time fixed in the Invitation for Bids.
12. If more than one bid is offered on the same item by one party, or by any person or persons representating a party, all such bids shall be rejected.
13. The owner reserves the right to reject any and all bids.
14. The bidder to whom award is made may enter into a written contract with the Metro Government within the time specified in the Invitation. All insurance requirements including performance and payment bonds shall be furnished the time of signing the formal agreement.
15. The contractor agrees that in the performance of this agreement with the Metro Government, he/she will not discriminate against any workers because of race, creed, color, religion, national origin, handicap or sex and will comply with all applicable Federal, State or local laws and regulation prohibiting such discrimination. The aforesaid provision shall include, but not be limited to the following: Employment and upgrading, demolition or transfer, recruitment and recruitment advertising, lay-off or termination, rates of pay or other forms of compensation, selection for training including apprenticeship. The contractor agrees to post

thereafter in conspicuous places, available for employees and all applicants for employment, notices setting forth the provisions of the above non-discrimination clause. The contractor further agrees to insert the foregoing provision in all sub-contracts hereunder.

16. PATENT INFRINGEMENT - The supplier/contractor must indemnify the Metro Purchasing Department against all damages and expenses resulting from patent infringement.

PLEASE READ CAREFULLY

This Invitation for Bids contains a signature page at the end of the document. By signing the signature page, the Bidder agrees to be bound by the following terms and conditions:

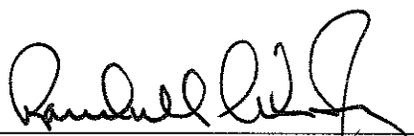
Bidder agrees that this document shall become the final contract and shall be legally bound by the bid document including all terms, conditions and specifications contained in the Invitation for Bids.

Bidder acknowledges that the individual signing the bid document for the Bidder has the authority to contractually and legally bind Bidder to the bid document and all terms, conditions and specifications contained therein.

Once this Invitation for Bids document has been signed and received by the Purchasing Department of the Metro Government, Bidder will not be allowed to change, alter, amend or withdraw their bid except with the express permission of the Director of Purchasing or in accordance to law.

In accordance with Condition #2 attached to the Invitation, if the award is divided among or between vendors, written notification will be given to each vendor of the specific items covered on their respective contracts.

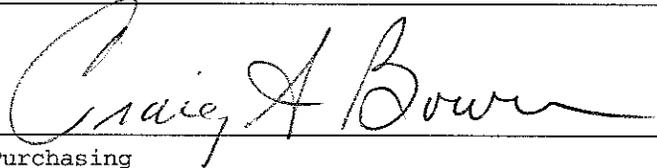
SIGNATURE PAGE

 , President

Contractor (Please sign here and type in company name on line immediately below. Please leave all other lines blank)

Path Master, Inc.

Company Name



Director of Purchasing

Contract Term:

Effective: January 1, 2010

Expires: December 31, 2010

Items Covered:

All: ✓ *PRIMARY*

See Attached: _____

The Invitation for Bid and response will become part of the contract

LIVING WAGE PREFERENCE

Ordinance 91, Series 2003 establishes a preference for businesses, which provide their employees a minimum wage equal to or exceeding the minimum wage set forth in Section I of the ordinance as of July 1, 2003. That amount is currently **\$9.00/hour for all full time employees.**

If supplies or services are to be purchased by competitive sealed bidding, or by competitive negotiation, and the supplies or services are available from a minimum wage business, the bid price or cost quoted by each minimum wage business shall be reduced by 5% for the purpose of determining the lowest bid price; however nothing in the ordinance prohibits the awarding of contracts by Metro Government on the basis of evaluated bid price.

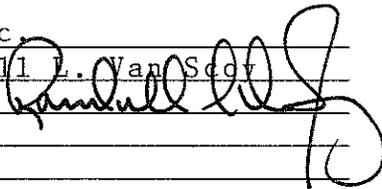
In order to qualify for the 5% preference under Section II of the ordinance, if a contract is for services, and a bidder or offeror uses subcontractors to perform all or part of the work required under the contract, the bidder or offeror shall not subcontract more than 20% of the work to non-minimum wage businesses unless such services are not available from minimum wage businesses.

If a business holds itself out as a minimum wage business by indicating so below, and is subsequently awarded a contract, then it is later discovered that such information was falsely provided, such business will be liable to the Metro Government equal to 30% of the amount of the contract awarded.

If a minimum wage business is awarded a contract under this ordinance, then such business shall post a sign of the applicable minimum wage rate set forth in this ordinance in a conspicuous place and manner so as to inform employees and the public alike that such business pays its employees wages at least commensurate with the applicable minimum wage rate established by this ordinance.

If you meet the requirements of this ordinance and wish to claim certification as a minimum wage business for this bid please sign in the space below.

I certify that my business meets the requirements of Ordinance 91, Series 2003 and wish to be certified as a minimum wage business for this bid. (This page shall be included with bid submission)

Company Name Path Master, Inc.
Authorized Official(Print) Randall L. VanSledright
Signature of Authorized Official 
Title President
Date September 2, 2009

LOCAL VENDOR PREFERENCE APPLICATION

To qualify for local vendor preference a business must:

- Have been established in the Louisville Metropolitan Statistical Area, as defined by the United States Census Bureau (MSA) for twelve (12) months and have an up to date local tax identification number on the date of the bid opening.
- Have its headquarters located in the Louisville MSA, or have a branch office currently located in the Louisville MSA for at least seven (7) years prior to the bid date.
- The city or county which the business is located in must have a reciprocal ordinance which recognizes businesses located in the Louisville MSA as a local business for the purpose of a procurement preference. A copy of the reciprocal ordinance shall be included with your bid.
- Utilizes local businesses to furnish at least 75% of the services under a contract unless such services are not available locally.
- Submit this completed form with your submitted bid. Incomplete applications or applications submitted after the bid opening will not be considered.

If you meet the above criteria and wish to apply for Local Vendor Preference on this bid please fill out the information at the bottom of this page. Incomplete applications will not be considered. The preference you will receive is 5% of your bid total or 5 points added to your evaluated bid total.

If a vendor is deemed a local vendor for the purposes of this preference on the basis of false information the vendor will be subjected to a fine equal to 25% of the contract price.

Any vendor who is denied local business status may petition the Director of Purchasing within 5 days of the denial. The petition shall outline the reasons why the local vendor status should be awarded. The Director of Purchasing will set a hearing for the petition. The decision of the Director will be final.

Any vendor may challenge in writing within three (3) business days following the day of in which a contract is awarded for a project the grant of a local vendor preference to another vendor. The challenge shall outline why the local vendor preference should not have been awarded. A hearing will be set by the Director of Purchasing who will hear the challenge and render a decision. The decision of the Director will be final.

You may request a complete copy of this Ordinance from the Louisville-Jefferson County Metro Purchasing Department.

.....

Company: _____ N / A _____

Address: Street _____

City _____ County _____ State _____ Zip _____

Revenue Commission Number: _____

Official: _____

Signature: _____ Date: _____



HUMAN RELATIONS COMMISSION
Carolyn Miller-Cooper, Director

GOOD FAITH EFFORT (“GFE”) REQUIREMENTS

Participation by certified female owned, certified handicapped owned, or certified minority owned business entities or utilization by contractors of certified female, certified handicapped, or certified minority owned business as subcontractors, if the contract requires or warrants the use of subcontractors, is strongly encouraged and will be a consideration in determining the award of a contract.

All contractors are to utilize their best good faith efforts to utilize subcontractors, certified female owned, certified handicapped owned, and certified minority owned businesses if the procurement situation requires or warrants the use of subcontractors. Good faith efforts by contractors shall be made to reach the goals established by Metro Code of Ordinances § 37.67.

Under Metro Code of Ordinances §37.67, Louisville Metro Government has adopted the following minimum utilization goals for its annual procurement expenditures with certified minority owned, female owned and handicapped owned business enterprises (“MFHBEs”):

- 15% for certified minority owned businesses;
- 5% for certified female owned businesses; and
- 0.5% for certified handicapped owned businesses.

Failure to meet such goals will not result in disqualification from participation in the particular procurement process. Contractors, however, will be expected to provide written explanations (See attached GFE Forms) to the Executive Director of the Human Relations Commission of efforts they have made to utilize as subcontractors from certified minority, female and handicapped owned businesses.

Good faith efforts of a potential bidder include, but are not limited to the following:

- Attendance at pre-bid meetings, if any, scheduled to inform MFHBEs of prime and subcontracting opportunities;
- Advertisement in general circulation media, trade association publications, and minority and female business enterprise media to provide notice of subcontracting opportunities;
- Communication with the Human Relations Commission Office seeking assistance and identifying available qualified MFHBEs;
- Efforts made to select portions of work for MFHBE subcontracting in areas with established availability or MFHBE subcontractors;
- Providing a minimum of ten days written notice to known qualified MFHBEs that their interest in prime and subcontracting opportunities or furnishing supplies is solicited;
- Efforts to negotiate with qualified MFHBEs for specific sub-bids, including reasons for rejection of any such sub-bids offered.
- Efforts made to assist qualified MFHBEs meet bonding, insurance, or other governmental contracting requirements.

These requirements are contractual obligations and will be included in the construction contract. Failure to comply may result in a finding of breach of contract, possible disqualification of the Bidder to bid on future contracts, or a claim for damages.

SUBCONTRACTOR AND SELF-PERFORM WORK LIST (FORM GFE-1)
FORM GFE-1 DUE DAY AFTER BID OPENING BY 4:00PM - FROM ALL BIDDERS - TO LOUISVILLE METRO HUMAN RELATIONS COMMISSION (Failure to timely submit Form GFE-1 will result in bid rejection)

- Bidders shall list ALL Subcontractors/Suppliers to be used on this contract regardless of the dollar amount on Form GFE-1. If this bid includes bid alternates for additional work, Bidders shall list ALL Subcontractors/Suppliers who will be used if Louisville Metro elects to contract the additional work.
- Bidders are required to make good faith efforts to subcontract with MFHBES for every division of work available in this bid opportunity ("Divisions of Work") unless the work will be self-performed by the Bidder.
- Bidders shall list any GFE Divisions of Work they intend to self-perform and separately list any GFE Divisions of Work where the identity of the subcontractor who will perform the work is undetermined at bid time.
- Examples of Divisions of Work to be listed on Form GFE-1 include, but are not limited to: clearing/earthwork, site concrete, asphalt paving, framing, painting, flooring plumbing, electrical, and HVAC. The number of subcontracting opportunities or Divisions of Work for GFE purposes may be greater and/or different than the divisions of work that might be outlined in the technical specifications.
- Best good faith efforts require that Bidders make contact with each MFHBE at least ten (10) calendar days before bid opening and that MFHBES be provided the same information as other subcontractors/suppliers.
- Bidders shall contact MFHBES by letter, fax or email ("Written Communication") to advise them of potential subcontracting opportunities.
- Bidders should follow up the Written Communication with telephone calls to each MFHBE contacted to determine if a bid will be submitted or if further information is required. A MFHBE need not be contacted if that MFHBE responds to the Written Communication with a statement that the MFHBE will not bid on this project or if a MFHBE has already submitted a sub-bid.

MFHBE SUBCONTRACTOR GFE LOG (FORM GFE-2)
FORM GFE-2 WITH ATTACHED WRITTEN COMMUNICATIONS DUE DAY AFTER BID OPENING BY 4:00PM - FROM ALL BIDDERS - TO LOUISVILLE METRO HUMAN RELATIONS COMMISSION (Failure to timely submit Form GFE-2 will result in bid rejection and failure to timely submit the attached Written Communications may result in bid rejection, at the Metro Government's discretion)

- Each Bidder shall submit with the Form GFE-2 one copy of each Written Communication sent to a MFHBE Subcontractor/Supplier to solicit bids for this project.
- **Optional Good Faith Efforts**

Bidders should consider public advertisements, attendance at pre-bid meetings, and technical and/or financial assistance to MFHBES as part of their good faith efforts activities. Such activities should be listed on GFE-2 with written documentation of such activities attached.

SUBCONTRACTOR PAYMENT CERTIFICATION (FORM GFE-3)
FORM GFE-3 DUE EACH MONTH OF THE CONTRACT PERIOD

- The reporting of subcontractor payments for all Louisville Metro Government contracts will be accomplished by using the Form GFE-3, which must be submitted monthly to the Louisville Metro Human Relations Commission.
- The Form GFE-3 requires the listing of invoice numbers sent to the responsible Metro departments for payment. The amounts listed on the form should equal the total amount billed to Louisville Metro Government for the applicable month.

All forms are available on the Louisville Metro Human Relations Commission website:
<http://www.louisvilleky.gov/HumanRelations>

Louisville Metro Human Relations Commission • 410 W. Chestnut Street, Suite 300A • Louisville, KY 40202
502-574-3631 phone • 502-574-3190 fax • 502-574-4332 TDD



Louisville Jefferson County
Metro Government

Public Works & Asset - Electrical Maintenance Division

BID #1882

Type 170 Traffic Signal Controllers, Cabinets, and Miscellaneous Equipment

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REQUEST FOR COMPETITIVE SEALED BIDS

- I. Invitation and Instructions to Bidders**
- II. General Provisions**
- III. Insurance and Hold Harmless Agreement**
- IV. General Specifications**
- V. Evaluation Criteria**

SECTION I

INVITATION AND INSTRUCTION TO BIDDERS

- 1.0 Invitation: Louisville/Jefferson County Metro Government ("Metro Government") is now accepting bids for **type 170 traffic signal controller, cabinets, and miscellaneous equipment**. The process of accepting bids and choosing the successful bidder shall be by Competitive Sealed Bidding. Sealed bids will be received at the office of Louisville Metro Government Office for Management & Budget – Division of Purchasing until 3:00 PM September 3, 2009, 611 West Jefferson Street, Mezzanine Level, Louisville Kentucky, 40202. Prices for any bid item shall not be contingent upon the purchase of any other bid item included within this bid.

Bids received after the **3PM deadline on September 3, 2009** will be unopened.

Bidder Questions and Inquiries: Bidders having questions and inquiries on the specifications of this Competitive Sealed Bids shall be directed to:

Stephanie St. Clair - or - Pat Seifert
Public Works & Assets - Electrical Maintenance Division
636 E.Gray Street
Louisville, KY 40203
Phone: 502-574-3261

Any information provided is not official unless reduced to writing by the Metro Purchasing Department. Any unauthorized contact with any other city official or employee in connection with this CSB is prohibited and shall be cause for disqualification of the Bidder. No questions or inquiries will be allowed beyond the pre-bid conference date as stated in the cover letter (if one is scheduled).

Careful attention must be paid to all requested items contained in this Competitive Sealed Bid (CSB). Bidders are invited to submit bids in accordance with the requirements of this CSB. Please read the entire package before bidding. Bidders shall make the necessary entry in all blanks provided for the responses. The submitted bid shall be firm for an acceptance period of ninety (90) days from the date of the bid opening.

Submitted bid shall be for a firm, fixed price.

The entire set of documents constitutes the CSB. The Bidder must respond in total and in the same numerical order in which the CSB was issued. Bidder's notes and comments may be rendered on an attachment, provided the same format of this CSB text is followed. All notes and comments shall be made in ink or be typewritten. Mistakes may be crossed out and corrections typed or written in ink adjacent thereto and must be initialed in ink by the person signing the bid. All bids shall be returned in a sealed envelope with CSB number and opening date stated on the outside of the envelope.

By submitting a Bid, the bidder acknowledges and agrees to be bound by the terms and conditions of the solicitation. This Competitive Sealed Bid document including all terms, conditions and specifications contained herein shall become the contract if Metro Government awards the Bid to the bidder hereunder. The bidder agrees that a resulting contract is the complete and exclusive statement of the agreement between the parties, which supersedes all prior agreements, oral or written, and all other communications between the parties relating to the subject matter of this solicitation. It is further agreed between the parties, that any change of the contractual agreement must be formalized by issuance of a written modification from the Purchasing Department. The only terms and conditions acceptable to Metro Government are as outlined in this CSB. Bids containing additional and/or inconsistent terms and conditions will be

considered non-responsive and shall be rejected. Purchase or sales agreements, supplied by the bidder, making an offer in reply to this solicitation will not be accepted.

In the event a conflict exists between sections of this CSB, such conflict shall be brought to the attention of the Purchasing Department in writing for resolution.

Unless contractually provided, Metro Government agencies utilizing these contracts will not be required to enter into nor sign further agreements, leases, company orders or other documents to complete or initiate the terms of a delivery order resulting from these contracts. Any such documents so obtained will not be binding on the Metro Government or its agents and shall be cause for termination of the contract by the Metro Government.

As allowed by the Metro Government Finance Manual, Purchasing Policies, Section III, A, 3, multiple contracts may be issued and those contracts, if any, shall be ranked. A secondary or lower ranking contract may be used if the primary contractor is unable to perform. However, the primary contractor shall be given the first opportunity to provide the services required. Contracts shall be utilized in the order stated in the award.

- 1.1 Bid Opening: Sealed bids will be accepted in accordance with the instructions detailed in section 1.0. The bid opening is open to the public. The Bidder shall file all documents necessary to support its bid and include them with its bid. Bidders shall be responsible for the actual delivery of bids during business hours to the address indicated in the cover letter. It shall not be sufficient to show that the bid was mailed in time to be received before scheduled closing time for receipt of bids.

SECTION II

GENERAL PROVISIONS

- 2.1 Each Bidder shall comply with all Federal, State & Local regulations concerning this type of service or good.

The Bidder agrees to comply with all statutes, rules, and regulations governing safe and healthful working conditions, including the Occupational Health and Safety Act of 1970, *29 U.S.C. 650 et seq.*, as amended, and KRS Chapter 338. The Bidder also agrees to notify the Metro Government in writing immediately upon detection of any unsafe and/or unhealthful working conditions at the job site. Bidder agrees to indemnify, defend and hold the Metro Government harmless from all penalties, fines or other expenses arising out of the alleged violation of said laws.

- 2.2 Failure to submit ALL forms and information required in this CSB may be grounds for disqualification.

- 2.3 Addenda: All addenda, if any, shall be considered in making the bid, and such addenda shall be made a part of this CSB. Before submitting a bid, it is incumbent upon each Bidder to be informed as to whether any addenda have been issued, and the failure to cover in the bid any such addenda may result in disqualification of that bid.

- 2.4 Bid Reservations: Metro Government reserves the right to reject any or all bids, to award in whole or part, and to waive minor immaterial defects in bids. Metro Government may consider any alternative bid that meets its basic needs.

- 2.5 Liability: Metro Government is not responsible for any cost incurred by a Bidder in the preparation of bids.

- 2.6 Changes/Alterations: Bidder may change or withdraw a bid at any time prior to bid opening; however, no oral modifications will be allowed. Only telegrams, letters, or other formal written requests for modifications or corrections of a previously submitted bid which is addressed in the same manner as the bid, and received by Metro Government prior to the scheduled closing time for receipt of bids, will be accepted. The bid, when opened, will then be corrected in accordance with such written request(s), provided that the written request is contained in a sealed envelope which is plainly marked "modifications of bid".

- 2.7 Clarification of Submittal: Metro Government reserves the right to obtain clarification of any point in a bid or to obtain additional information from a Bidder.

- 2.8 Bribery Clause: By his/her signature on the bid, Bidder certifies that no employee of his/hers, any affiliate or Subcontractor, has bribed or attempted to bribe an officer or employee of the Metro Government.

- 2.9 Additional Information: While not necessary, the Bidder may include any product brochures, software documentation, sample reports, or other documentation that may assist Metro Government in better understanding and evaluating the Bidder's bid. Additional documentation shall not serve as a substitute for other documentation which is required by this CSB to be submitted with the bid.

- 2.15 Ambiguity, Conflict or other Errors in CSB: If a Bidder discovers any ambiguity, conflict, discrepancy, omission or other error in the CSB, they shall immediately notify Metro Government of such error in writing and request modification or clarification of the document.

- 2.16 Agreement to Bid Terms: In submitting this bid, the Bidder agrees that Bidder has carefully examined the specifications and all provisions relating to the work to be done attached hereto and

made part of this bid. By acceptance of a Contract under this Competitive Sealed Bid, Bidder states that it understands the meaning, intent and requirements of the Competitive Sealed Bids and agrees to the same. The successful Bidder shall warrant that it is familiar with and understands all provisions herein and shall warrant that it can comply with them. No additional compensation to Bidder shall be authorized for services or expenses reasonably covered under these provisions that the Bidder omits from its Bid.

2.17 Cancellation: If the services to be performed hereunder by the Bidder are not performed in an acceptable manner to the Metro Government, the Metro Government may cancel this contract for cause by providing written notice to the Bidder, giving at least thirty (30) days notice of the proposed cancellation and the reasons for same. During that time period, the Bidder may seek to bring the performance of services hereunder to a level that is acceptable to the Metro Government, and the Metro Government may rescind the cancellation if such action is in Metro Government's best interest.

A. Termination for Cause

- (1) Metro Government may terminate a contract because of the contractor's failure to perform its contractual duties.
- (2) If a contractor is determined to be in default, Metro Government shall notify the contractor of the determination in writing, and may include a specified date by which the contractor shall cure the identified deficiencies. Metro Government may proceed with termination if the contractor fails to cure the deficiencies within the specified time.
- (3) A default in performance by a contractor for which a contract may be terminated shall include, but shall not necessarily be limited to:
 - (a) Failure to perform the contract according to its terms, conditions and specifications;
 - (b) Failure to make delivery within the time specified or according to a delivery schedule fixed by the contract;
 - (c) Late payment or nonpayment of bills for labor, materials, supplies, or equipment furnished in connection with a contract for construction services as evidenced by mechanics' liens filed pursuant to the provisions of KRS Chapter 376, or letters of indebtedness received from creditors by the purchasing agency;
 - (d) Failure to diligently advance the work under a contract for construction services;
 - (e) The filing of a bankruptcy petition by or against the contractor; or
 - (f) Actions that endanger the health, safety or welfare of Metro Government or its citizens.

B. At Will Termination

Notwithstanding the above provisions, the Metro Government may terminate this contract at will in accordance with the law upon providing thirty (30) days written notice of that intent. Payment for services or goods received prior to termination shall be made by the Metro Government provided those goods or services were provided in a manner acceptable to the Metro Government. Payment for those goods and services shall not be unreasonably withheld.

2.18 Assignment of Contract: The Bidder shall not assign or subcontract any portion of the Contract without the express written consent of Metro Government. Any purported assignment or subcontract in violation hereof shall be void. It is expressly acknowledged that Metro Government shall never be required or obligated to consent to any request for assignment or subcontract; and further that such refusal to consent can be for any or no reason, fully within the sole discretion of Metro Government.

- 2.19 No Waiver: No failure or delay by Metro Government in exercising any right, remedy, power or privilege hereunder, nor any single or partial exercise thereof, nor the exercise of any other right, remedy, power or privilege shall operate as a waiver hereof or thereof. No failure or delay by Metro Government in exercising any right, remedy, power or privilege under or in respect of this Contract shall affect the rights, remedies, powers or privileges of Metro Government hereunder or shall operate as a waiver thereof.
- 2.20 Authority to do Business: The Bidder must be a duly organized and authorized to do business under the laws of Kentucky. Bidder must be in good standing and have full legal capacity to provide the services specified under this Contract. The Bidder must have all necessary right and lawful authority to enter into this Contract for the full term hereof and that proper corporate or other action has been duly taken authorizing the Bidder to enter into this Contract. The Bidder will provide Metro Government with a copy of a corporate resolution authorizing this action and a letter from an attorney confirming that the Bidder is authorized to do business in the State of Kentucky if requested. All bids must be signed by a duly authorized officer, agent or employee of the Bidder.
- 2.21 Governing Law: This Contract shall be governed by and construed in accordance with the laws of the State of Kentucky. In the event of any proceedings regarding this Agreement, the Parties agree that the venue shall be the state courts of Kentucky or the U.S. District Court for the Western District of Kentucky, Louisville Division. All parties expressly consent to personal jurisdiction and venue in such Court for the limited and sole purpose of proceedings relating to this Agreement or any rights or obligations arising thereunder. Service of process may be accomplished by following the procedures prescribed by law.
- 2.22 Ability to Meet Obligations: Bidder affirmatively states that there are no actions, suits or proceedings of any kind pending against Bidder or, to the knowledge of the Bidder, threatened against Bidder before or by any court, governmental body or agency or other tribunal or authority which would, if adversely determined, have a materially adverse effect on the authority or ability of Bidder to perform its obligations under this Contract, or which question the legality, validity or enforceability hereof or thereof.

VIOLATIONS OF AND COMPLIANCE WITH KENTUCKY LAWS

The contractor shall reveal any final determination of a violation by the contractor or subcontractor with the previous five (5) year period pursuant to KRS Chapters 136, 139, 141, 337, 338, 341, and 342 that apply to the contractor or subcontractor. The contractor shall be in continuous compliance with the provisions of KRS Chapters 136, 139, 141, 337, 338, 341 and 342 the apply to the contractor or subcontractor for the duration of the contract.

COMPETITIVE SEALED BID
SUBMITTED BY:

By signing below you are agreeing to all Louisville Metro Government Terms
& Conditions that are a part of this Request for Bid.

Include this page in your response to this bid.

Firm: Path Master, Inc.
By: Randall L. Van Scoy
Title: President
E-Mail Address: [REDACTED]
Address: 1960 Midway Dr.
Twinsburg, OH 44087
Telephone: 330-425-4994
Fax: [REDACTED]
Date: September 2, 2009

Metro Louisville Revenue
Commission Number: [REDACTED]
Federal ID Number : [REDACTED]

**Please include a copy of your W-9 with your submitted bid.
This must be submitted prior to the award of a contract.**

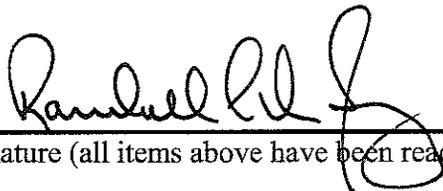
I acknowledge receipt of the following Addendum:

Addendum #1: _____

Addendum #2: _____

Addendum #3: _____

Any Additional Addendum (write in numbers): _____



, President

Vendor Signature (all items above have been read and completed)

SECTION III

HOLD HARMLESS AND INDEMNIFICATION CLAUSE, AND INSURANCE REQUIREMENTS FOR CONTRACT TO SUPPLY PRODUCTS

I. HOLD HARMLESS AND INDEMNIFICATION CLAUSE

The Supplier shall indemnify, hold harmless, and defend the Louisville/Jefferson County Metro Government, its elected and appointed officials, employees, agents and successors in interest from all claims, damages, losses and expenses including attorneys' fees, arising out of or resulting, directly or indirectly, from the Supplier's (or Supplier's subcontractors, if any) performance or breach of the contract provided that such claim, damage, loss, or expense is: (1) attributable to personal injury, bodily injury, sickness, death, or to injury to or destruction of property, including the loss of use resulting therefrom, or breach of contract, and (2) not caused by the negligent act or omission or willful misconduct of the Louisville/Jefferson County Metro Government or its elected and appointed officials and employees acting within the scope of their employment. This Hold Harmless and Indemnification Clause shall in no way be limited by any financial responsibility or insurance requirements and shall survive the termination of this Contract.

II. INSURANCE REQUIREMENTS

Prior to commencing work, Supplier shall obtain at its own cost and expense the following types of insurance through insurance companies licensed in the State of Kentucky. Insurance written by non-admitted carriers will also be considered acceptable, in accordance with Kentucky Insurance Law (KRS 304.10-040.). **The Supplier must submit a Certificate of Insurance evidencing coverage required below with their bid, prior to being awarded a contract by the Louisville/Jefferson County Metro Government's Department of Purchasing, (who may request review by Louisville/Jefferson County Metro Government's Risk Management Division**

Without limiting Supplier's indemnification requirements, it is agreed that Supplier shall maintain in force at all times during the performance of this agreement the following policy of insurance covering its product and operations.

The insurance to be procured and maintained and **minimum** Limits of Liability shall be as follows, unless different limits are specified by addendum to the contract:

1. **COMMERCIAL GENERAL LIABILITY**, via the **Occurrence Form**, with a **\$1,000,000** Combined Single Limit for any one Occurrence for Bodily Injury, Personal Injury and Property Damage, and \$2,000,000 aggregate including:
 - a. Premises - Operations Coverage
 - b. Products and Completed Operations Coverage
 - c. Contractual Liability

III. ACCEPTABILITY OF INSURERS

Insurance is to be placed with Insurance Companies with an A. M. Best Rating of no less than "B+ VI", unless proper financial information relating to the Company is submitted to and approved by the Louisville/Jefferson County Metro Government's Risk Management Division.

IV. MISCELLANEOUS

A. The Supplier shall procure and maintain insurance policies as described herein and for which the Louisville/Jefferson County Metro Government Department of Purchasing shall be furnished Certificates of Insurance upon the execution of the Contract. The Certificates shall include provisions stating that the policies may not be cancelled without the Louisville/Jefferson County Metro Government having been provided at least (30) thirty days written notice.

B. Certificates of Insurance as required above shall be furnished, with your bid to the

Louisville/Jefferson County Metro Government
Office of Management and Budget
Purchasing Division
611 West Jefferson Street
Louisville, Kentucky 40202

C. The supplier agrees that it will not materially alter any of the insurance policies currently in force and relied on under this agreement. Further, the supplier will not reduce any coverage amount below the limits required in this agreement.

D. Approval of the insurance by the Louisville/Jefferson County Metro Government shall not in any way relieve or decrease the liability of the Supplier hereunder. It is expressly understood that the Louisville/Jefferson County Metro Government does not in any way represent that the specified Limits of Liability or coverage or policy forms are sufficient or adequate to protect the interest or liabilities of the Supplier.

SECTION IV

GENERAL SPECIFICATIONS FOR TYPE 170E TRAFFIC SIGNAL CONTROLLERS, CABINETS, AND MISCELLANEOUS EQUIPMENT

Introduction

Louisville Jefferson County Metro Government is soliciting bids from qualified contractors to furnish pricing for Type 170E traffic signal controller equipment. The contract will be for variable quantities that range from 1 to 10 and 11 to 25 and 26 to 100 of any of the bid items defined within this contract.

Successful bidders will be required to furnish the material specified by Delivery Order within 60 days of the receipt for same unless otherwise noted in the delivery schedule. Prototypes shall have passed acceptance testing within 90 days of the initial delivery order for any specified bid item. All material and assemblies shall be subject to acceptance testing including the prototype, and pre-delivery tests substantiate that the material and or assemblies meet or exceed the Louisville Metro's Technical Specifications for such material and assemblies. Prototype tests shall be performed on any controller or related device that had not previously been prototype tested by or for the City of Louisville now known as Louisville Jefferson County Metro Government. Testing shall not be required until after a delivery order is placed for a specific item, but testing may be performed prior to placing an order to demonstrate acceptance of the design for any and all equipment defined within this contract. Prior to acceptance, any equipment ordered shall be pre-delivery tested. The contractor is required to develop such tests to be approved by Louisville Metro's Traffic Operations staff.

Louisville Metro reserves the right to order any quantity of the specified bid items within the 12-month period of this contract. All prices shall include delivery, taxes, insurance, and any required initial and pre-delivery testing, support, and documentation as defined within each bid item description.

Delivery shall be to:

Louisville Jefferson County Metro Government
Public Works, Electrical Maintenance
636 East Gray St.
Louisville, KY 40203

All deliveries shall be FOB prepaid destination.

The bid items consist of:

1. Type 170E controller w/HC-11 CPU
2. Type 200 load switch
3. Type 204 flasher
4. Type 210 conflict monitor/ watchdog timer
5. 222 compatible loop detector amplifier
6. Fiber optic splice enclosure, small
7. Fiber optic splice enclosure, large
8. Twisted pair terminal block

9. Type 242 input isolator
10. Multi point fiber optic modems
11. 336 cabinet power supply
12. 303 power distribution assembly
13. 332 power distribution assembly
14. 2400 baud modem
15. Flash transfer relay
16. 12" Sq. Pedestal Base
17. 20" x 16" Pedestal Base
18. Type 332 adapter base
19. Type 303 controller cabinet assembly operational and tested, including load switches, flasher, transfer relays, power supply, conflict monitor- watchdog timer, fiber optic modem, input and output files and isolators, rack, power distribution assembly, thermostatically controlled fan, air filter, police panel, input and output terminations, and cabinet mounting hardware.
20. Type 303 controller cabinet assembly operational and tested, including load switches, flasher, transfer relays, power supply, conflict monitor- watchdog timer, twisted pair termination assembly, twisted pair terminal blocks, 2400 baud type 404 modem, input and output files and isolators, rack, power distribution assembly, thermostatically controlled fan, air filter, police panel, input and output terminations, and cabinet mounting hardware.
21. Type 332 controller cabinet assembly operational and tested, including load switches, flasher, transfer relays power supply, conflict monitor- watchdog timer, AC and Dc isolators, input and output files, rack, power distribution assembly, thermostatically controlled fan, air filter, police panel, input and output terminations, twisted pair interface assembly, twisted pair terminal blocks, 2400 baud type 404 modem, and cabinet mounting hardware.
22. Type 336 controller cabinet assembly operational and tested, including load switches, flasher, transfer relays, power supply, conflict monitor- watchdog timer, AC and DC isolators, input and output files, rack, power distribution assembly, thermostatically controlled fan, air filter, police panel, input and output terminations, twisted pair terminal blocks, twisted pair interface assembly, 2400 baud type 404 modem, and cabinet mounting hardware.
23. Type 303 rack assembly operational and tested including, rack, input-output files, power distribution assembly, and input-output terminations.
24. Type 332 rack assembly operational and tested including, rack, input-output files, power distribution assembly, and input and output terminations.
25. Type 336-rack assembly operational and tested rack, input- output files, power distribution assembly, and input-output terminations.
26. Direct connect serial communications assembly

27. Fiber Optic Splitter
28. Fiber Optic Splitter without ST Connector
29. Fiber Optic Splitter with ST connector
30. Model HC-11 CPU Board

General Material and Services Description

The equipment procured under this contract are for Louisville Metro's Traffic Signal System. This system utilizes Econolite's PYRAMIDS (trademark of Econolite Control Products, Inc.) Advanced Traffic Control software. This is a fully distributed, client-server based system, providing Distributed Processing System Software, specifically developed for traffic signal control. The communications network utilizes fiber optic communications within the downtown utilities underground conduit network. Out side of the downtown area, controller cabinets are served by twisted pair full duplex 2400-baud communication channels. At 3 points, up to 32 of these channels are multiplexed and sent over a single mode fiber optic cable. The PYRAMIDS system utilized by Louisville Metro, supports Type 170 E controllers running WAPITI (W4IKS) software and Model 2070 controllers running Econolite's OASIS (trademark of Econolite Control Products, Inc.) software.

In addition to the detailed specifications for each piece of equipment, material, or services furnished under this contract the following general specifications apply.

Type 170E controllers shall be fully compatible with the W4IKS software as previously modified for the City of Louisville (now known as Louisville Metro). All bid items shall be provided with complete maintenance, and operational documentation. All items shall be new and unused and fully tested. Controllers, load switches, flasher, loop detector amplifiers, isolators, flash transfer relays, conflict monitors, communication devices, and communication termination devices shall be compatible with the 303, 332, or 336 racks provided in the respective controller cabinets. The internal modems shall be compatible with the type 170E controllers. The controller cabinet racks shall be compatible with the respective controller cabinets. The racks shall be complete in that the rack assembly shall be a direct replacement for either the 303, 332, or 336 racks provided in the respective controller cabinets. Installation of a replacement rack shall only require plug and power wiring disconnections and reconnections and the installation of plug and edge connector equipment described within bid items 1 through 24 to form a complete ready for operation controller and cabinet assembly, assuming that the proper software is resident on the controller prom module.

The 303 cabinets shall be provided with pedestal mount hardware.

The 332 cabinets shall be base mounted and provided with base mount bolt, nuts, and washers and mounting bolt pattern template.

The 336 cabinets shall be provided with pole mount hardware.

Louisville Metro reserves the right to witness and participate in the acceptance testing defined for each bid item.

Support, full hardware and software documentation, acceptance testing, and one year firmware, parts and labor warrantee will be required and included in the price bid for all bid items.

UNIT PRICES

Single unit prices will be used in determining the total amount of the bid within the quantities of (1-10), (11-25) and (26-100). Louisville Metro shall have the right to order, at the unit price for each bid item, with the respective pricing, any quantity, during a twelve (12) month period. Prices for any bid item shall not be contingent upon the purchase of any other bid item included within this bid.

MANUFACTURERS

The following is a list of manufacturers for the materials supplied upon which this proposal is based. It is understood that the manufacturers listed will actually be used in providing the materials and that no changes will be made in this list without the written approval of the Engineer.

Type 170E controller w/HC-11 CPU Safetran Traffic Systems
Type 200 load switch PDC, Inc.
Type 204 flasher PDC, Inc.
Type 210 conflict monitor/ watchdog timer EDI
222 compatible loop detector amplifier Reno A&E
Fiber optic splice enclosure, small Corning Cable Systems
Fiber optic splice enclosure, large Corning Cable Systems
Twisted pair terminal block Marathon Special Products
Type 242 input isolator EDI
Multi point fiber optic modems Traffic Fiber Systems
336 cabinet power supply Safetran Traffic Systems
~~303 power distribution assembly Safetran Traffic Systems~~
332 power distribution assembly Safetran Traffic Systems
2400 baud modem GDI Communications
Flash transfer relay Deltrol Controls
12" Sq. Pedestal Base Path Master, Inc.
20" x 16" Pedestal Base Path Master, Inc.
Type 332 adapter base Safetran Traffic Systems
Type 303 controller cabinet assembly Safetran Traffic Systems
Type 303 controller cabinet assembly Safetran Traffic Systems
w/ 2400 baud type 404 modem

Type 332 controller cabinet assembly Safetran Traffic Systems
w/2400 baud type 404 modem

Type 336 controller cabinet assembly Safetran Traffic Systems
w/2400 baud type 404 modem

Type 303 rack assembly Safetran Traffic Systems

Type 332 rack assembly Safetran Traffic Systems

Type 336-rack assembly Safetran Traffic Systems

Direct connect serial communications assembly Path Master, Inc.

Fiber Optic Splitter Gould Fiber Optics

Fiber Optic Splitter without ST connector Gould Fiber Optics

Fiber Optic Splitter with ST connector Gould Fiber Optics

Model HC-11 CPU Board Safetran Traffic Systems

Project Description

This project consists of furnishing all materials, equipment, software media and licenses, documentation, training, insurance, and transportation necessary for the manufacture, assembly, testing and delivery and support of the traffic signal equipment procurement project titled **Type 170 Traffic Signal Controllers, Cabinets, and Miscellaneous Equipment.**

All material shall be new and of good quality. All workmen fabricating products described within the technical specifications shall be skilled in their trades and all workmanship shall be of good quality. The bidder guarantees the products or work to be free of defective materials or workmanship for a period of at least one (1) year from the date of final certificate of payment is approved by Louisville Metro.

Substitutions

Where the technical specifications refer to specific products of one or more manufacturers or vendors, such references designate the specific items comprising the base bid, and the base bid must be based on these specific products, however they are not intended to restrict competitive bidding. Substitutions for materials specified by name may be offered as a voluntary alternate. Louisville Metro's project manager shall decide if equivalent materials are acceptable. Whenever the word "APPROVED" is used in these technical specifications, it shall be interpreted as meaning approved specifically by the Louisville Metro's project manager.

Handling and Protecting Materials

The Bidder and each of its subcontractors shall be responsible for the proper care and protection of all their material until delivery of same is accepted by Louisville Metro. The Bidder shall be responsible for loss or damage for any reason what so ever until delivery is accepted by an authorized representative of Louisville Metro. The Bidders responsibility shall include the replacement of the lost or damaged

material to the Louisville Metro delivery point within the time allotted for the delivery as defined in the contract schedule.

Quality of Material and Equipment

The specifications require that the material and equipment furnished under this agreement be of high quality, manufactured and supported by reputable and qualified vendors. Where materials and/or equipment are designated in the technical specifications by mention of the manufacturer's name, make brand, or model, it shall be considered as indicating a standard of quality, style, grade, or type. The Bidder's shall include as a base bid, unless specifically exempted, materials and equipment so specified. If the Bidder's proposal is accepted, it shall be the obligation of the Bidder to furnish such materials and equipment unless substitutions are allowed by the acceptance of a voluntary alternate.

For this specific bid, catalog cuts and complete descriptive material shall be submitted with the Bid. The submission shall consist of catalog cuts for the following materials and equipment:

- 170E Controller Assembly
- Load Switch
- Transfer Relay
- Flasher
- Conflict Monitor- Watchdog Timer
- Loop Detector Amplifier
- Input Isolator
- Cabinet Power Supply
- Controller Cabinet Assemblies (303, 336 and 332)
- 2400 Baud Modems
- Fiber Optic Modems
- Fiber Optic Splice Enclosure Small
- Fiber Optic Enclosure Large
- Twisted Pair Terminal Block
- Twisted Pair Interface Assembly
- Cabinet Mounting Hardware and Adapter
- Cabinet Test Firmware
- Controller Test Firmware
- Controller and Cabinet Test Firmware Manual
- 12" Square Pedestal Mounting Base
- 20" x 16" Pedestal Mounting Base
- Fiber Optic Splitters
- Model HC-11 CPU Board

This materials shall be included in a bound GBC or ACCO binder labeled CATALOG CUTS, Annual Type 170 Traffic Controllers, Cabinets, and Miscellaneous Equipment Contract.

Bid Schedule

Type 170 Traffic Signal Controllers, Cabinets, and Miscellaneous Equipment

Item Number	Description	Unit Price Quantities		
		1 to 10	11 to 25	26 to 100
1.	Type 170E Controller	<u>1190.00</u>	<u>1150.00</u>	<u>1100.00</u>
2.	Type 200 Load Switch	<u>18.00</u>	<u>18.00</u>	<u>17.00</u>
3.	Type 204 Flasher	<u>18.00</u>	<u>18.00</u>	<u>17.00</u>
4.	Type 210 Conflict Monitor	<u>350.00</u>	<u>335.00</u>	<u>320.00</u>
5.	Loop Detector Amplifier	<u>85.00</u>	<u>75.00</u>	<u>72.00</u>
6.	Standard 222 Without Comm Fiber Optic Splice Encl. Sm. (1)	<u>135.00</u>	<u>135.00</u>	<u>135.00</u>
7.	Fiber Optic Splice Encl. Lg(2)	<u>606.00</u>	<u>606.00</u>	<u>606.00</u>
8.	Twisted Pr. Term Blk.	<u>3.00</u>	<u>3.00</u>	<u>3.00</u>
9.	Type 242 Isolator	<u>30.00</u>	<u>30.00</u>	<u>28.00</u>
10.	Fiber Optic Modems	<u>310.00</u>	<u>300.00</u>	<u>290.00</u>
11.	Internal FO400 336 Cabinet Power Supply	<u>265.00</u>	<u>250.00</u>	<u>230.00</u>
12.	303 Cabinet Power Supply	<u>740.00</u>	<u>720.00</u>	<u>700.00</u>
13.	332 Cabinet Power Supply	<u>265.00</u>	<u>250.00</u>	<u>230.00</u>
14.	2400 Baud TP Modem	<u>265.00</u>	<u>265.00</u>	<u>265.00</u>
15.	Internal 404 Flash transfer relay	<u>20.00</u>	<u>20.00</u>	<u>18.00</u>
16.	12" Sq. Pedestal Base	<u>585.00</u>	<u>485.00</u>	<u>475.00</u>
17.	20" x 16" Sq. Pedestal Base	<u>705.00</u>	<u>495.00</u>	<u>480.00</u>
18.	Type 332 Adapter Base	<u>150.00</u>	<u>150.00</u>	<u>145.00</u>
19.	303 Controller Cabinet FO *	<u>3725.00</u>	<u>3595.00</u>	<u>3470.00</u>
20.	303 Controller Cabinet TP *	<u>3725.00</u>	<u>3595.00</u>	<u>3470.00</u>
21.	332 Controller Cabinet *	<u>6805.00</u>	<u>6550.00</u>	<u>6310.00</u>
22.	336 Controller Cabinet *	<u>4980.00</u>	<u>4805.00</u>	<u>4645.00</u>

* All Controller Cabinets Include Standard 222 Type Loop Detector Units Without RS-232 Communications. Provide Quantity As Required.

(1) Small Fiber Optic Splice Enclosure Quote Is WIC2-02P, Measures 13"H x 8.5"W x 4"D

(2) Large Fiber Optic Splice Enclosure Quote Is WSH-11SPT-F, Measures 13.5"H x 22.5"W x 5.2"D

23.	303 Rack	2230.00	2125.00	2030.00
24.	332 Rack	5000.00	4770.00	4560.00
25.	336 Rack	3225.00	3080.00	2950.00
26.	Direct Connect Comm Assem	90.00	80.00	78.00
27.	Fiber Optic Splitter	125.00	125.00	125.00
28.	FO Splitter without ST conn	250.00	250.00	250.00
29.	FO Splitter with ST conn	130.00	130.00	130.00
30.	Model HC-11 CPU Board	190.00	185.00	175.00

All material shall be provided as per the technical specifications and in accordance with the Louisville Metro's standard specifications for procurement of materials and supplies.

Type 170 E Controllers

The controller units shall comply with the specifications for the Model 170E extended controller unit in the latest revision of the CALTRANS Traffic Signal Control Equipment Specifications and the Specification Requirements of the State of Kentucky. In addition the controllers shall have the following specifications:

- All circuit boards shall be mounted vertically in the chassis to facilitate air circulation.
- Two separate buses off the CPU board shall be provided, one for input/out. And the other for memory.
- All lines to the memory bus shall be tri-state logic, and shall be in high impedance state when not in use so that the program board can be inserted. In use so that the program board can be inserted or removed with the controller power on.
- The input board shall contain only input circuitry. The output board shall contain only output circuitry.
- Controllers shall be supplied with a removable blanking plate installed in the front panel for the purpose of covering the prom module opening.
- Each controller should also include an HC-11 CPU board which replaces the 6800 MPU's that were previously installed in older 170E controllers. The specifications for the Model HC-11 CPU board is included below.

The KDOT and CalTrans specifications as well as those that follow shall define the minimum general requirements relative to the electronics and electrical component, design and construction of the Type 170E traffic signal controllers, and associated devices including the cabinets that house same at the local intersection.

ALTERNATE ITEMS:

10A.	Fiber Optic Modem External F0512	335.00	335.00	335.00
14A.	2400 B TP Modem External 404SA	320.00	320.00	320.00

The content of this document shall be considered Louisville Metro's specifications for Type 170E controllers and associated equipment including controller cabinets. Where conflicts occur between the KDOT, CalTrans, or other referenced specifications and the Louisville Metro's specifications, the Louisville Metro specifications shall govern.

Type 170E controllers furnished under this specification shall be the same as those that have been tested and placed on the list of qualified product or traffic signal equipment lists maintained by KDOT.

The controller, firmware, and associated devices shall be warranted against defects and failures by the manufacturer for a period of not less than one year from the date of acceptance. This warranty shall include the repair or replacement of said controller and associated devices including all labor, parts, transportation, and insurance from the repair facility to the Louisville Metro Electrical Maintenance Shop, 636 East Gray Street, Louisville, KY. Transportation from the Electrical Maintenance Shop to the repair facility for warranty service shall be the responsibility of Louisville Metro.

Repairs shall be made and the effected units shipped to the city within two weeks of receipt at the repair facility. Individual circuit cards may not be repaired more than two times, upon the third failure of the same circuit card within the warranty period the card shall be replaced with a new card with a warranty expiration date equivalent to the original card, i.e., if the card is replaced in the ninth month of warranty the warranty of the new card shall expire three months after receipt of same by Louisville Metro.

All repairs and replacements shall be accompanied by a repair report indicating when the controller or device was received, repaired, tested, the serial number of the assembly, what parts were replaced, and the date of return shipment to Louisville Metro.

All electronics equipment shall be of solid state design and the components used therein rated for at least 150 percent of the normal operating voltages and currents. Electrolytic capacitors shall be avoided whenever possible. Circuit design and component selection shall be such that heat dissipation and component degradation is minimized. No custom components shall be permitted except by written permission of the city. If such components are necessary, at least two sources for the custom component shall be included within the parts list provided with the equipment.

Maintenance and operation manuals and related documentation shall be provided with the equipment in the following quantities:

- For purchases of from 1 to 5 controllers, 2 complete sets
- For purchases of from 6 to 10 controllers, 4 complete sets
- For purchases of from 11 to 20 controllers, 6 complete sets
- For purchases of over 20 controllers, 8 complete sets

Maintenance and Operation manuals and related documentation shall be defined as:

- Three sets of cabinet and controller diagnostic firmware shall be provided with each ten controllers or part of ten furnished by the Contractor.
- General description of the equipment
- General operating characteristics
- Adjustments
- Theory of operation with block diagrams and detailed circuit descriptions
- Maintenance procedures including field and shop trouble analysis, bench repair and diagnostics, trouble shooting chart (this doesn't work—look at this and check for that), voltage measurements and wave forms, and any alignment or level adjustments.
- Parts lists referencing manufacturer, manufacturer's part number, circuit card or assembly part designation, controller manufacturer's part number; and voltage, capacity, current or size rating.

- A full size reproducible mylar drawing set shall be provided for each type of cabinet supplied. These drawings shall describe in detail the wiring and physical placement of the cabinet components and configuration options.

Type 170 E Controller Software

The Type 170E controllers shall be fully compatible with the applications software that was modified by WAPITI Micro Systems for Louisville Metro. Controllers shall be supplied without the firmware. One 32K EPROM shall be supplied with each controller.

Controller Mechanical Requirements

The controller assembly shall be nominally not more than 7 inches high, 14 inches deep including connectors and allowance for connecting cables and width consistent with the EIA 19 inch mounting rack spacing requirements.

All controls normally used to operate the controller, i.e. turn on-off, enter database, and view stored as well as entered data shall be provided on the front panel. The front panel shall be attached to the controller such that it may be opened and all of the circuit cards including the power supply may be replaced without removing the controller cabinet mounting screws or the need to remove the controller.

The maximum weight of the controller with all circuit cards, power supply, modem, and front panel fully operational shall not exceed 25 pounds.

The front panel shall be silk screened in black or a color sharply contrasting to the panel color. The silk screening shall identify all controls and indicators in easy to understand standard terms. The serial, model number, and date of manufacture shall be permanently attached to the rear of the controller near the CI connector. The metal work shall be free of burrs, sharp edges, deformation, and cuts.

Electrical and Environmental Operating Parameters

The controller and all of the other bid items shall operate within the maximum allowable functional parameters including current sink, clock intervals, and timing intervals within the following parameters without the benefit of a internal fan:

95 to 135 volts, 57 to 63 Hertz alternating current
-35 to + 165 degrees Fahrenheit
10 to 95 percent relative humidity
4.5 G lateral acceleration, at approximately 40 hertz, .5 inch amplitude

Model HC-11 CPU Board

The purpose of this specification is to define a replacement CPU board for the 6800 based CPU board in older 170E controllers.

The HC-11 based CPU Module shall operate a 68HC11F1 MPU to replace the older 6800 MPU's installed in older 170E CPU boards. The MPU shall operate with a crystal frequency of 8MHz. The MPU chip shall be socket mounted in an AMP PLCC socket #821574-1 series HPT or equal.

The 6850 communication IC's shall be used and shall operate with a crystal frequency of 6.144 MHz. There shall be four (4) chips (6850) with programmable jumpers to select 5 different communication baud rates per chip (1200, 2400, 4800, 9600, and 19200) for a total of 20 jumpers. There shall be no IRQ

inhibits provided therefore all ACIA's shall be active. Programs should be written to initialize the four communications chips upon startup. An IRQ status register shall be provided as defined in the 170 E CALTRANS spec.

The EPROM and RAM shall be resident on the CPU board, and shall be socket mounted. The EPROM socket shall be a 32 pin ZIF force device. The RAM socket shall be a 28 pin Augat 828 series or equal. Ram will be continuous from locations \$0000 to \$6FFF. RAM shall be a ZERO power device exclusively, and be a Dallas 1230 or equal.

When an optional RTC clock is required, the RAM shall be a DALLAS 1644 or equal. (Clock address shall be in the I/O map at location \$7FF8 to \$7FFF.) A jumper select shall be provided to switch locations \$6000 to \$6FFF from Internal to External for access to the remote Dual Port location. The status of the jumper position shall be read on the IRQ register - bit five (5).

When an enhanced Program Module is used with this system, it will only have access to addresses 6000/6FFF for dual-port. The Prom chip shall be either a 32K X 8 or a 128K x 8 device, and be jumper selectable. When using a 128K EPROM, a bank switch shall be enabled within the EPROM memory system. This bank switch shall function by moving to the upper 64K segment of the EPROM. The bank switch jumper controls address line A16. The bank shall be activated by a write to location \$7002 (directly connected to Port G on HC-11 MPU), which will cause memory to go to the upper 64K of the 128K EPROM. This will enable an extra 32K of EPROM memory via bank switching. The status of A16 will be read on the IRQ status register - bit six (6).

Feature and location switches shall be provided on the front portion of the CPU board. Each switch shall be an eight-position front reading dip switch. These switches shall be decoded as follows:

Features switch shall be addressed at \$700A - Port E

Location switches shall be addressed at \$7000 - Port A

A header shall be provided near the front of the module for the SPI and serial interface pins.

There shall be one LED indicator located on the front of the CPU board, that shall be controlled via a software output of Port G bit 3.

The +12VDC, +5VDC and +/-12 VDC voltages input to the CPU board shall have transorb protection.

The system address organization of the HC-11 Module shall consist of two addressing configurations. The decoder shall be furnished in address I.

The two addressing configurations shall be selectable by use of a three- post jumper. The following input line state conditions shall cause the Decoder to provide the associated address configuration. The jumper shall be labeled "INT" and "EXT".

CONFIGURATION	LINE	FUNCTION
1	INT	Address 6000-6FFF shall reside on the internal RAM
2	EXT	Address 6000-6FFF shall reside on the external Program Module

HC11 BASED 170 MEMORY MAP

Configuration 1

LOCATION	BLOCK SIZE	FUNCTION	NOTES
0000-5FFF	24K	170 RAM	CPU BOARD RAM
6000-6FFF	4K	RAM	INT JUMPER POSITION (* See Note below)
7000-73FF	1K	CONFIG REG + RAM	INITIATE IMMEDIATELY ON START UP
7400-75FF	512 BYTES	I/O	EXTERNAL I/O FUNCTIONS
7600-7FFF	2K	RAM	CPU BOARD RAM
8000-FFFF	32K	EPROM	CPU BOARD PROM MEMORY
DETAILED BLOCK ALLOCATION			
LOCATION	BLOCK SIZE	FUNCTION	NOTES
700A	1 BYTE	SWITCH	FEATURE SWITCH/HC11 PORT E
7000	1 BYTE	SWITCH	LOCATION SWITCH/HCLL PORT A
7002	1 BYTE	BANK SELECT	PROM BANK SWITCH SELECT HC11 PORT G - BIT 1
7002	1 BYTE	STATUS INDICATOR	HC11 PORT G - BIT 3 1=ON
7000-705F	96 BYTES	CONFIG. REG.	68HC11 CONFIG REGISTERS
7060-73FF	1K (-96)	RAM	68HC11 RAM
7400	1 BYTE	DTA MINUTES	I/O DTA READ MINUTES
740F	1 BYTE	DTA SECONDS	I/O DTA READ SECONDS
7401-740A	10 BYTES	I/O	I/O READ AND WRITE
7410-7417	8 BYTES	ACIA	SERIAL PORTS 1-4
7500-7507	8 BYTES	DPR	DUAL PORT SEMAPHORES
75FF	1 BYTE	IRQ/STAT	60 HZ. RESET AND IRQ STATUS
7600-7FF7	2K	RAM	CPU BOARD RAM
7FF8-7FFF	8 BYTES	RESERVED	RESERVED CLOCK/CALENDAR OPERATION

NOTE:

EXT JUMPER POSITION is CONFIGURATION #2 -- Configuration #2 Redirects addresses 6000-6FFF to the Prom Module Slot.

Load Switches

Load switches shall be three circuits, indicating with separate solid state switches for each of the three circuits. Load switches shall be 10 ampere per circuit inductive. All load switches shall be of the indicating type and shall provide monitoring of the input and output side of the load switch. The monitoring shall be such that not only are the load switch outputs monitored but also the presence of flash is command. Additionally, the inputs shall be optically isolated from the outputs. The LED indicators on

the output shall be compatible with the Model 210 conflict monitor, with absence of red monitor indications.

Flasher, transfer and other relays

The flasher shall be a type 204 indicating solid state flasher. Flash transfer relays shall be 10 ampere per circuit enclosed types, jack mounted with Jones plug and sockets and retainers. Other relays shall be used only for logic functions as approved by the City and in applications where solid state relays are not approved such as stop timing circuits.

The flasher and transfer relays shall be standard items for use with Type 170E controller cabinets.

Conflict Monitor

The conflict monitor shall be a Type 210 unit compatible with the cabinets specified elsewhere. The conflict monitor shall comply with the specifications for conflict monitors in the latest revision of the CALTRANS Traffic Signal Control Equipment Specifications and the latest Specification Requirements of the State of Kentucky.

Loop Detector Amplifiers

Loop detector amplifier shall be edge card and input file slot compatible with the standard type 222 loop detector amplifier. Additionally, they shall meet the following minimum performance characteristics.

- Two separate channels.
- Serial communications interface with front panel mounted RS-232 port and rear edge connector transmit receive connections.

These communication ports shall provide shall allow access to real time detector set up and operating characteristics including the following:

- Loop frequency
- Reference frequency
- Loop inductance
- Delta inductance
- Detection time
- Vehicle count
- Last fault

The detector amplifier shall provide optically isolated solid state outputs that fail safe to on condition when the amplifier fails.

The amplifier shall detect and hold presence of all licensable vehicles including small motorcycles when connected to micro loops, and standard loop configurations from 6' by 6' to 6' by 50' with lead in lengths ranging from 15' to 1000'.

LED indicator status lights for each channel shall be provided on the front panel that indicate:

- Channel Detect Output
- Loop Fault
- Delay Timing
- Extension Timing

Each channel shall tune to an external inductive load of 20 to 2400 microhenries and shall operate properly with loops with $Q > 2$ or single point short to ground.

Each channel shall provide front panel selection of at least 6 sensitivity levels in both the pulse and presence modes, as well as channel reset, and channel off.

Pulse mode shall provide nominal 100 ms output pulse for each vehicle detected.

Presence hold times shall be nominally 4 minutes for a small motorcycle to nominally 60 minutes for a standard automobile.

The detector amplifiers shall utilize a common, switched, loop oscillator to eliminate cross talk between adjacent or overlapped loops connected to the same amplifier.

Detector amplifiers shall self-tune within two seconds after application of AC power.

Each channel shall dip switch select either standard loop or microloop operation.

Detector amplifiers shall provide dip switch selection of 0 to 60 seconds of delay or 0 to 12 seconds of extension.

Detector amplifiers shall provide 60 Hz power line noise filtering.

Fiber Optic Splice Enclosure, Small

Fiber optic splice enclosures shall be steel enclosures designed to store fiber optic fusion splice. The unit shall be equivalent to Seicor Model NSO-012-041, and shall have the capacity to house at least 24 fiber splices. The unit shall weigh no more than 4 pounds, shall occupy no more than 120 cubic inches of space, and no dimension shall be greater than 10 inches. The unit shall include provisions for cable strain relief, for neatly organizing slack fiber and buffer tubes, and for wall mounting the unit. Wall mounting provisions shall consist of at least two holes in the back of the enclosure, 7-5/8 inches apart. The unit shall include at least one fusion splice tray and four cable ties.

Fiber Optic Splice Enclosure, Large

Fiber optic splice enclosure, large shall be 10 inches wide, by 17 inches high, by 4.6 inches deep, steel enclosure designed to house fiber optic splices. It shall be similar to Seicor Model WSC-001, with the following exceptions:

- The width shall be 10 inches instead of 12 inches
- Cable entry shall be through the bottom rather than the 17-inch side.

The enclosure shall be finished with a neutral or beige colored power coating. The enclosure shall have the capacity to hold, and shall come equipped with 8 fusion splice trays, enough to accommodate 96 splices. The enclosure shall also come equipped with a locking kit and provisions for wall mounting the unit. Wall mounting provisions shall consist of at least two holes in the back of the enclosure, 7-5/8 inches apart along its 10-inch length, 1/2 inch from its top edge. The enclosure shall be able to accommodate as a minimum five outdoor fiber optic cables. The enclosure shall weigh no more than 10 pounds.

Twisted Pair Terminal Block

Twisted pair terminal blocks shall be the molded, two positions, six poles, and barrier type with sealed backs and nickel-plated brass binding head screws. All terminal blocks shall have legible markings on the terminal body or contiguous surface to uniquely identify each terminal point of the block. The blocks require separate mounting clamps and shall be mountable to a flat surface by machine screws. The blocks shall not crack or split under normal installation or use. The molded block material shall not carbonize or provide current paths through the molded material when subjected to high voltage spikes.

Twisted Pair Interface Assembly

The twisted pair interface assembly shall be a molded modular unit consisting of:

- A printed circuit board, connector type surge suppressor, equivalent to EDCO model PC642-008; and
- A two-position five-pole connector block, similar to EDCO model PCB1B.

The interface assembly shall include all appropriate wiring to connect the surge suppressor and connector block to the twisted pair terminal block and the C-20 connector on the controller.

Fiber Optic Splitter

Fiber optic splitters shall be devices similar to Gould series A multimode fused bi-directional couplers using packaging style 21. Splitters shall be designed to split light from one fiber into two fibers, or to combine light from two fibers in a 1X2 port configuration, and shall be capable of operating at 850nm or 1300 NM wavelengths. Splitters shall be manufactured with the following split ratios, and shall exhibit insertion losses no greater than shown below.

<u>Split Ratio</u>	<u>Insertion Loss (dB)</u>
50/ 50	4.3
40/ 60	5.3/ 3.1
30/ 70	6.8/ 2.3
20/ 80	8.7/ 1.5
10/ 90	13.3/ 1.0
5/ 95	20.0/ 0.8

Typical thermal stability shall be less than or equal to 0.2 dB.

Operating temperature shall be -20 to +70 C.

The cable shall be marked or colored to distinguish input, primary output, and secondary output fibers.
The splitter shall have a typical pull strength of >2 pounds.

3mm Ruggedized Fiber Optic Splitter With ST Connector

Fiber optic splitters shall be devices similar to Gould series A multimode fused bi-directional couplers using packaging style 32 with 3mm diameter leads 62.5/125um fiber 1 meter lead length input and outputs, ST Connector on (tap) lead only.

Splitters shall be designed to split light from one fiber into two fibers, or to combine light from two fibers in a 1X2 port configuration, and shall be capable of operating at 850nm or 1300 NM wavelengths. Splitters shall be manufactured with the following split ratios, and shall exhibit insertion losses no greater than shown below.

<u>Split Ratio</u>	<u>Insertion Loss (dB)</u>
50/ 50	4.3
40/ 60	5.3/ 3.1
30/ 70	6.8/ 2.3
20/ 80	8.7/ 1.5
10/ 90	13.3/ 1.0
5/ 95	20.0/ 0.8

Typical thermal stability shall be less than or equal to 0.2 dB.

Operating temperature shall be -20 to +70 C.

The cable shall be marked or colored to distinguish input, primary output, and secondary output fibers. The secondary output fiber shall be equipped with a factory installed ceramic ST connector. The splitter shall have a typical pull strength of >2 pounds

Input Isolators

Input isolators shall type 242 and compatible with the controller cabinets and controllers specified herein.

Fiber Optic Modems

Multimode fiber optic modems shall be used for multipoint and point to point multimode fiber optic communications. Fiber optic modems shall be designed for full duplex multipoint (daisy chained) communications at rates up to at least 9600 baud. Fiber optic modems shall interface with a model 170 controller unit including two optical transmitters and two optical receivers. It shall also have a switch for switching between master and local operation.

When the switch is in the master position, the modem shall convert the electrical signal received via its RS-232 port to optical signals, which it shall transmit using both its transmitters. It shall also convert signal from either optical receiver to electrical signals.

The modem shall operate differently when the switch is in the local position. When an optical signal arrives at receiver #1, the device shall convert the optical signal to an electrical signal and transmit it. It shall also regenerate the optical signal and transmit it via transmitter #2. When an optical signal arrives at receiver #2, the device shall regenerate the signal and transmit it via transmitter #1. In addition, it shall convert the electrical signal to an optical signal that it transmits via transmitter #1.

The modem shall have an internal power source as a backup that keeps the modem operating in the absence of external power. The power source shall be capable of keeping the transceiver operating in both directions for 12 hours based on a half duty cycle. The power source may be either a super capacitor, standard 9-volt alkaline battery, or rechargeable nicad battery.

The front panel of the modem shall contain two lighting emitting diodes, one that illuminates when the transceiver is receiving and the other when the transceiver is transmitting.

The optical transmitters and receivers shall operate at 850 NM and provide a power budget of at least 15 dB using 62.5/ 125-multimode fiber. Pulse width distortion shall not exceed +/-3 microseconds.

The operating temperature range shall be -35 C to + 75 C.

The transceiver shall be packaged in two versions, both meeting all of the above requirements:

1. Internal Modems- The internal version shall be printed circuit board assembly 9.375 inches long by 6.25 inches high that fits into the 400 modem slot of the controller. On the modem there shall be an edge connector that shall mate with the internal connector of the model 170 controller unit's motherboard. It shall be powered by the controller. The front panel shall also contain an RJ-11 jack that can be used to interface the internal modem to an external modem thereby permitting the controller to communicate over two additional full duplex fiber optic links via the same communications port. Internal modems shall be interoperable with Traffic Fiber Systems model FO400.
2. External Modems- The external version shall be fully enclosed in a durable case shall include a connecting cable to link the modem's RS-232 port to the RJ-11 jack on an internal or external fiber optic modem. It shall have an external power supply that plugs into a standard 120 VAC outlet. Excluding the power supply, it shall occupy less than 50 cubic inches. External modems shall be interoperable with Traffic Fiber Systems model FO212.

Twisted Pair Modems

Twisted pair modems shall be asynchronous, designed for full duplex multipoint (daisy chained) communications at rates up to at least 2400 baud. The modems shall transmit and receive information via a 4 wire twisted pairs copper circuit. The modems shall be phase coherent FSK (frequency shift keyed), and shall have a switch selectable anti streaming feature to prevent a modem connected to malfunctioning controller from monopolizing an entire communications channel.

Twisted pair modems shall use the same communications protocol as a standard 400 modem.

The operating temperature range shall be -40 C to +75C.
Line impedance shall be 600 ohms resistive.

Receiver dynamic range shall be +3 dbm to -48 dbm.

Carrier threshold shall be -42 dbm +/- 3 db. Maximum hysteresis shall be 3db.

Receiver performance shall yield less than 15% peak jitter and 10% peak distortion at 2400-baud operation.

Receive frequencies shall be: Mark 2400 Hz
Space 4400 Hz
Receive frequency accuracy shall be +/- 25 hertz for -40 dbm minimum.

Transmit frequencies shall be: Mark 2400 Hz
Space 4400 Hz
Transmit levels shall be 0 dB to -8 dbm adjustable by potentiometer.

Modems shall have the following status indicators mounted on the front edge:

Transmit Data XMT
Receive Carrier CAR
Receive Data RCV
Clear To Send CTS
Request To Send RTS

Timing Specifications shall be:

CTS Timing	12 or 6 +/- 2 mS
REC Line Signal Detector	8 or 4 +/- 2 mS
Carrier Turnoff	10 or 5 +/- 2 mS
Receiver Squelch	6.5 or 3.5 +/- 2 mS

The modems shall be packaged in two versions, both meeting all of the above requirements:

1. Internal Modems- Internal modems shall be a printed circuit board assembly that fit into the 400 modem slot of the controller and or a 7 inch high by 9 inch wide by 15 inch deep powered modem rack designed to hold up to 16 modems. Modems shall have a 44 pin edge connector that shall mate with the internal connector on the controller unit's mother board and or the dB-25 female interface on the back panel of the modem rack. The edge connectors shall be keyed to prevent inadvertent upside down installation of the modems. Modems shall be powered by the controller or modem rack.
2. External Modems- The external version shall be stand alone, fully enclosed in a durable case and shall include a connecting cable to link the modem's RS-232 port to the RJ-11 jack on an internal or external or fiber optic transceiver. It shall have an external power supply that plugs into a standard 120 VAC outlet. Excluding the power supply, it shall occupy less than 60 cubic inches.

Cabinets General

This specification defines the minimum requirements of three basic types of controller cabinets and associated wiring for the installation of a type 170 traffic signal controller. It also covers the interface of the controller and all peripheral equipment for the interface of said controller and the signal head wiring power source, communications systems and the operator/ programmer of the controller. The communications equipment that will be installed in each cabinet ordered will be defined within the delivery order. The cost of the installation of the communications equipment shall be included within the price of the respective bid item.

Mechanical requirements

The cabinet shall be constructed to prevent entry of moisture in the form of rain, snow, or by passing vehicles splashing same from the roadway. The cabinet shall have gasketed doors. Other openings shall be designed to prevent moisture entry when water is sprayed on the cabinet from a garden hose with normal household water pressure (40 PSI) at a zero degree angle from the top, left, right, front and back sides. The cabinet shall resist water entry with the nozzle of the hose adjusted to form a fan spray against the cabinet from a fan spray against the cabinet from the five directions described above.

The nominal interior dimensions of the cabinets shall be:

	Depth	Width	Height
<u>Type 303</u>	17 in.	20 in.	36 in.
<u>Type 332</u>	30 in.	24 in.	66 in.
<u>Type 336</u>	22 in.	24 in.	39 in.

The cabinet top, bottom, sides, back, and door shall be fabricated from ASTM 5052- H32, .188 inch thick aluminum or .125 high quality stainless steel. Welds shall be continuous with no burn through, free of all splatter. The completed assembly shall be free of scratches, dents, and abrasions identifiable by the city inspector from a distance of 6 feet or that may effect the strength of the finished product. The top shall be angled to prevent water from collecting on the surface of the cabinet. Metal mounting rails shall be installed running the depth of the cabinet along the lower left and right hand bottom of the fabricated cabinet. The rails shall be designed and fabricated of material that will allow the installation of the cabinet rack at the required height, and of such a strength to fully support the rack in its installed position, and to facilitate installation and removal of the rack. A metal document compartment shall be attached to the inside of the front door to house the cabinet drawings and door/ lid shall have a rubber gasket to prevent the entry of moisture into the compartment.

The type 303 cabinet shall have a single main door. The type 332 and 336 shall have two main doors. The main doors(s) shall be attached to the cabinet with a stainless steel hinge pin within a full length hinge fabricated of the same material as the cabinet walls and bolted to the door and cabinet with a minimum of one bolt every 8 inches in such a fashion that minimizes the exposure of the hinge to vandalism and damage. The type 303, 332, and 336 cabinets shall have a police panel door shall be opened by a 5/8 inch by 6 inch hard aluminum removable hex key handle stored within the police door compartment after the number two Corbin key lock has been moved into the open position. The lock shall be the heavy-duty self-locking 5-pin tumbler rim cylinder type with outside cover.

The main door or doors latching system shall be three point with a position limiting device installed to prevent the shearing of the door lock key with the movement of the hex handle and to assure proper latch movement. All latch arms shall be designed and constructed of material with the proper thickness to prevent banding or deformation of the material with the movement of the latch handle from or to the latched position.

The 336 and 332 cabinets latch arms shall be fitted with rollers to reduce the opening and closing effort and assure the tight security of the door when fully closed, latched, and locked with the key removed.

The front door shall be provided with a louvered vent equipped with a removable and reusable filter nominally 11 to 16 inches wide, 4 to 6 inches high, and .500 to .875 inches thick. The filter shall overlap the vent by at least 1 inch and shall be retained in place with a spring-loaded bracket or cover and clamps. The filter assembly shall not allow water, dirt, or dust to enter the cabinet interior. Drain channels may be used to provide a water proof installation with drainage of moisture through a sump formed by the bottom bracket or other as effective means to assure that water does not enter the cabinet as verified by the garden hose test described above. The filter material shall be held captive to the filter frame such that the material shall not be blown or washed from the frame during the water hose test.

The clearance between the door and the installed controller equipment shall be at least one and one-half inches as measured from the front panel of any such equipment.

The cabinet shall contain a flush mounted police door with labeled switches inside the panel to place the intersection in normal, flash, or manual operation and a signals off switch. A 9 pin DB type serial connector shall be provided adjacent to the police panel switches accessible when the police door is open. This connector shall be wired to a controller communication port defined by the 170 software. The door shall be fitted with the city's standard key lock for police doors.

All gasketing for both the cabinet and police door shall be secured with waterproof cement. All gaskets shall be closed cell neoprene lubricated with silicone spray on the mating surfaces. Gaskets shall be positioned neatly and in such a fashion to assure positive sealing of all doors. Mechanical supports or other means are required to prevent sagging from all horizontal surfaces during installation.

Type 332 and 336 cabinets shall be clean and unpainted on the inside and outside. The outside shall be a non-glare brushed aluminum finish. Type 303 cabinets shall be painted by powder coat finish black on the outside and unpainted and clean on the inside.

All cabinets shall be provided with mounting hardware. Type 303 cabinets shall be provided with a slip fitter pedestal mount, 12-inch square pedestal or 16 x 20 pedestal base adapter as specified within the delivery order. This hardware shall be suitable for attachment to existing 4-inch conduit pedestals, new 12-inch square pedestals, or 16x 20-pedestal base. Type 336 cabinets shall be provided with side of pole mounting hardware. The 303 cabinet bottoms shall be fitted with a doubler that increases the bottom plate thickness to a minimum 3/8-inch. This doubler shall span the full width and depth of the cabinet bottom.

The bottom shall be cut and formed to accept the slip fitter hardware for the 4-inch pipe pedestal or the 12-inch square adapter. No other mounting holes are to be drilled or cut in the 303 cabinet. The doubler shall act as reinforcements added to the bottom of the 303 cabinet to provide a sturdy base for the pedestal mount hardware. Type 336 cabinets are to be provided without the bottom mounting holes but with side of pole mounting hardware. Type 332 cabinets shall be provided with base mount openings in the bottom of the cabinets. Base mount hardware including anchor bolts, washer and nuts of high strength galvanized steel shall be provided with each 332 cabinet.

Cabinet Rack

An equipment rack shall be installed in each cabinet to provide installation and mounting facilitated for all equipment installed in the controller cabinet. The rack shall provide standard EIA spacing that matches the controller and other equipment requirements. The equipment that must be accommodated are:

- Type 170 controller
- Load switches, flasher, and transfer relays
- Conflict monitor and watchdog timer
- Power supply and power distribution panel
- Fiber optic and or twisted pair modem
- All input and output wiring including terminations
- Fiber optic splice enclosure and or twisted pair terminal block
- Shelves and trays

The rack shall be fabricated from the minimum 18 gauge thick plated steel tapped with number 10-32 threads for installation of the controller and equipment chassis and peripherals. Two pair, full-length angles shall be used with chassis supporting angles to support the weight of the processor unit.

The rack shall be removable with simple hand tools, i.e., standard sockets, wrenches, screwdrivers, etc. and by unplugging the fan connector, removing the field wiring, and the installed processor and peripherals.

Ventilation fan assembly

A ventilation fan assembly shall be installed in the cabinet within the top rear and shall consist of the following:

- A heavy-duty ball bearing permanently lubricated fan motor with fan.

- An adjustable 90 to 150 degrees Fahrenheit thermostat to control the fan motor on off cycle. The thermostat shall be provided with EMI noise suppression installed. The on off differential shall be no more than 25 degrees Fahrenheit. No live terminals shall be exposed.
- The fan circuit shall be separately fused at 125 % of the rated fan current with a circuit breaker.

The ventilation fan assembly shall provide at least 100 CFM circulation with fresh air drawn into the cabinet area through the louvered door mounted vents and exhausted through the top of the cabinet front edge vent. The assembly shall prevent the recirculation of air emitted from the fan within the cabinet, i.e.; the exhaust air shall not be allowed to leak by the internal baffle of the ventilation fan assembly.

Controller power receptacle

A NEMA type 5-15R GFI receptacle shall be provided at a location within the cabinet that will allow unencumbered connection and disconnection of the controller assembly from the AC power source.

Detector input files

Vehicle detector and input isolator input files shall be provided as follows:

- 303 cabinets; 14 channels
- 332 and 336 cabinets; 26 channels

Terminal facilities shall be provided to accommodate the input file field wiring and protection devices.

Power Supply/ Power Distribution Assembly

A cabinet power supply shall be provided with each cabinet. The power supply shall be designed to provide all of the power requirements of the cabinet and installed equipment. The power supply/ power distribution assembly shall be sized to adequately furnish the DC and AC power required to support the full complement of input and output devices that may be installed in the controller cabinet.

These devices include, but are not limited to the following:

- Load switches and input isolators for pedestrian detectors and other external inputs.
- Flashers, indicators, monitors, manual advance push buttons, and any other device that may be installed as a standard or manufacturers available optional item to fully use, control, monitor, or command the controller and attributes of the cabinet assembly.

AC input distribution shall be provided through NEMA approved devices that meet or exceed the requirements of the National Electrical and Fire Underwriters Codes. The AC service shall be terminated on a three pole or three single pole service blocks capable of accepting at least one number 4 AWG conductor per block input pole and the cabinet required number and size wires on the output side of the block. The connections shall be of the compression screw clamp type constructed of material that is compatible with copper or aluminum wire. The three terminals shall be wired and labeled as AC+, Neut, and Earth Ground. AC+ shall be the fused AC power, Neut shall be the unfused AC power, and Earth Ground shall be the cabinet ground rod and earth bond.

The power supply, associated wiring, protection, termination, and distribution devices shall be sized to no less than 125 percent of the anticipated load with the cabinet fully configured considering an average of 300 watts on each signal lamp circuit.

The minimum wire size shall be 22 AWG. The AC+ shall be wired to a main circuit breaker from which power shall be distributed to the Conflict Monitor, Current Monitor, Flasher input, signal bus, and auxiliary circuit breakers.

All terminal blocks shall be the screw back closed back, barrier type, rated for at least 300 volts.

Surge Suppression

All surge protectors shall be located so that they can easily be replaced. After the main circuit breaker but before the distribution to any other device, an EMI filter/ surge arrestor shall be installed of sufficient size to suppress electrical spikes. The protector shall be a two stage series/ parallel device equivalent to an EDCO- 1210. The CALTRANS standard gas tube and MOV across the AC service terminals shall be deleted. Each input channel shall be protected by an external surge protection device, which shall be equivalent to an EDCO SRA-6LC.

The outputs of each signal load switch shall be provided with a 20-joule MOV, which is connected, from the AC+ filed terminal to chassis ground.

Each low voltage communications input/ output shall be protected as it enters the cabinet with a surge protection unit, which shall be equivalent to an EDCO PC 642C-30-X. Each DC input channel shall be protected by an external surge protection device, which shall be the equivalent of an EDCO SRA 64-30N.

Each preemption or AC signal input channel shall be protected by an external surge protection device which shall be equivalent to an EDCO SPA 60-BS-2.

Overvoltage protection devices shall be installed for all power, twisted pair communications, loop and pedestrian detector input terminations. These devices and any other that the bidder deems appropriate shall be installed to prevent induced or other voltage spikes from damaging or otherwise effecting the equipment housed within the controller cabinet.

Factory testing shall demonstrate the functionality of the installed protection devices.

Other items furnished with the Controller Cabinet

The following items of equipment shall be furnished with each controller cabinet.

Type 303

- 8 load switches
- 2, 242 input isolators
- 1, 210E conflict monitor
- 1, 204 flasher
- 1, full set of electromechanical relays
- 2, 2 channel loop detector amplifiers

Type 332

- 10 load switches
- 3, 242 input isolators
- 1, 210E conflict monitor
- 2, 204 flasher

- 1, full set of electromechanical relays
- 8, 2 channel loop detector amplifiers

Type 336

- 8 load switches
- 3, 242 input isolators
- 1, 210E conflict monitor
- 2, 204 flasher
- 1, full set of electromechanical relays
- 8, 2 channel loop detector amplifiers

12 inch Square Pedestal Mounting Base

12 inch square pedestal bases are used with a number of the 303 cabinets within the signal system. The 12-inch square pedestal base shall be thirty inches in height. The mounting of the cabinet to the square mounting pedestal base shall be with 4, ¼ inch diameter bolts, washers, and nuts. The bottom of the base shall mount over the conduits and shall be of nominal 3/16-inch thick hard aluminum reinforced to add sufficient strength to securely hold the cabinet to the pedestal and the pedestal to the foundation. The outside of the square-mounting pedestal shall be of the same texture and paint as the 303 cabinet, specified elsewhere within this document. One side of the pedestal shall be a door with a full length stainless hinge to allow access to the installed fiber optic splice enclosure and the signal feed and AC wiring.

The pedestal door shall be approximately 6 inches less in height and 2 inches less in width than the pedestal and shall be secured to the pedestal by stainless steel bolts through the stainless steel hinge. The bottom of the door shall be a least 4 inches from the bottom of the pedestal and at least 2 inches from the top. This door shall be gasketed to prevent water, dust, and dirt from entering the pedestal. The door and pedestal mating surface shall be formed to provide rounded burr free edges. The door shall be secured to the pedestal with a standard Corbin lock mating to a striker plate on the side. The tab shall engage a slot formed in the inside edge of the side pedestal frame approximately at mid opening. The door shall be fabricated of the same material and of the same finish as the pedestal.

A grounding lug shall be provided on the inside of the pedestal. The pedestal shall have provisions for hanging a fiber optic splice enclosure inside of it, consisting of two hooks welded to the inside of the pedestal 7-7/8 inches apart and 4-1/2 inches from the top of the pedestal. The hooks shall be fabricated from a 3-inch long by ¼-inch round piece of metal that is the same grade as the pedestal. Two inches of the 3 inch length shall be welded to the inside of the pedestal while the remaining 1 inch shall be formed into the shape of a "J" hook.

16 inch (deep) x 20 inch (wide) Pedestal/ Mounting Base

16 inch (depth) x 20 inch (width) pedestal bases will be used with a number of the 303 cabinets within the signal system. These pedestal bases shall be thirty inches in height. The mounting of the cabinet to the square mounting pedestal base shall be with 4, ¼ inch diameter bolts, washers, and nuts. The bottom of the base shall mount over the conduits and shall be of nominal 3/16-inch thick hard aluminum reinforced to add sufficient strength to securely hold the cabinet to the pedestal and the pedestal to the foundation. The outside of the square-mounting pedestal shall be of the same texture and paint as the 303 cabinet, specified elsewhere within this document. One side of the pedestal shall be a door with a full length stainless hinge to allow access to the installed fiber optic splice enclosure and the signal feed and AC wiring.

The pedestal door shall be approximately 6 inches less in height and 2 inches less in width than the pedestal and shall be secured to the pedestal by stainless steel bolts through the stainless steel hinge. The bottom of the door shall be at least 4 inches from the bottom of the pedestal and at least 2 inches from the top. This door shall be gasketed to prevent water, dust, and dirt from entering the pedestal. The door and pedestal mating surface shall be formed to provide rounded burr free edges. The door shall be secured to the pedestal with a standard Corbin lock mating to a striker plate on the side. The tab shall engage a slot formed in the inside edge of the side pedestal frame approximately at mid opening. The door shall be fabricated of the same material and of the same finish as the pedestal.

A grounding lug shall be provided on the inside of the pedestal. The pedestal shall have provisions for hanging a fiber optic splice enclosure inside of it, consisting of two hooks welded to the inside of the pedestal 7-7/8 inches apart and 4-1/2 inches from the top of the pedestal. The hooks shall be fabricated from a 3 inch long by 1/4 inch round piece of metal that is the same grade as the pedestal. Two inches of the 3 inch length shall be welded to the inside of the pedestal while the remaining 1 inch shall be formed into the shape of a "J" hook.

332 Adapter Base

An adapter base may be required for the 332 base mounted cabinets. The adapter base shall be capable of bolting to any concrete foundation with a NEMA 8 phase control box bolt pattern. The material used for the adapter shall be the same grade, thickness, color, and texture as used for the control box. The height of the adapter shall not be more than 12 inches above the concrete foundation.

Support

Telephone support shall be provided during normal Louisville Metro working hours (8:30 AM to 4:30 PM, Monday through Friday, Eastern time) during the warrantee period. This telephone support shall be provided to resolve operational problems with the use and implementation of the controller and cabinet hardware. The same type of support shall be provided to resolve problems related to the operation and implementation of the controllers and controller diagnostic software.

Updates

Updates for the controller diagnostic software shall be provided at no cost to the city during the warrantee period. Updates to the controller diagnostic software shall include PROMS for the controllers and or PROM modules furnished under this contract and documentation describing the change and the implementation procedures. Revised documentation shall be provided within two weeks of the date they are delivered to the contractor.

Delivery

All hardware and software including documentation shall be delivered pre-paid, insured to:

Louisville Jefferson County Metro Government
Department of Public Works
Electrical Maintenance
636 East Gray Street
Louisville, KY 40202

Deliveries shall be made between the hours of 9:00 AM and 3:00 PM Monday through Friday and with notification to Electrical Maintenance at (502) 574-3261 at least 24 hours in advance.

Quality Assurance- Acceptance Testing

All equipment designs proposed by the successful bidder, including the fabricated cabinets shall be subjected to an initial order environmental and operational performance acceptance test if not previously tested for/ or by the City of Louisville (now known as Louisville Metro). Prior to delivery all equipment shall be subjected to a pre delivery test. The initial order test shall demonstrate the operation of the equipment under what is expected to be field conditions. The tests must be completed without failure of any component or performance parameter.

Performance parameter is defined as "any feature or function that may be measured" the following are examples of performance parameters:

- Input or outputs, Voltage and current; signal load switches and wiring.
- Voltage sense levels; conflict monitor and load switch flasher.
- Turn on off sensitivity; thermostat, transfer relays, load switches, conflict monitor.
- Current output, regulation, and ripple; power supply/ power distribution assembly.
- Electrical noise generated by the fan/ thermostat, and transfer relays.
- Suppression of electrical noise; 300-volt spikes across the sine wave and, 600-volt 10-minute surges.

Initial order tests

The contractor shall provide an acceptance test procedure for review and approval by the city. The procedure shall demonstrate the proposed equipment's ability to meet or exceed the requirements of the technical specifications within the environmental ranges defined. An outline of the procedure shall be submitted with the post bid submittal with the actual submittal required no less than 30 days before the conduct of any acceptance testing. The outline shall contain sufficient detail to demonstrate that the bidder understands the level of testing required. It is anticipated that the testing will be conducted by the contractor in the presence of a Louisville Metro representative at the contractors facility and may take up to five working days to complete.

At a minimum the testing environment shall consist of two controller cabinets of each type, with test controllers and all other controller cabinet devices installed, connected to multi channel voltage, temperature, and relative humidity monitoring equipment. The voltage monitoring shall include the AC power input lines, output at the load switches, and input at the detector-input terminals. Each of the input and output lines shall have voltage spikes introduced during each of the three stabilized temperature and AC voltage levels, high, nominal and low. The equipment under test shall be powered and operational within a temperature/ humidity chamber capable of subjecting the complete controller and cabinet assembly to the following:

- Vibration testing on a shake table.
- -30 degrees Fahrenheit to + 165 degrees Fahrenheit temperatures. Humidity of 20% to 95% RH over the test temperature range, graded from 95% RH at 110 degrees Fahrenheit. The test shall continue while temperature, humidity ranges are changed from one level to another.

- While under low, ambient, and high temperatures/ humidity the input voltage shall be varied between 95 VAC and 135 VAC in three steps and for periods of at least 15 minutes. The three steps shall be 95 VAC, 115 VAC, and 135 VAC.
- While at low, ambient, and high temperatures/ humidity, 300-volt noise and 600 volt test spikes shall be applied to the controller and cabinet

Prior to the conduct of a specific test, the temperature and humidity shall be stabilized for at least 2 hours at low and ambient. The high temperature/ humidity and high/ AC input voltage shall be stabilized at these levels for at least 12 hours prior to the conduct of performance measurements. Additionally the cabinet assembly, with test controller installed shall be subjected to a cold start test. This test shall consist of soaking the cabinet and controller at the low (-30 degrees F) temperature with all AC power off to the cabinet for at least two hours after stabilization. At the conclusion of the two hours the AC power shall be reapplied to the test cabinets and satisfactory operation shall be demonstrated with the conduct of the performance measurements.

All equipment within the cabinet shall perform within specifications during this series of tests. Any failure the city attributes to a design or manufacturing flaw must be corrected and the entire series of tests must be corrected and the portion of the test that was underway must be repeated.

Measurements shall be made with recording devices that produce a hard copy of the results. Examples of this type of recording devices are:

- Strip chart recorders
- Programmable storage oscilloscope with printer outputs.
- Polaroid photographs of digital and analog measuring device displays.

Any other method that will document the test conditions and the equipment under test performance.

Pre delivery tests

In addition to the initial order tests, pre delivery tests are required for all equipment prior to shipment to the city. These tests shall demonstrate that the equipment and material are fully operational and defect free. The tests shall include the following:

Controller and Modem

Exercise of all inputs and outputs during ambient, high, and low temperature and AC power voltage conditions.

The input consists of-

1. Vehicle and pedestrian detector input
2. Emergency vehicle and railroad preempt input
3. RAM load/ burn
4. Voice grade communications
5. Fiber optic communications

Controller Cabinet, and input and output devices

Exercise all inputs and outputs circuits during low AC power voltage conditions.

The inputs consist of-

1. Input file to controller
2. Controller to load switch
3. Controller to conflict monitor
4. Controller to communications term. block
5. Power wiring to load switch bus, circuit breakers, and fused inputs to equipment
6. Flasher to transfer relays to load switches
7. Field wiring terminations to input file
8. Police panel functions

The outputs consist of-

1. Load switch circuits to back panel
2. Hardwire and voice grade communications from the controller to field wiring terminations
3. Conflict monitor to transfer relay
4. Cabinet power supply to DC voltage terminations

The contractor shall develop a test procedure for review and concurrence by the Engineers for the performance of these and other tests to demonstrate that the material proposed meets or exceeds the requirements of this contract.

SUBMITTED BY:

Firm: Path Master, Inc.
By: Randall L. Van Scoy
Title: President
Address: 1960 Midway Dr.
Twinsburg, OH 44087
Telephone: 330-425-4994
Fax: XXXXXXXXXX
Date: September 2, 2009

SECTION V

EVALUATION CRITERIA

The bids received pursuant to this Competitive Sealed Bid will be evaluated on the following selection criteria:

Single unit prices will be used in determining the total amount of the bid within the quantity ranges as indicated in the technical specifications. Metro Government shall have the right to order, at the unit price for each bid item, with the respective pricing, any quantity, during a twelve (12) month period. Prices for any bid item shall not be contingent upon the purchase of any other bid item included within this bid.

Proposals will be reviewed by a committee consisting of representatives from Louisville Metro Traffic Operations and the Electrical Maintenance Division.

PRICING ----- 90%

QUANTITY ----- 10%

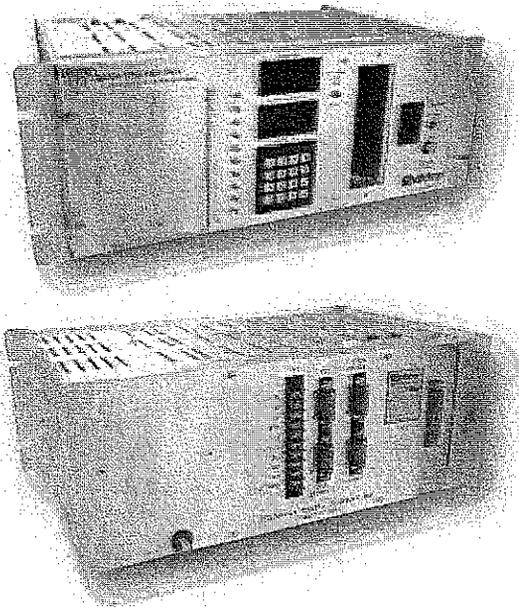
ORIGINAL

PATH MASTER, INC.

**BID NUMBER 1882
CATALOG CUTS, ANNUAL**

**TYPE 170 TRAFFIC CONTROLLERS, CABINETS,
AND MISCELLANEOUS EQUIPMENT CONTRACT**

Model 170E Microcomputer/6800/68HC11



Features

- Multipurpose microcomputer:
 - Traffic control
 - Ramp metering
 - Sign control
 - Sprinkler control
- Meets or exceeds the Caltrans requirements
- Accepts two plug-in communication modules
- Designed for ease of maintenance
- Low wattage, removable power supply
- HC11 CPU board option
- M170E board option

Description

The Model 170E Microcomputer is Safetran's most successful family of microcomputers and complies with all applicable Caltrans requirements. The model 170E incorporates the latest concepts in design for operation in hostile environments. The HC11 CPU can replace the 6800 CPU by simply removing the 6800 CPU board and sliding the new Model HC11 CPU into the same slot.

Applications

The Model 170E has been designed to manage virtually all traffic applications, from two-phase intersection control to computerized, networked systems. In addition, with the implementation of various software packages, the Model 170E has found applications in ramp-metering control, matrix sign control, sprinkler control, pump control, and changeable lane control.

Module Design

Mounted on a vertical plane to facilitate heat dissipation, all modules have been designed to increase reliability, reduce maintenance, and lower power consumption. A unique module and chassis design ensures proper positioning of each module. All modules may be extended for maintenance purposes, using extender cards.





CPU Module

The CPU houses the 6800/68HC11 MPU, the quad Asynchronous Communication Interface Adapters (ACIA), up to 32K RAM, decode logic, and bus drivers. The optional HC11 board allows the installation of up to 128K of EPROM on the CPU, thus eliminating the requirement of a program module. The optional 4701B PROM module still communicates to the HC11 board from the communication link on the edge connector. An optional blank panel is available to cover the PROM module slot.

Input Module

The single input module draws heavily on High Speed CMOS, TTL Compatible (HCT) technology. Lightning protection devices have been added to enhance surge protection. All input circuits are resident on this module to facilitate maintenance. The power start-up and super capacitor circuitry are also located on the module.

Chassis

The model 170E chassis was designed on a CAD system. Numerically controlled production equipment guarantees perfectly matched assemblies. A printed circuit motherboard assembly provides reliable interconnect between modules and a separate bus for the I/O increases noise immunity. In addition, separate logic ground paths are supplied from the power supply to each module. Vertically mounted, the C1, C2, C20, C30, and C40 connectors are located on the back of the Model 170E. To facilitate the installation of the program module, card guides have

been extended to the front panel. A hinged front panel is held in place by two thumb-screws. When closed, the front panel prevents the modules from backing out of the connectors. The Model 170E may be equipped with two communication modules.

Output Module

The single output module contains the entire output circuitry for the 170E. Operation can be easily diagnosed by simply exchanging output modules.

Power Supply Module

The Model 170E is equipped with a linear power supply. All components of the power supply, including capacitors, transformers, and power transistors are located on this removable module. Connection between the power supply and the motherboard is via a floating 15-pin, power-rated socket connector.

Standby Power

The Model 170E is supplied with super capacitors which supply standby power to volatile memory devices and the downtime accumulator circuitry.

M170E Module

An optional M170E Module can be provided to replace the 412C Program Module functions when the internal programming option is desired. The M170E Module has the 16 dip-switches and the real-time clock circuitry found on the 412C Program Module.

Operating Temperature Range:	-35°F to 165°F (-37°C to +74°C)
Power Requirements:	115 VAC, 60 Hz (40 W)
Dimensions:	7 in. H x 19 in. W x 11 in. D
Weight:	19 lbs
Timing Accuracy:	Accurate to within 100 ms with a power source frequency of 60 Hz
Power Supply:	Linear design, completely removable with low consumption (40 W)
Communications:	Four programmable ACIA ports
Modules:	All modules in vertical plane, all mechanically keyed
Dual Processor Speeds:	768 KHz and 1.53 MHz (6800), 2.0 mHz (HC11)



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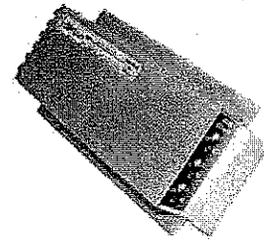
Safetran

An ECONOLITE Group Company



DATA SHEET

SSS-86I/O



Solid State Loadswitch with Output Indicators:

Description:

The PDC SSS-86I/O Solid State Loadswitch is a tri-pack solid state relay package designed specifically for the Traffic Control Industry. This unit meets NEMA specification TS1-1983, section 5, and has indicators for both the input and output signals.

Each switch will turn it's rated load ON or OFF within 10 deg. of the first zero cross-over point & within 5 deg. on succeeding alterations randomly timed input command signal.

The electronics are enclosed in a dust resistant, metal enclosure providing mechanical protection and excellent heat sinking for the heat generating components in the circuit. The electronic components are easily accessible by removing the cover with a screwdriver.

Installation:

The switchpac inter mates with any standard NEMA loadbay or with the model 332 cabinet output file. It is easily installed or removed by grasping the handle. Connector P1 pin outs are shown in FIG 1. The connector mates with a PDC BCS-12 or equal.

PIN	FUNCTION	P1
1	+115VAC, 60 Hz	(P1 as viewed from the outside of the product looking directly at the connector)
2	Chassis Ground	
3	A Output (Red, Don't Walk)	
4	Not Assigned	
5	B Output	
6	A Input (Red, Don't Walk)	
7	C Output (Green, Walk)	
8	B Input (Yellow)	
9	+24 VDC	
10	C Input (Green, Walk)	
11	-115 VAC, 60 Hz	
12	Not Assigned	

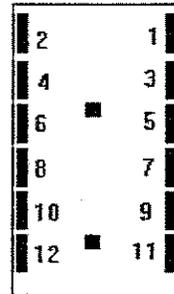


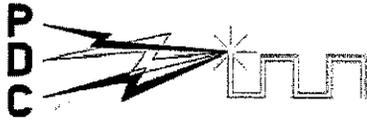
FIG 1.

General Characteristics:

Load	voltage.....	120 VAC
	current (max).....	15.0 Amps
(Tungsten Filament Load)		
Control Signal	voltage.....	+24VDC
	current	20.0 MA (max)
Switching	1st alternation after.....	+10 Degrees of line voltage at the zero signal is applied. crossover point.
	Succeeding alterations.....	+5 Degrees of line voltage at the zero crossover point.
	dv/dt.....	100 V per microsecond
Off State	line to load resistance.....	15 K Ohms Min
	leakage current.....	less than 20 MA
	Isolation voltage.....	2500 VDC Min
Surge Current	resistance.....	10 Meg Ohms Min
	one cycle.....	175 Amps RMS Min
	one second.....	40 Amps RMS Min
Life	operations.....	30 million Min
Mechanical	length.....	8.40 inches
	width.....	1.74 inches
	height.....	4.185 inches
	weight.....	1.135 LBS

Guarantee: The SSS-86I/O is fully guaranteed against all failures due to manufacturing defects for two years.

Adjustments: The switchpac has no adjustments

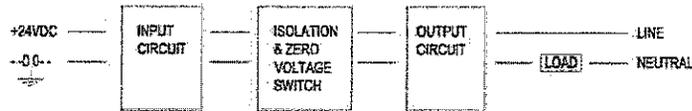


DATA SHEET

SSS-86I/O

Theory of operation:

General - The switchpac is an AC zero voltage switch which can be broken down into three (3) separate functions. The functions are illustrated in Fig 2.



Input - The input circuit is analogous to the coil of an electromechanical relay. CR1 is a reverse voltage protection diode. CR2, CR3, CR4, R1, R5, & R10 provide the proper voltage range for switch turn on.

Isolation & Zero Voltage Switch - Isolation and zero voltage switching is performed by IC1, IC2, & IC3 which are optically isolated zero voltage turn on triacs.

Output - The output circuit consists of a triac and the load circuit. The triac is a simple bi-directional switch whose on - off state is controlled by the zero voltage switch circuit.

Detailed Description of Circuit Operation

See above "Theory of Operation"

Maintenance:

If the switchpac does not function properly, follow the outline I and II to isolate the problem.

I. Perform the following preliminary checks:

- A. Check for 115VAC and 24 VDC at the input of switchpac.
- B. Check the control signal input circuit (which is part of the traffic control system)
- C. Check switchpac wiring external to P1.
- D. Check for burned out load lamp.
- E. check for broken component leads inside the switchpac.

II. If steps A through E of outline I are normal, the problem is within the switchpac. Select either problems 1 or 2 depending on the fault condition present. For example purposes, the isolation procedures shown in problem 1 assumes that the load A section of the switchpac is faulty.

A. Problem 1.

Switchpac stays on all the time, even in absence of a control signal.

Probable Cause - Either IC1 or TR1 is shorted.

Isolation Procedure- Remove one side of R3. If switchpac is still shorted change TR1. If not, change IC1.

B. Problem 2.

Switchpac does not turn on when signal is applied.

Probable cause - I1, CR2, IC1, or TR1 is open. If TR1 is open, R2 would be burnt.

Isolation Procedure-

1. Lift one side of R1 and put ammeter in series. Switchpac should draw approximately 20MA. If current measures approximately 20MA, change IC1.
2. If no current, then jumper CR2. If current flow is over 20MA, change CR2.
3. Jumper I1. If current flow of 20MA or more, change I1.
4. Measure resistance of R1. If it is not 510 ohms, change R1



A Leader in the Design & Manufacture of Electro-Mechanical Products

295 POWER RELAY

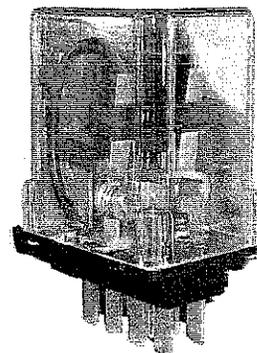
Power relay rated for 20/10 amps Tungsten @ 120/240 VAC (2.4 KW) switching on all contacts in a DPDT configuration.

Applications

- Traffic controller equipment

Features

- 20 amp Tungsten switching on all contacts
- Molded class F (155° C) coil construction
- Contacts designed for superior switching performance
- Contact wiping action results in long contact life
- PPS molded panel for superior physical characteristics

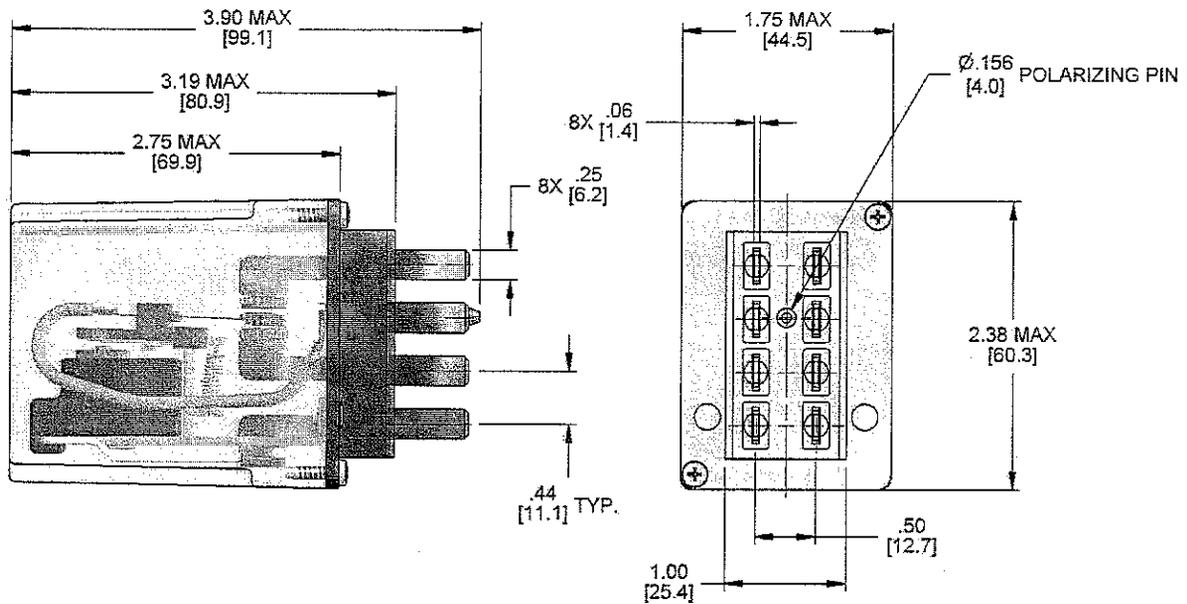


Contact Data	Expected Life
• Configuration: DPDT	• Electrical: 200,000 operations min. @ rated load
• Material: Silver Cadmium Oxide	• Mechanical: 5,000,000 operations min. @ no load
• Size: 3/8" diameter	Dielectric Strength
Contact Ratings	• Across open contacts: 1200 VRMS
• Tungsten load rating	• Contacts to coil: 2200 VRMS
• 20 Amps @ 120 VAC (2.4 KW)	• Contacts to frame: 2200 VRMS
• 10 Amps @ 240 VAC (2.4 KW)	• Pole to pole: 2200 VRMS
Coil Data	Mechanical Data
• Nominal input voltage: 120/110 VAC, 60/50 Hz	• Operating position: Any
• Nominal coil power: 7.0 VA	• Mounting: Cinch-Jones 2408 8 pin socket or equiv.
• Coil resistance: 970 Ohms ±10%	• Terminals: 0.250" x 0.055" (6.35mm x 1.40 mm)
• Coil insulation: Molded Rynite® class F system	• Insulation material: Thermoplastic 94V-O rating
• Insulation resistance: 100 Megohms minimum	• Cover material: Clear Polycarbonate 94V-2 rating
• UL insulation system file No: E74443	• Cover protection category: 40 IP rating
Operate Data	• Weight: 7.0 oz. (198 grams) approx.
• Pull-in voltage: ≤ 75% of nominal voltage	Agency Information
• Drop-out voltage: ≥ 30% of nominal voltage	• UL recognized file No.: E37066 (US & Canada)
• Operate time: 20 ms approx.	• NEMA: Exceeds NEMA Standard TS 2-2003
• Release time: 20 ms approx.	• D.O.T. Approvals:
Temperature Data	
• Operating ambient: -40°C to +65°C	
• Storage ambient: -40°C to +130°C	

A Leader in the Design & Manufacture of Electro-Mechanical Products

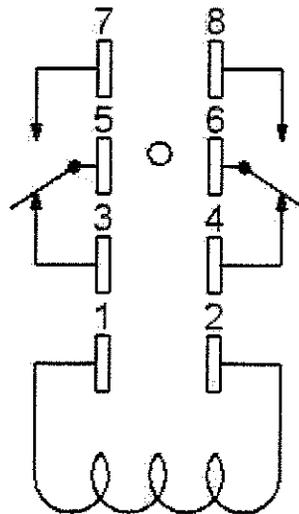
Outline Dimensions

(Dimensions shown in inches and [millimeters])



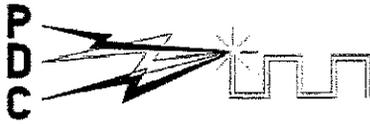
Wiring Diagram

(Viewed from pin end)

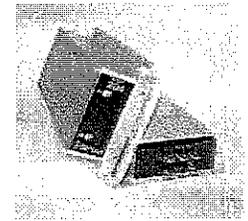


Specifications subject to change without notice

Page 2 of 2



DATA SHEET : SSF-88



Solid State Flasher:

Description:

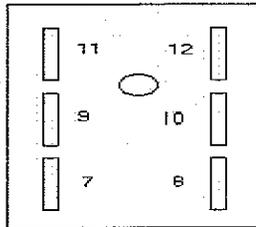
The PDC model SSF-88 solid state flasher is a dual circuit flasher designed for the Traffic Control Industry, specifically to meet California Department of Transportation Model 204 specifications. This unit is conservatively rated up to 15 A per circuit. The flash rate is 56.25 flashes per minute and does not vary due to voltage or temperature variations.

Installation:

The flasher intermates with the model 332 cabinet. It is easily installed or removed by grasping the handle. Connector pinouts are shown in FIG 1. The connector mates with a Beau P-5406-LAB or equivalent.

FIG 1.

Pin	Function
7	Load #1
8	Load #2
9	Chassis ground
10	AC-
11	AC+
12	Spare



General Characteristics:

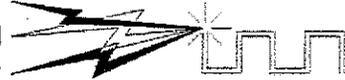
Load	Voltage.....	120 VAC
	Current (max).....	15.0 Amps (Tungsten filament load)
Flash Rate	Flashes /min.....	56
	Duty cycle.....	50%
Switching	1 st alteration after signal is applied	+10 degrees of line voltage
	Zero crossover point
	Succeeding alterations.....	+5 degrees of line voltage
Off State	Dv/dt.....	100 V per microsecond
	Line to load resistance.....	15K ohms min.
	Leakage current.....	Less than 20 MA
Isolation	Voltage.....	2500 VDC min.
	Resistance.....	10,000 meg ohms min.
Surge Current	One cycle.....	175 Amps RMS min.
	One second.....	40 Amps RMS min.
Life	Operations.....	30 million min.
Mechanical	Length.....	8.40 inches
	Width.....	1.70 inches
	Height.....	4.185 inches
	Weight.....	1.5 lbs

Adjustments: The model SSF-88 flasher has no adjustment controls.

Theory of Operation:

General - The model SSF-88 flasher can be broken down into three functions, as shown in FIG 2.

P
D
C



DATA SHEET : SSF-88

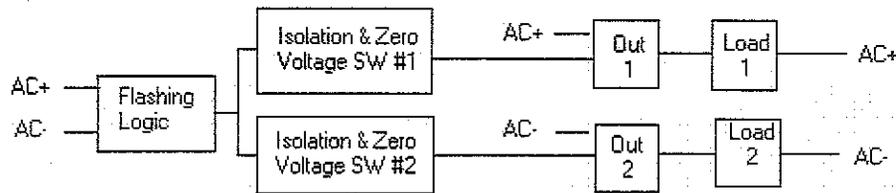
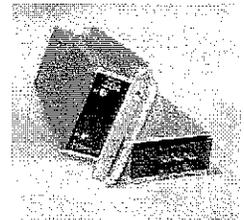


FIG 2.

Flashing Logic – the flashing logic circuit counts the incoming AC line and switches control between circuits 1 and 2, one each ½ second.

Isolation & Zero Voltage Switch – This portion of the flasher is an optocoupler which provides a high degree of electrical isolation between the input signal and the output triac. A LED light source within the optocoupler is used to switch on a photo-triac. The optocoupler contains the zero voltage switching circuitry which turns the output triac on or off within five degrees of the line voltage zero voltage point.

Output – The output circuit consists of a triac and the load circuit. The triac is a simple bi-directional switch whose on-off state is controlled by the zero voltage switch.

Detailed Description of Circuit Operation:

Referring to the schematic diagram, FIG 3., the flashing logic circuit consists of C1, C2, C3, CR1, R2, R3, R5, R12, IC1, Q1, Q2, & Q3. The flashing logic circuit is a free running circuit as long as the AC+ is applied. The heart of the flashing logic circuit is the 4024 (7 stage cmos counter) IC1. IC1 counts the AC line presented at pin1 via the components C2, R3, & C3. IC1 counts the AC on pin 1 and every 32 counts changes the status of the output at pin 4 (533 m sec.) When pin 4 is in the (+) state q# is energized activating circuit #1. When pin 4 is at ground, Q2 activates circuit #2. The output of the flashing logic circuit drives 2 identical optocouplers (IC2 & IC3). When Q3 saturates, IC3 switches on due to the current flow through its photo diode. The photo triac in IC3 has a zero voltage sense circuit built in which will allow the photo triac to turn on or off only within 5 degrees of 0 volts on the AC sine wave. When the photo triac turns on the main power triac TR2 is turned on. TR2 will remain on until the photo triac turns off. I1 & I2 are LEDs that come on with their respective outputs.

Note that regardless of when the input signal (GND) is applied or removed the load is not switched on or off until the pulsating AC voltage drops to zero. With an incandescent lamp load the line voltage and current are in phase and the possibility of RFI due to switching transients is reduced drastically because actual load switching occurs at nearly zero voltage and current. The zero voltage switching action also helps reduce the surge current as the tungsten filament is turned on.

Maintenance:

Preventative Maintenance: The flasher may be stored in any non-corrosive environment until needed. Once installed and operating the flasher unit needs no preventative maintenance during normal operation.

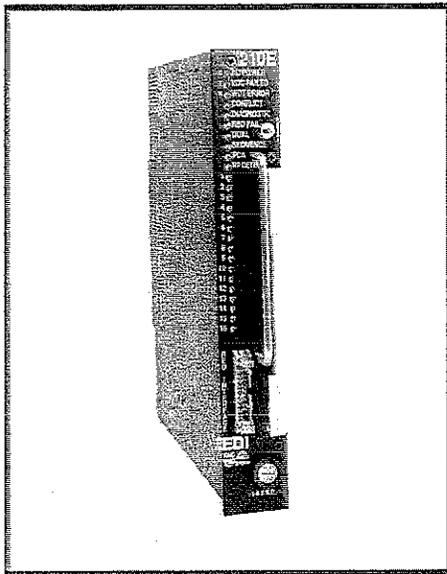
Trouble Analysis: If the flasher does not operate properly, follow outline I., II., and III to isolate the problem.

- I. Perform the following preliminary checks:
 - A. Check for 115 VAC at the input of the flasher.
 - B. Check for 115 VAC flashing on pins 7 & 8 of the flasher connector (while flasher is operating).
 - C. Check flasher indicators
 - D. Check flasher wiring external to P1.
 - E. Check for burned out load lamp.
 - F. Check for broken wires or component leads inside the flasher.
- II. If steps A through D of outline are normal, the problem is within the flasher. Select either problems 1 or 2 depending on the fault condition present. For example purposes the isolation procedures shown assume that load #1 section of the flasher is faulty.
 - A. Problem 1 – Load #1 stays on all the time & load #2 flashes normally.
Probable cause – TR2, IC3, or Q3 is shorted on.

P.O. Box 7172 #205 Stateline, NV. 89449 • PH (925) 455-7711 • FAX (925) 455-7714

210E Series

Type 170 / 179 Signal Monitor



The EDI 210E Series Signal Monitor is designed to upgrade the capabilities of the basic 210 monitor used in Type 170 / 179 Output Files. The unit is fully compatible with the requirements of the 170 and 179 Controller Units. The 210E Signal Monitor utilizes enhanced monitoring functions to increase cabinet fault coverage, providing additional assurance that cabinet equipment malfunctions will be detected and diagnosed properly.

Model Options:

- | | |
|------|------------------------------------------------------------|
| 210E | 16 channel capability for 170 and 179 compatibility |
| 2010 | 16 channel capability for 170, 179, and 2070 compatibility |

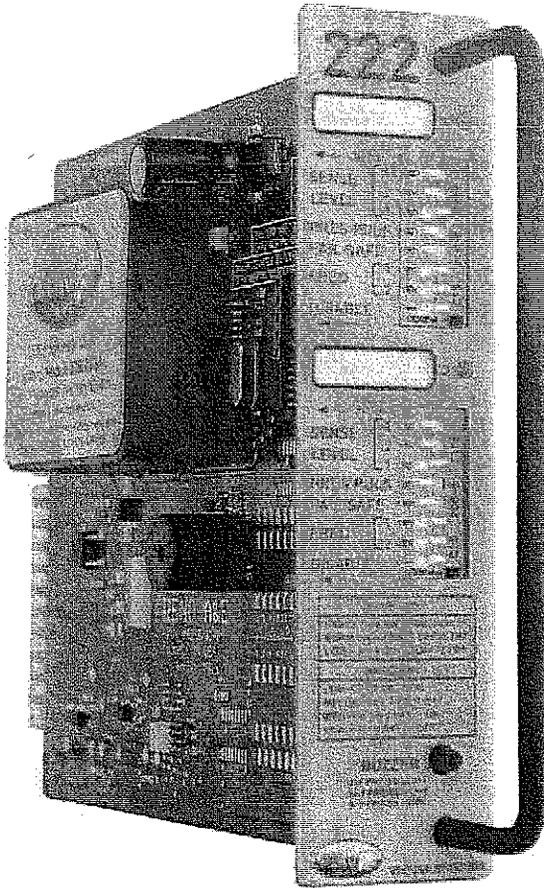
210E FEATURES

- Enhanced 210 Monitoring Functions:** The 210E meets or exceeds the requirements of the Caltrans Traffic Signal Control Equipment Specifications of January 1989. Basic fault coverage includes Conflict, 24Vdc, CU Watchdog, and AC Line monitoring.
- Red Monitoring:** Red Fail Monitoring senses the absence of signal on all three inputs of a channel and requires the output file to be wired for Red signals. Two Special Function inputs disable Red Fail Monitoring to accommodate RR preempt or TOD flash sequences.
- Dual Indication Monitoring:** GYR Dual Indication Monitoring detects simultaneous active signals on a channel. GY Dual Indication monitoring provides Dual Indication sensing capabilities for 5 section signal heads.
- Sequence Monitoring:** Sequence Monitoring ensures sequencing of signals with a proper minimum yellow clearance interval (Short Yellow or Absence of Yellow).
- EDI RMS-Engine™:** A DSP coprocessor converts ac input measurements to True RMS voltages, virtually eliminating false sensing due to changes in frequency, phase, or sine wave distortion.
- Recurrent Pulse Detection:** Recurrent Pulse Detection works in conjunction with the RMS-Engine to detect faults that are pulsing or intermittent in nature.
- LEDguard™:** This EDI innovative signal thresholding technique is used to increase the level of monitoring protection when using LED based signal heads.
- Diagnostic Displays:** Two Diagnostic display modes show active colors of channels for both real-time intersection status and latched fault status of the current and two previous fault events.
- AC Line Monitoring:** AC Line Monitoring detects and responds to low AC Line voltages as well as interruptions.
- Configuration Monitor:** Detects potentially unsafe programming changes and Red Interface cable problems.
- Flashing Yellow Arrow PPLT:** Two operational modes are built-in for support of the MUTCD Flashing Yellow Arrow PPLT operation depending on the number of load switches in the cabinet.
- Option Programming:** Programmable options include:
- | | |
|-------------------------------------|------------------------------------|
| ✓ Watchdog Fault Timing | ✓ Red Fail Fault Time |
| ✓ Configuration Change Fault Enable | ✓ Dual Indication Fault Time |
| ✓ Watchdog Latch Enable | ✓ Minimum Flash Enable |
| ✓ AC Line Brownout/Restore Levels | ✓ Special Function Input Polarity |
| ✓ GY Dual Indication Enable | ✓ Red Interface Cable Check Enable |

LEDguard, and RMS-Engine are trademarks of Eberle Design Inc.

222 SERIES

TWO CHANNEL RACK MOUNT DETECTOR



- Two detector channels in a single unit
- Eight front panel DIP switches for each channel provide:
 - ◆ Eight levels of sensitivity
 - ◆ Presence or Pulse mode
 - ◆ Four loop frequencies
 - ◆ Fail-Safe or Fail-Secure operation
 - ◆ Channel disable
- Loops are sequentially scanned to eliminate crosstalk
- Loop fail event monitor remembers and indicates intermittent and current loop failures
- Detector is self tuning and provides complete environmental tracking
- Dual color (red / green), high intensity LEDs provide detect and loop fail indications
- Complete built-in detector integrity test
- Space provided on front panel to label each channel
- Audible detect signal (buzzer) facilitates loop and/or detector troubleshooting

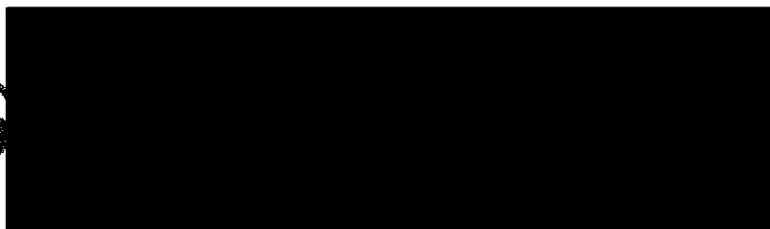
With Audible Detect Signal

Ordering Information

Model 222-XX ← R = Relay outputs
 Blank = Solid State outputs

Overview

The Model 222 is a California Department of Transportation (Caltrans) approved vehicle detector. Model 222 detectors are two channel, DIP switch programmable, card rack type loop detectors with individual channel detect and loop fail indications provided via two dual color, high intensity LEDs.



Since 2000

722 SERIES SPECIFICATIONS

This is a Performance Specification. It is not intended to be used as Operating Instructions.

General Characteristics:

Loop Frequency Each channel has four (4) DIP switch selectable loop frequencies (normally in the range of 20 to 100 kilohertz) that are a function of the actual loop / lead-in network.

Sensitivity Eight (8) sensitivity levels are available for each channel. The eight settings are selectable using three DIP switches. Each of the eight sensitivity levels are binary encoded from 0 to 7 (lowest to highest sensitivity). The sensitivity level selected determines the percentage of negative inductance change of the loop circuit required for a Call output signal. (See *Sensitivity, -ΔL/L, & Response Time* table.)

Channel Disable When set to the Disable position, the channel output is continuously in the No Call state regardless of the presence or absence of vehicles over the loop. The loop oscillator is not activated when the channel is in the Disabled (ON) state. Changing this setting will reset the channel.

Presence / Pulse Mode Each channel can be independently set to operate in one of two modes by means of front panel mounted DIP switches.

Presence Mode Call hold time is a minimum of four minutes regardless of vehicle size, and is typically one to three hours for an automobile or truck.

Pulse Mode A pulse of 125 ±10 milliseconds duration is generated for each vehicle entering the loop detection zone. Each vehicle detected is instantly tuned out if it remains in the loop detection zone longer than two seconds. This feature allows detection of vehicles subsequently entering the detection zone. After each vehicle leaves the loop detection zone, the channel resumes full detection sensitivity within one second. Changing the Presence / Pulse Mode switch will reset the channel.

Fail-Safe / Fail-Secure Operation During a loop failure condition, the state of the channel's output can be selected as Call in the Fail-Safe mode or No Call in the Fail-Secure mode. Fail-Safe operation during a loop failure is the standard mode of operation for intersection control. Fail-Secure operation during a loop failure is typically used for incident detection systems for freeway management. Fail-Secure selection also selects fast response for very accurate speed measurements. Changing this setting will reset the channel. (See *Sensitivity, -ΔL/L, & Response Time* table.)

Audible Detect Signal A front panel mounted pushbutton is used to enable an audible detect signal that is emitted any time a given channel's detection zone is occupied.

100 Millisecond Minimum Output When the detector is operating in Presence mode, two modes of operation are available for the Call outputs; Normal mode or 100 Millisecond Minimum Output mode. 100 Millisecond Minimum Output mode can be selected via a DIP switch on a PC board mounted two-position DIP switch module. When this feature is OFF, Call outputs will stay on only as long as the detection zone is occupied. When this feature is ON, every Call output will have a minimum duration of 100 milliseconds.

Detect / Fail Indicator Each channel has a super bright, high intensity, dual color (red / green) LED that indicates a Call output and/or the status of any current or prior loop fault condition. A continuous ON (green) state indicates a Call output. A continuous ON (red) state indicates that a current open loop failure condition or an inductance change condition of greater than +25% condition exists. A one Hz (red) flash rate indicates that a current shorted loop failure condition or an inductance change condition of greater than -25% condition exists. A flash rate of three 50 millisecond (red) pulses indicates a prior loop failure condition. A flash rate of three 50 millisecond (red) pulses followed by a 750 millisecond (green) pulse indicates a prior loop failure condition and a current Call output (detect state). If the audible detect signal is activated, any detect indication that would normally be displayed as green will be displayed as orange.

Loop Fail (Event) Monitor: If the total inductance of the loop input network goes out of the range specified for the detector, or rapidly changes by more than ±25%, the affected channel will immediately enter the programmed Fail-Safe or Fail-Secure mode of operation. Fail-Safe operation generates a continuous Call output in the Presence or Pulse mode. Fail-secure operation does not generate a Call output during a loop failure. In both modes of operation, the detect / fail LED will illuminate (red) and remain on for as long as the loop fault exists. If the loop self-heals, the channel will resume operation in a normal manner, but the detect / fail LED of the channel will begin to flash at a rate of three flashes per second as a means of indicating a prior loop fail condition. The detect / fail LED will continue its indication of a prior loop failure until the detector channel is reset, the detector channel is reset, or the detector is reset.

Specifications (Physical):

Weight 6.0 oz (170 gm.)

Size 4.50 inches (11.43 cm.) high x 1.12 inches (2.84 cm.) wide x 6.875 inches (17.46 cm.) deep (including connector, excluding handle). Handle adds 1.00 inch (2.54 cm.) to depth measurement.

Operating Temperature -40° F to +180° F (-40° C to +82° C)

Circuit Board Printed circuit boards are 0.062 inch thick FR4 material with 2 oz. copper on both sides and plated through holes. Circuit boards and components are conformal coated with polyurethane.

Connector 2 x 22 contact edge card connector with 0.156 inch (0.396 cm.) contact centers. Key slots located between pins B/2 & C/3, E/5 & F/6, and M/11 & N/12. (See *Pin Assignments* table.)

Specifications (Electrical):

Power 10.8 to 30 VDC. Solid State outputs, 100 mA maximum; Relay outputs, 130 mA maximum.

Loop Inductance Range 20 to 2000 microhenries with a Q factor of 5 or greater.

Loop Feeder Length Up to 5000 feet (1500 m) maximum with proper feeder cable and appropriate loops.

Loop inputs Transformer isolated. The minimum capacitance added by the detector is 0.068 microfarad.

Scanning: The loop(s) connected to each detector channel are activated alternately to minimize crosstalk between adjacent loops connected to the same detector.

Lightning Protection The detector can tolerate, without damage, a 10 microfarad capacitor charged to 2,000 volts being discharged directly into the loop input terminals, or a 10 microfarad capacitor charged to 2,000 volts being discharged between either loop terminal and earth (chassis) ground.

Detector Reset Changing the position of either channel's DIP switches (except the frequency switches) will reset that detector channel. The detector can be reset by connecting a logic ground signal to Pin C (Reset Pin). Reapplication of power after a power loss will also cause the detector to reset. After changing either channel's frequency selection switches (DIP switches 2 & 3), the channel must be reset.

Solid State Outputs Optically isolated. 30 VDC max. collector (drain) to emitter (source). 100 mA max. saturation current. 2 VDC max. transistor saturation voltage. The output is protected with a 33-volt Zener diode connected between the collector (drain) and emitter (source).

Relay Outputs The relay contacts are rated for 6 Amps max., 150 VDC max., and 180 Watts max. switched power.

Response Time The response time of either channel is affected by the sensitivity level setting and Fail-Safe / Fail-Secure selection of that channel. When set to operate in Fail-Safe mode, response time is 65 ±25 milliseconds for all sensitivity levels. When set to operate in Fail-Secure mode, response time varies and depends on the sensitivity level selected. (See *Sensitivity, -ΔL/L, & Response Time* table.)

Self Tuning The detector automatically self tunes and is operational within two seconds after application of power or after being reset. Full sensitivity and hold time requires 30 seconds of operation.

Environmental & Tracking The detector is fully self-compensating for environmental changes and loop drift over the full temperature range and the entire loop inductance range.

Grounded Loop Operation The loop isolation transformer allows operation with poor quality loops (which may include one short to ground at a single point).

Test Mode A PCB mounted DIP switch enables Test Mode. Test Mode provides a means of verifying proper operation of the detector's controls and indicators (switches and LEDs). Each channel's loop oscillator circuit is also checked to verify the correct frequency in each of the four frequency settings.

Sensitivity, -ΔL/L, & Response Time

Sensitivity	-ΔL/L	Response Time	
		Fail-Safe Mode	Fail-Secure Mode
0	1.28%	65 +/-25 ms	3.5 +/-2.5 ms
1	0.64%	65 +/-25 ms	3.5 +/-2.5 ms
2	0.32%	65 +/-25 ms	3.5 +/-2.5 ms
3	0.16%	65 +/-25 ms	3.5 +/-2.5 ms
4	0.08%	65 +/-25 ms	4.5 +/-3.5 ms
5	0.04%	65 +/-25 ms	7.0 +/-6.0 ms
6	0.02%	65 +/-25 ms	11.5 +/-10.5 ms
7	0.01%	65 +/-25 ms	21.5 +/-20.5 ms

Factory Default Settings (Both Channels)

DIP Switch	ON	OFF	Factory Default
1	Channel Disabled	Channel Enabled	OFF
2	Four (4) Frequency Selections		OFF
3			OFF
4	Fail-Safe Mode	Fail-Secure Mode	ON
5	Presence Mode	Pulse Mode	ON
6			OFF
7	Eight (8) Sensitivity Selections		ON
8			ON

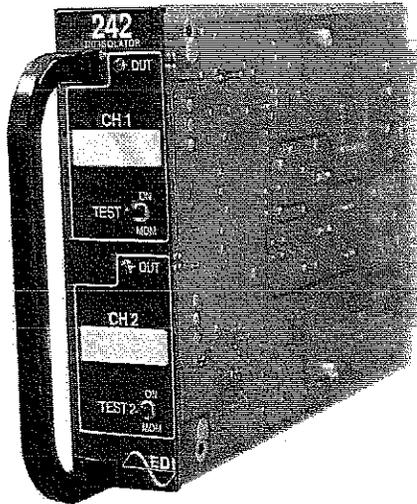
Pin Assignments

Pin	Function	Pin	Function
A	DC Common	1	No Connection
B	DC +	2	No Connection
C	Reset Input	3	No Connection
D	Channel 1 Loop Input	4	Channel 1 Loop Input
E	Channel 1 Loop Input	5	Channel 1 Loop Input
F	Channel 1 Output, Collector (Drain) / Relay Normally Open	6	No Connection
H	Channel 1 Output, Emitter (Source) / Relay Common	7	No Connection
J	Channel 2 Loop Input	8	Channel 2 Loop Input
K	Channel 2 Loop Input	9	Channel 2 Loop Input
L	Chassis Ground	10	No Connection
M	No Connection	11	No Connection
N	No Connection	12	No Connection
P	No Connection	13	No Connection
R	No Connection	14	No Connection
S	No Connection	15	No Connection
T	No Connection	16	No Connection
U	No Connection	17	No Connection
V	No Connection	18	No Connection
W	Channel 2 Output, Collector (Drain) / Relay Normally Open	19	No Connection
X	Channel 2 Output, Emitter (Source) / Relay Common	20	No Connection
Y	No Connection	21	No Connection
Z	No Connection	22	No Connection

Model 242

DC ISOLATOR SERIES

- DUAL CHANNEL – RACK MOUNT
- CALTRANS APPROVED



For over 25 years Eberle Design, Inc. (EDI), has provided technicians and engineers with reliable, high quality mission critical component products that improve the performance and lifecycle of traffic control systems.

EDI's wide range of traffic control vehicle detection products help technicians save valuable time and bank budgeted dollars by quickly installing, accurately troubleshooting, and reliably maintaining traffic control systems with easy to use hi-tech vehicle detectors.

The Model 242 and Model 242E DC Isolator has been specifically designed to deal with all traffic applications and meets or exceeds all requirements of:

- Caltrans QPL, TSCES January 1989
- Caltrans TEES August 2002, Chapter 1

The Model 242E adds additional Fault Output indicators to alert a technician to problems with the Model 242E outputs, cabinet wiring or associated Controller Unit inputs. Three separate Input Pulse filter settings provide a mechanism to screen out transient input pulses that may be the result of noise conditions or signal bounce.

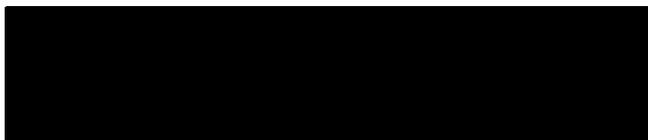
STANDARD FEATURES

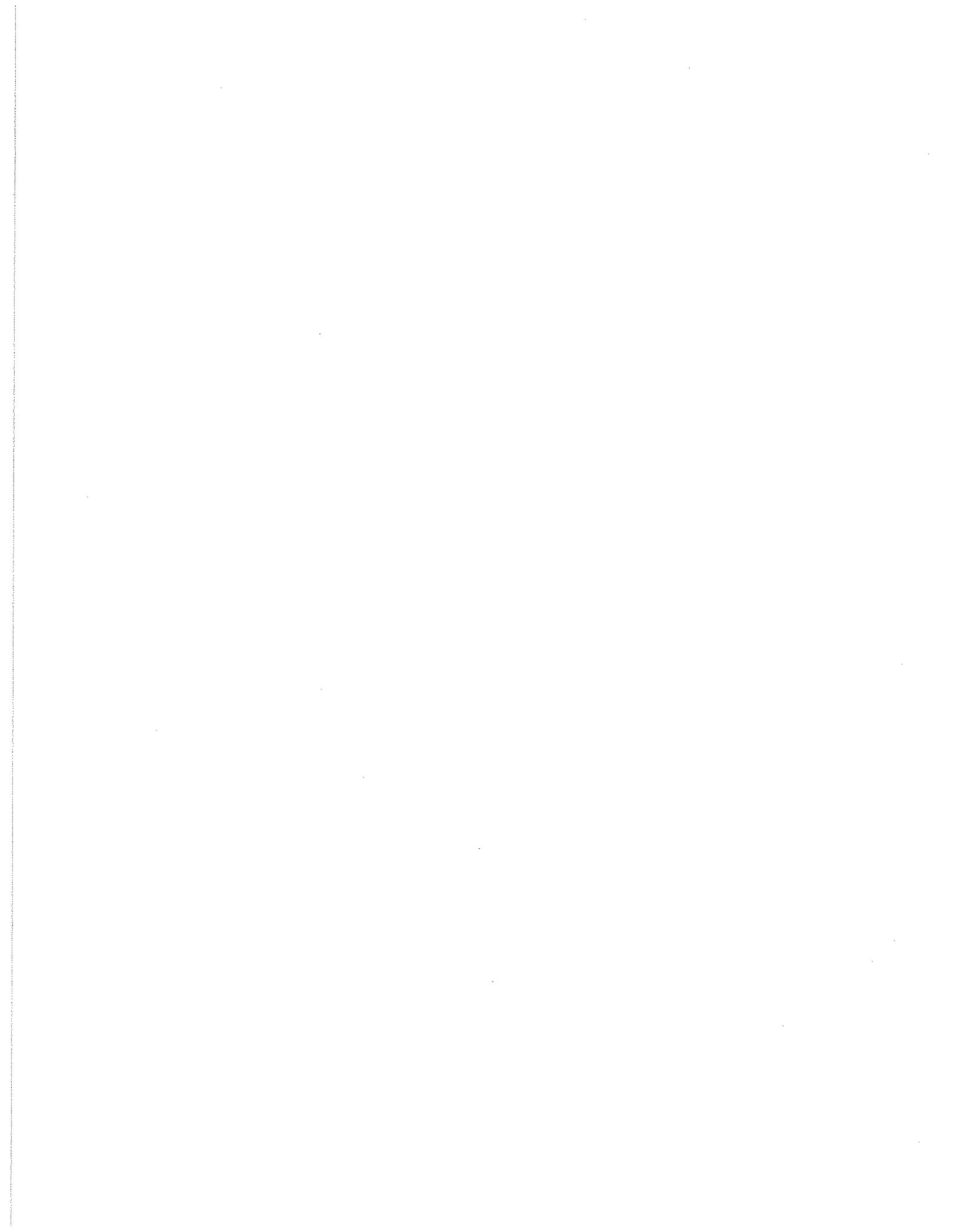
- Rugged Handle Assembly:** The Model 242 series handle assembly is made of GE Lexan™, which is a super durable polycarbonate resin. The design of this assembly strengthens and protects the whole PCB assembly much better than conventional metal face plates.
- Reliable Off-Line Power Supply:** The Model 242 series uses a reliable and efficient isolated off-line switching power supply to provide the DC voltages of the unit.
- Enhanced I/O Transient Protection:** Both the DC inputs and outputs are protected from damage due to transient voltages. AC Main protection is provided by an MOV and a fuse option is available.
- 100 ms Minimum Output Pulse Option:** The Model 242 series can be programmed to provide output pulse widths of 100ms minimum.
- Polarity Option:** The input polarity for each channel can be inverted.
- Model 242 Product Options:** **Model 242-J:** provides two-pin post jumpers for the minimum pulse width option and the polarity option.
Model 242-NY: operates from a 24VDC power supply. Meets requirements of New York State DOT for 179 cabinets.

MODEL 242E ENHANCED FEATURES

- True Electrical Output Monitoring:** The Model 242E adds a FAULT indicator for each channel that reports when the true output isolated electrical state is not consistent with the intended output state of the isolator. This may result from a cabinet wiring problem, damaged isolator output or defective CU input.
- Separate Output & Fault LEDs:** For each channel, separate Red and Yellow LED indicators are provided for the Output and Fault status respectively.
- Programmable Input Pulse Filtering:** Pulse filters may be programmed for each channel to reject input pulses that do not meet minimum values for leading edge and trailing edge pulse widths
- Polarity Option:** The input polarity for each channel can be inverted.

Patent Pending
LEXAN Resin is a trademark of General Electric





336/332 POWER DISTRIBUTION ASSEMBLY #2

INTRODUCTION

The 336/332 Power Distribution Assembly is a combined PDA (Power Distribution Assembly) and 24VDC power supply (206). The PDA #2 Assembly is mounted in the rack just below the J File and uses 7 inches of rack space. The primary AC power is fed into this assembly and the AC distribution and DC power is derived from a four terminal block on the rear panel.

CIRCUIT DESCRIPTION

AC power enters via a #8 gauge wire attached to the main circuit breaker. AC- and Chassis Ground enter via T1 (rear panel) on pins 2-3 for AC- and 1 for Ground. T1 5,6, and 9 are attached to the load side of the main circuit breaker (MCB). T1-7 and T2-6 are attached to the MC coil and Field CB indicating switches. T2-7,8,9,10 supply field power to the Output File load switches. In the event one of the Field Breakers trips or is set to OFF, the indicating switches will place power on the MC coil and FTR coils causing flashing operation. In this situation the Flash Indicator will illuminate solid on.

Two Flasher units are installed in this assembly and receive power from a 2-pole 20 ampere breaker attached to the load side of the main circuit breaker.

A Ground Fault power source is provided on the front and rear of this assembly. A GFI receptacle is placed on the front, swing-out panel and an outlet wired to the load side of the GFI is provided on the rear of this assembly.

The Front Panel may be opened during operation but caution must be used since high voltage AC power is present on the panel. If any question exists regarding safety, it is best to remove power from the cabinet before opening the panel.

On the extreme right-hand side of the assembly is an opening for the installation of a 206 24VDC power supply. The power supply is removable from the front of the assembly. However, please note the shipping retainer "wing nut" placed in the rear of the PDA#2. This "wing nut" must be removed before the power supply is pulled from the front. Access to the shipping retainer is gained by tilting the rear panel. The rear panel is held in place by two thumb screws placed at each end of the assembly. The "wing nut" is in the lower left hand side of the inner panel.

MODEL 206 POWER SUPPLY MODULE

INTRODUCTION

The 206 Power Supply Module is mounted in an access area to the right side of the PDA #2 and is electrically connected via PS socket pins as shown below. All other pins are not connected.

PIN NUMBER	FUNCTION
7	+24VDC OUTPUT
8	DC GROUND
9	EQ. GROUND
11	AC- INPUT
12	AC+ INPUT

Mounted to the Front Panel are fuses for AC power and 24VDC, as well as a power on (AC in) indicator lamp and test points for the DC+ and DC ground. Test points are in series with 100 ohm resistors to prevent using these for external loading.

CIRCUIT DESCRIPTION

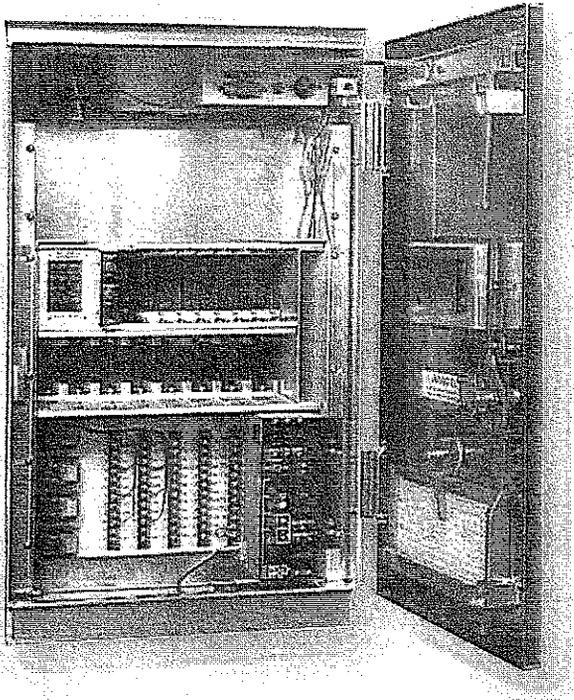
AC power enters at terminals 11 and 12 supplies 115 volts AC to power-on lamp DS1 and the MOV (Movistor) transient protectors in series with R1 and R2 wire wound resistors. Three movistors (RV1,2,3) are wired from AC+ to Equipment Ground, AC- to Equipment Ground and AC+ to AC-. Capacitor C3 parallels RV3. This configuration provides both common mode and differential mode transient and noise protection.

F1, a 3 Ampere 115VAC fuse is placed in series with the suppressors, before the transformer. The fuse is after the suppressor network to prevent transient clamping from blowing the fuse and causing the power supply to be inoperative.

Power is applied through F1 to the primary of the transformer T1. This transformer is of ferro-resonant design. AC tuning capacitor C4 is self regulating and prevents variations in input voltage from affecting the output level of the power supply.

The transformer drives a high capacity bridge rectifier with two large filter capacitors C1 and C2, providing low ripple voltage at a high (5 ampere) current. A parallel load resistor R3 (50 ohms 25 watts) is used to partially load the power supply thereby improving load regulation and preventing open circuit operation.

Control Cabinet Model 303/8 System



Features

- Single-door access
- Mountable on side of pole or top of post
- Three-point locking system
- Suited for intersection controllers and accessories
- Cabinet diagnostic (optional)
- 0.125/0.188-inch thick aluminum

Description

The Model 303/8 cabinet system is the direct result of customer requirements for a smaller cabinet. The 303/8 accomplishes this without compromising the standards for quality and durability set forth by New York State Department of Transportation (NYSDOT) and Caltrans specifications. The single door design allows access to all Subassemblies and field

terminations from the front of the cabinet. The 303/8 cabinet has been widely accepted, in part, due to the reduced size and cost to the end user. The design allows for up to eight vehicle/pedestrian phases. Each of these eight load switch positions can be flash-programmed to provide maximum flexibility and the rack assembly can be removed as a complete unit for ease of maintenance. In addition,

the power supply/Power Distribution Assembly (PDA) can be easily removed and replaced. Constructed of heavy 0.125/0.188-inch aluminum, the 303/8 provides a durable, weatherproof enclosure designed to NEMA 3R specifications. The 303/8 can be mounted on the side of the pole or top of the post.



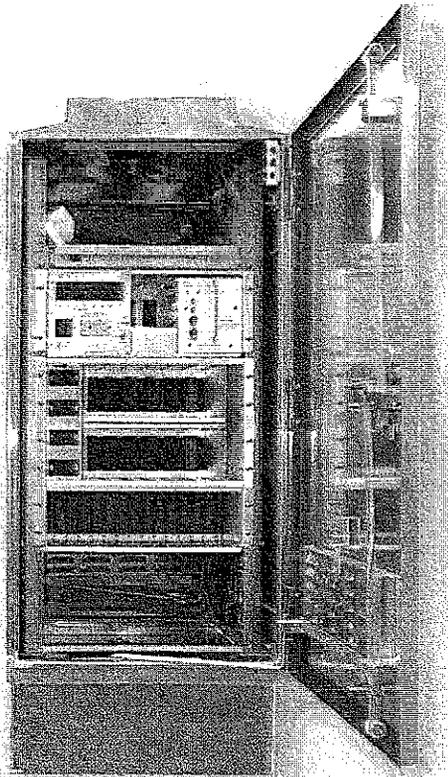


Dimensions:	36 in. H X 20 in. W x 18 in. D
Material:	Aluminum 0.125 in. (door and top)/0.188 in. (sides and bottom)
Ship Weight:	145 lbs
Finishes:	Anodized, bare, painted, or anti-graffiti
Mounting:	Side of pole – two sturdy pole-mounting brackets (optional) Top of post – post-top mounting hardware (optional)
Access:	Single front door
Ventilation:	Pleated media fiber filter in door 100 Cubic Feet per Minute (CFM) fan with thermostatic control
Locking System:	Three-point locking system with Corbin locks
Door Stops:	Two-position bar stops at top
Rack Assembly:	Removable self-standing rack assembly with: <ul style="list-style-type: none">• One PDA/power supply• One input/output subassembly
Configuration:	Eight vehicle/pedestrian phases
Police Door:	Signal on/off and flash/auto switches Auto/manual switch with police cord (optional)
Light:	Fluorescent front (optional)
Conflict Monitor:	Slot for Conflict Monitor Unit (CMU)
Flasher:	Slot for one two-circuit flasher
Flash Transfer Relay:	Receptacles for four flash transfer relays
Program Blocks:	Receptacles for eight flash program blocks

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Safetran
An **ECONOLITE** Group Company

Model 336S Cabinet Control System



Features

- Meets all Federal Highway Administration (FHWA) and Caltrans requirements
- Two doors (one front, one rear)
- Mounted on base, side of pole, or top of post
- Three-point locking system
- Suited for intersection controllers and accessories
- Cabinet diagnostic (optional)
- 0.125-inch thick aluminum

Description

The Model 336S cabinet system is a versatile modular design providing control of up to eight vehicle and four pedestrian phases. An optional configuration provides six additional load switch positions for use as overlaps, seven-wire interconnect out-

puts, or a variety of special function outputs.

The use of standard subassemblies, as defined by Caltrans and FHWA, assures interchangeability between manufacturers. All subassemblies are mounted in a removable 19-inch Electronic Industries Alliance (EIA)

rack for ease of maintenance and are fully interchangeable with the Model 332, 336, 333SD, and 332D cabinets. The 336S can be base-mounted using an 8-inch high "M" base adapter. It can also be mounted on the side of the pole or the top of the post.



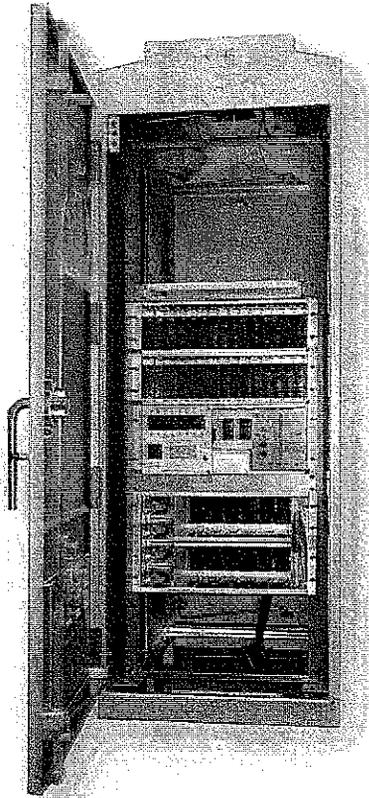


Dimensions:	46 in. H X 24 in. W x 22 in. D
Material:	Aluminum 0.125 in.
Ship Weight:	280 lbs
Finishes:	Anodized, bare, painted, or anti-graffiti
Mounting:	Base-mounted – 4¾ in. x 16 in. anchor bolts (optional) Side of pole – two sturdy pole-mounting brackets (optional) Top of post – post-top mounted hardware (optional)
Access:	Two full-size doors (one front, one rear)
Ventilation:	Pleated media fiber filter in door intake area Two 100 Cubic Feet per Minute (CFM) fans with thermostatic control
Locking System:	Three-point locking system with choice of locks: <ul style="list-style-type: none">• Corbin locks (optional)• Best locks (optional)
Handles:	Stainless steel with padlock feature
Door Stops:	Two-position bar stops on bottom of each door
Rack Assembly:	Removable self-standing rack assemblies with: <ul style="list-style-type: none">• One Power Distribution Assembly (PDA) #2• One input file• One output file
Configuration:	Eight vehicle phases, four pedestrian phases, four overlaps (optional)
Police Door:	Signal on/off and flash/auto switches Auto/manual switch with police cord (optional)
Light:	Fluorescent front and/or back (optional)
Shelf-Drawer:	Slide-out shelf/drawer storage unit (optional)
Conflict Monitor:	Slot for Conflict Monitor Unit (CMU)
Flasher:	Two slots for two-circuit flashers
Flash Transfer Relay:	Receptacles for four-flash transfer relays Two additional relays (optional)
Program Blocks:	Receptacles for eight-flash program blocks Four additional blocks (optional)

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2230980507-1

Safetran
An ECONOLITE Group Company

Control Cabinet Model 332 System



Features

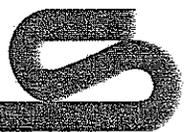
- Meets all Federal Highway Administration (FHWA) and Caltrans requirements
- Two doors (one front, one rear)
- Base-mounted
- Three-point locking system
- Suited for intersection controllers and accessories
- Cabinet diagnostic (optional)
- 0.125-inch thick aluminum

Description

The Model 332 cabinet system is a versatile, modular design providing for control of up to eight vehicle and four pedestrian phases. An optional configuration provides six additional load switch positions for use as overlaps, seven-wire interconnect outputs, and a variety of special function outputs. Ample space is provided for mounting two 170 type control-

lers for master/local applications. The use of standard Subassemblies, as defined by Caltrans and FHWA, assures interchangeability between manufacturers. All Subassemblies are mounted in a removable 19-inch Electronic Industries Alliance (EIA) rack for ease of maintenance and are fully interchangeable with the Model 336, and 336S, 333SD, and 332D cabinets. Constructed of heavy 0.125-inch alu-

minum, the 332 provides a durable, NEMA 3R-specified, weatherproof enclosure. An optional lower input termination panel provides a point to terminate input field wires. The panel is located on the left side wall of the cabinet as viewed from the rear door. The 332 cabinet housing can be supplied with an optional Underwriters Laboratories Inc. (UL) label.



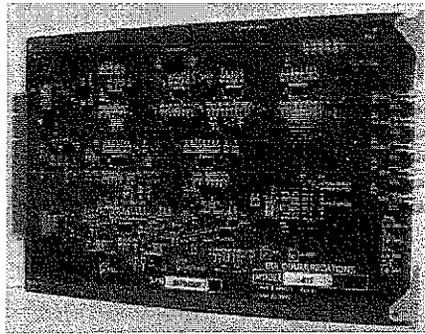


Dimensions:	66 in. H X 24 in. W x 30 in. D
Material:	Aluminum 0.125 in.
Ship Weight:	300 lbs
Finishes:	Anodized, bare, painted, or anti-graffiti
Mounting:	Base-mounted – 4¾ in. x 16 in. anchor bolts (optional)
Access:	Two full-size doors (one front, one rear)
Ventilation:	Pleated media fiber filter in door 100 Cubic Feet per Minute (CFM) fan with thermostatic control
Locking System:	Three-point locking system with choice of locks: <ul style="list-style-type: none">• Corbin locks (optional)• Best locks (optional)
Handles:	Stainless steel with padlock feature
Door Stops:	Two-position bar stops on top and bottom of each door
Rack Assembly:	Removable self-standing rack assembly with: <ul style="list-style-type: none">• One Power Distribution Assembly (PDA) #2• One power supply• Two input files• One output file
Configuration:	Eight vehicle phases, four pedestrian phases, four overlaps (optional)
Police Door:	Signal on/off and flash/auto switches Auto/manual switch with police cord (optional)
Light:	Fluorescent front and/or back (optional)
Shelf-Drawer:	Slide-out shelf/drawer storage unit (optional)
Lower Input Termination Panel:	Optional
Conflict Monitor:	Slot for Conflict Monitor Unit (CMU)
Flasher:	Two slots for two-circuit flashers
Flash Transfer Relay:	Receptacles for four flash transfer relays Two additional relays available in auxiliary file (optional)
Program Blocks:	Receptacles for eight flash program blocks Four additional blocks available in auxiliary file (optional)
UL Label:	Cabinet Housing UL 3R listed, UL File #E256326 (label optional) 



Model 400 Series Modems

Models 400, 400F, 400NY, 404
419, 496 Internal Cards



Description

The GDI Series 400 Modems are the most versatile models for private wire and Telco 3002 interconnect. There are 6 versions internal card modems for different applications. Begin with the industry standard Model 400 at 1200 bps, add anti-streaming for the Model 400F/400NY and 2400 bps for the Model 404. Then raise the speed to 9600 or 19,200 bps for Models 496 and 419 respectively. They are temperature tested rugged modems designed for the transportation industry. Directly connected to traffic controllers or variable message signs, they communicate at 1200 bps over leased telephone lines or higher speeds via private wire interconnect. Both point-to-point and multi-drop, the GDI Series 400 modems offer data rates of 1200 to 19,200 bps.

FEATURES

- 1200 to 19,200 bps
- Bell 202T Type (400 only)
- Model 170/179 Style Card
- RS232 Interface
- Temperature Hardened
- 2 & 4 Wire Switchable
- Anti-Streaming Option
- Switch Selectable Timings

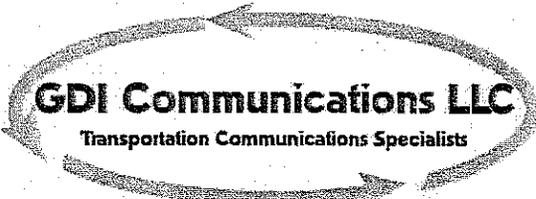
Specifications — General

Environmental Operating Ranges

Temperature Range -37 to + 74°C
Humidity 95% non-condensing

Modem

Modulation Frequency Shift Keying
Data Interface RS-232C compatible via Model 400 card
Mechanical Card Model 400 standard



Model 400

Series Modems

Models 400, 400F, 400NY, 404
419, 496 Cards and Standalone

Models, Frequencies & Data Rates

Model	Mark Hz	Space Hz	Soft Carrier Hz	Data Rate
400	1200	2200	900	0-1200
400F	1200	2200	900	0-1200
400NY	1300	2100	900	0-1800
404	2400	4400	1800	0-2400
496	11200	17600	7800	0-9600
419	19200	38400	13800	0-19200

Power Requirements

+12 volts and 12 volts \pm 5% @ 75 mA

Indicators

XMT	Transmit Data
RCV	Receive Data
RTS	Request To Send
CTS	Clear To Send
DCD	Carrier Detect

Timing (Switch Selectable)

Function	Model 400	All other Models
RTS—CTS	12mS + 2mS	6 or 12 mS + 2mS
CAR Delay	8mS + 2mS	4 or 8 mS + 2mS
Soft Carrier Off	10mS + 2mS	5 or 10 mS + 2mS
Rcvr Squelch	6.5mS + 2mS	3 or 6 mS + 1mS
Anti-Streaming	None	Switchable on/off

Receiver Characteristics

Dynamic Range	+3dBm to -48dBm
Carrier Detect Threshold	-42 \geq 3 dBm
Carrier Detect Hysteresis	3dB
Demodulator Distortion	<10% peak

Transmit, Level & Duplex

-8 dBm to 0 dBm potentiometer adjustable
2 wire half duplex, 4 wire full duplex switch selectable
Transmit Frequency Tolerance +1%

Multidrop Capability

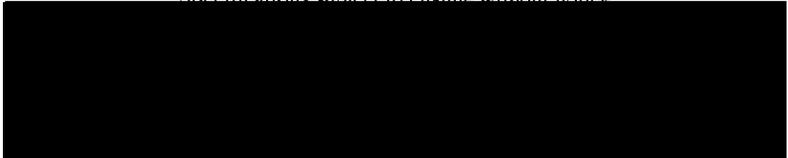
Recommend a maximum of 8 units per line. More can be used if the line is short, low noise or controller software configuration allows.

All Model 400 modems above are enhanced replacements designed to take advantage of newer traffic controllers and other products capable of higher speeds. System communications with our Series 400 modems can be improved due to the selectable timing, anti-streaming and transmitter options.

Model Numbers for Ordering

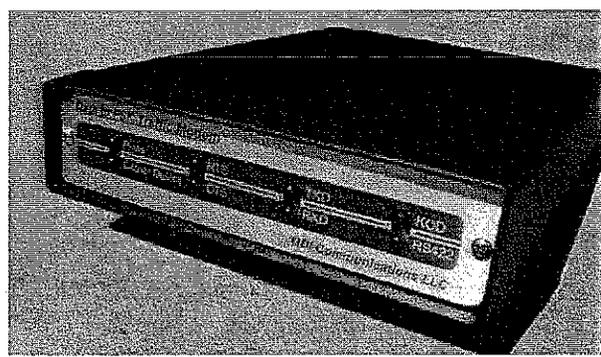
- 400, 400F
- 400NY
- 404
- 496
- 419

Specifications subject to change without notice





Model 400 Series Standalone Modems



- 1200 to 19,200 bps
- Bell 202T Type (400 only)
- Temperature Hardened
- 2 & 4 Wire Switchable
- Rugged Metal Enclosure
- Intergal Power Supply
- KOD (Key-on Data) Option
- RS232 Interface
- Optional RS422 Interface
- Anti-Streaming Option
- Switch Selectable Timings
- Optional DC power operation

Description

The GDI Series 400 Modems are the most versatile models for private wire and Telco 3002 interconnect. There are 17 versions of standalones for different applications. Begin with the industry standard Model 400SA at 1200 bps and for 2400 bps the Model 404SA. Then raise the speed to 9600 or 19,200 bps for Models 496SA and 419SA respectively. They are temperature tested rugged modems designed for the transportation industry. Directly connected to traffic controllers or variable message signs, they communicate at 1200 bps over leased telephone lines or higher speeds via private wire interconnect. Both point-to-point and multi-drop, the GDI Series 400 modems offer data rates of 1200 to 19,200 bps. The internal fused power supply on the standalone model eliminates the common "Brick" external transformer.

Adding the KOD function allows signals based on data received from the hardware to generate an RTS handshake. This unique Key-On-Data capability is essential for communicating with a communications device that requires active RTS/CTS handshaking.

Updated Standalone 400 Series Modem Full Backward Capability New Features

Specifications — General

Environmental Operating Ranges

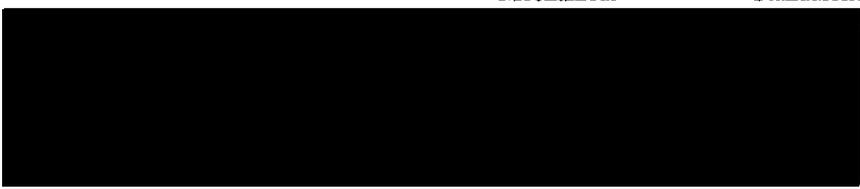
Temperature Range	-37 to + 74°C
Humidity	95% non-condensing

Modem

Modulation	Frequency Shift Keying
Data Interface	Primary: RS-232C compatible via DB9F Auxillary: RS-232C compatible via RJ45 Optional RS422 operation

Mechanical

Standalone case 1.54"H X 8.4"D





Model 400 Series Standalone Modems

Models, Frequencies & Data Rates

Model	Mark Hz	Space Hz	Soft Carrier Hz	Data Rate
400	1200	2200	900	0-1200
400F	1200	2200	900	0-1200
400NY	1300	2100	900	0-1800
404	2400	4400	1800	0-2400
496	11200	17600	7800	0-9600
419	19200	38400	13800	0-19200

Power Requirements

Standalone:

Voltage	90 to 130 VAC (Standard) 180 to 260 VAC (Optional)
Frequency	47 Hz to 63 Hz
Power	4 watts maximum
Optional DC operation	12 VDC

Indicators

TXD	Transmit Data
RXD	Receive Data
RTS	Request To Send
CTS	Clear To Send
Carrier Detect	Carrier Detect
Power	Modem Ready
KOD	KOD option enabled
RS422	RS422 option Enabled

Timing (Switch Selectable)

Function	Model 400	All other Models
RTS - CTS	12mS + 2mS	6 or 12 mS + 2mS
CAR Delay	8mS + 2mS	4 or 8 mS + 2mS
Soft Carrier Off	10mS + 2mS	5 or 10 mS + 2mS
Recv Squelch	6.5mS + 2mS	3 or 6 mS + 1mS
Anti-Streaming	None	Switchable on/off

Receiver Characteristics

Dynamic Range	+3dBm to -48dBm
Carrier Detect Threshold	-42 \geq 3 dBm
Carrier Detect Hysteresis	3dB
Demodulator Distortion	<10% peak

Transmit, Level & Duplex

-8 dBm to 0 dBm potentiometer adjustable
2 wire half duplex, 4 wire full duplex switch selectable
Transmit Frequency Tolerance +1%

Multidrop Capability

Recommend a maximum of 8 units per line. More can be used if the line is short, low noise or controller software configuration allows.

All Model 400 modems above are enhanced replacements designed to take advantage of newer traffic controllers and other products capable of higher speeds. System communications with our Series 400 modems can be improved due to the selectable timing, anti-streaming and transmitter options.

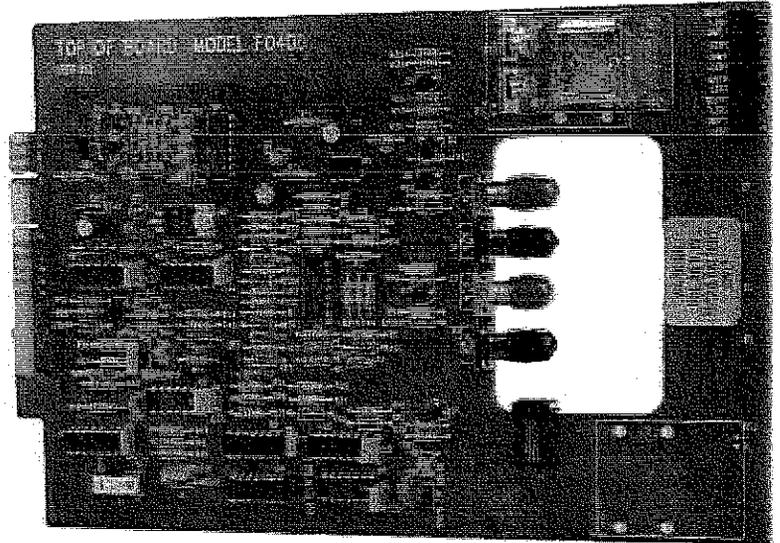
FO400

170/Internal

Fiber Optic Modem

FEATURES

- Fiber-Optic Technology
- Master/Local Operation
- Electrical Isolation
- Eliminates Lightning Damage
- Installs in 170/179 Modem Slot
- 6 LED indicators
- Anti streaming circuits
- Battery Backup
- Complies with NEMA/170 Specs.
- Operates Full Duplex in
a Multi-Drop/ Point to Point
- Single Mode or Multi Mode
- Caltrans Approved



DESCRIPTION

The FO400G is a dual mode, full duplex, multi-drop, communications link designed to interconnect traffic control equipment via the internal modem slot in the model 170/179 traffic controllers. Two sets of front mounted fiber-optic receptacles mate to ST type connectors (FC and SC connectors are available). The FO400 Fiber Optic Modem includes a holder for a battery. This optional battery provides temporary power when the traffic controller is removed for servicing and during short electrical outages. The FO400G has an auxiliary RJ-11 connector to expand the fiber-optic signal to four ports in either the local or master mode. There are 6 LED's located on the front panel, two for each channel to indicate Transmit and Receive, one to indicate AC power and one to indicate anti-streaming (fault).

OPERATION

The FO400G is operated in one of two modes - Master or Local - as chosen by a board mounted switch. The FO400G is a full duplex device, whether operated in the Master or Local Modes. Full duplex allows system testing with a bit error rate tester.

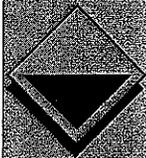
In the Master mode, the FO400G receives signals from the optical detectors (D1 and D2), converts data to electronic impulses, and passes it to the (Master) host. During transmissions, the FO400G receives data from the (Master) host, converts that electronic data into optical signals, and transmits them via emitters, (E1 and E2)

The Local mode of the FO400G is unique to fiber optic communication devices. When the FO400G is functioning as a Local, data is passed through a multi-drop of FO400G's. At each local FO400G, the signal is received and regenerated prior to transmission to the next FO400G. This design provides distant FO400G's with brilliant, clean signals, as if they were physically close to the master.

TFS

TRAFFIC FIBER SYSTEMS

TRAFFIC FIBER SYSTEMS



SPECIFICATIONS

Electrical Requirements:

Voltage: 12VDC

Current: 24MA Continuous
90MA max.

Battery Requirements: Optional - NiCad

Provides 10Hr. of backup

Voltage: 8.42VDC NiCad

Current: 12MA Continuous
60MA max.

Data Link Sensitivity

Max: 0 DBM

Min.: -40 BDM

Date Rate:

300-38.4K Baud

Power Budget:

Multimode:

@0.3K 22.9dB

@1.2K 24.3dB

@9.6K 25.2dB

@19.2K 25.3dB

@38.4K 25.3dB

Single Mode:

@0.3K 21.1dB

@1.2K 24.5dB

@9.6K 25.8dB

@19.2 26.3dB

@38.4 26.8dB

Connectors:

ST Type Standard

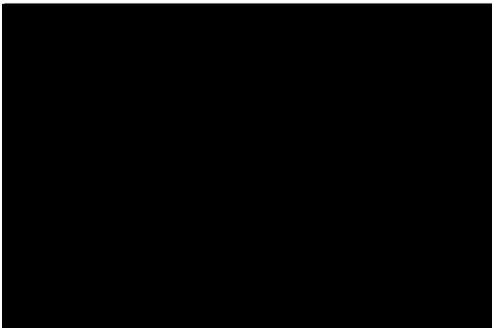
FC, or SC are available by special order

Operating Temperature Range:

-35 C to +75 C

Operating Range

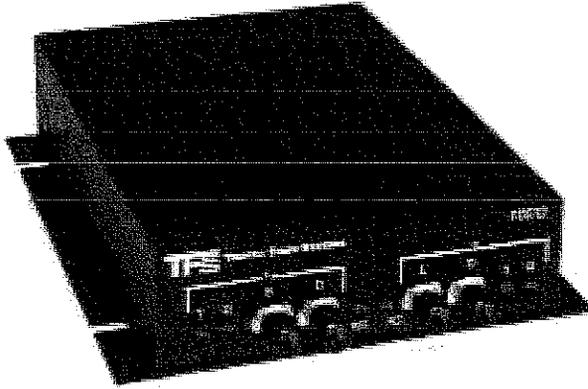
MODEL	OPERATION	WAVE LENGTH	PEAK MA	RANGE
FO400MM	MULTI DROP	850nm	165	3km
FO400SM	MULTI DROP	1310nm	165	16km



FO512

Fiber Optic Modem

FEATURES



- Master/Local Operation
- Electrical Isolation
- Eliminates Lightning Damage
- 6 LED indicators
- Anti streaming circuits
- Battery Backup
- Complies with NEMA/170/2070 Environmental Specs.
- Operates Full Duplex in a Multi-Drop/ Point to Point
- Single Mode or Multi Mode
- Rugged Aluminum case

DESCRIPTION

The FO512 is a dual mode, full duplex, multi-drop, communications link designed to interconnect electronic equipment using RS-232 ports via fiber optic cables.

Two sets of front mounted fiber-optic receptacles mate to ST type connectors (FC and SC connectors are available).

There are 6 LED's located on the front panel, two for each channel to indicate Transmit and Receive, one to indicate AC power and one to indicate anti-streaming (fault).

The primary port, DB25 wired as DCE, is located on the rear of the FO512 and provides electrical interface to any RS-232 port. An external cable is required to complete the interface to the host unit.

A secondary RJ45 port is also available on the rear panel. This port may be used to couple two FO512s together providing 4 channel communications to any host at a single location.

The FO512 is available with a rechargeable NiCad or alkaline battery. This optional battery provides temporary power when the electronic equipment is removed for servicing and during short electrical outages.

The FO512 is housed in an aluminum case, 5" W X 1.625"H X 8"L. The case is supplied with an aluminum panel mount plate

OPERATION

The FO512 is operated in one of two modes - Master or Local - as chosen by a rear mounted switch. The FO512 is a full duplex device, whether operated in the Master or Local Modes.

Full duplex allows system testing with a bit error rate tester.

In the Master mode, the FO512 receives signals from the optical detectors (D1 and D2), converts data to electronic impulses, and passes it to the (Master) host. During transmissions, the FO512 receives data from the (Master) host, converts that electronic data into optical signals, and transmits them via emitters, (E1 and E2).

The Local mode of the FO512 is unique to fiber optic communication devices. When the FO512 is functioning as a Local, data is passed through a multi-drop of FO512's. At each local FO512, the signal is received and regenerated prior to transmission to the next FO512. This design provides distant FO512's with brilliant, clean signals, as if they were physically close to the master.

When a continuous "On" condition of 1-second duration occurs, of either receive channel, the output of that channel is turned off. This is referred to as the anti streaming feature. The circuit will automatically reset if the "On" condition turns off for 10 milliseconds. Anti streaming is indicated by a single LED indicator.



SPECIFICATIONS

Electrical Requirements:

Voltage: 12VDC

Current: 24MA Continuous
90Ma max.

Battery Requirements: Optional - NiCad

Provides 10Hr. of backup

Voltage: 8.42VDC NiCad

Current: 12MA Continuous
60MA max.

Data Link Sensitivity

Max: 0 DBM

Min.: -40 BDM

Date Rate:

300-38.4K Baud

Power Budget:

Multimode:

@0.3K 22.9dB

@1.2K 24.3dB

@9.6K 25.2dB

@19.2K 25.3dB

@38.4K 25.3dB

Single Mode:

@0.3K 21.1dB

@1.2K 24.5dB

@9.6K 25.8dB

@19.2 26.3dB

@38.4 26.8dB

Connectors:

ST Type Standard

FC, or SC are available by special order

Operating Temperature Range:

-35 C to +75 C

Operating Range

MODEL	OPERATION	WAVE LENGTH	PEAK MA	RANGE
FO400MM	MULTI DROP	850nm	165	3km
FO400SM	MULTI DROP	1310nm	165	16km

TFS

TRAFFIC LIGHT SYSTEMS



Wall-Mountable Interconnect Centers (WIC)

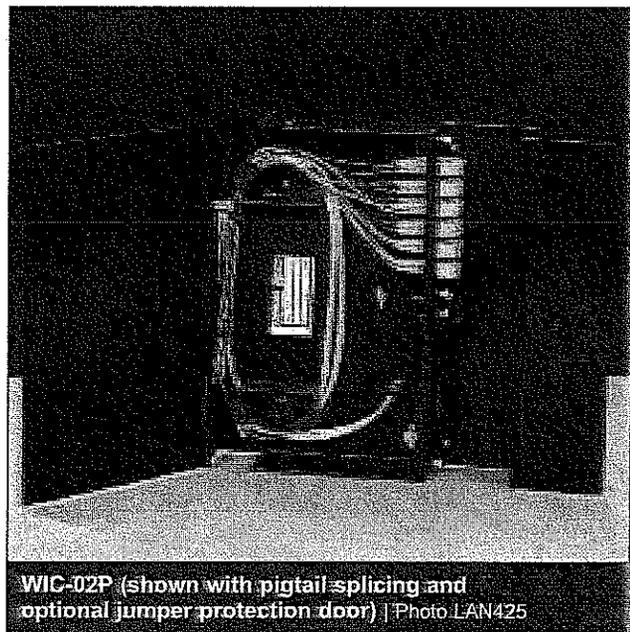
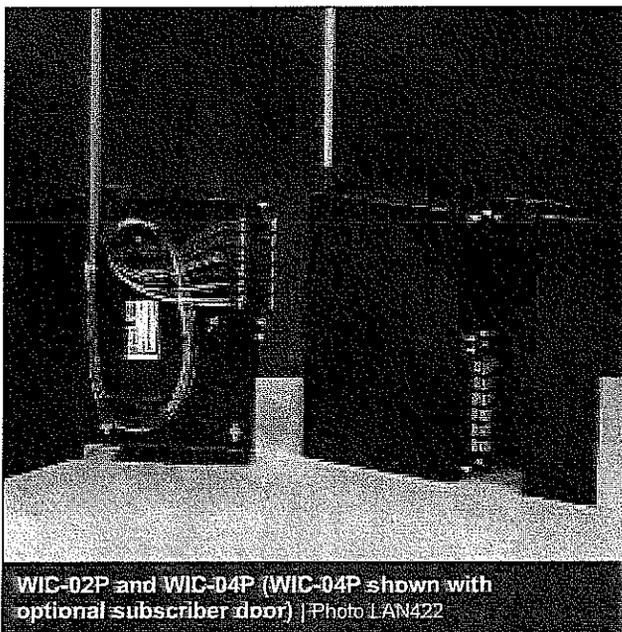
A LANscape®
Solutions Product

features and benefits |

Patented universal cable clamp	Cable strain-relief
Durable metal housing	Protection
Lockable doors	System security
Routing guides	Fiber management

Corning Cable Systems Wall-Mountable Interconnect Center (WIC) is an economical housing for terminating optical fiber cables. It provides protection for the connectors in the physical plant environment and is ideal for use in building entrance rooms, telecommunication rooms, or inside programmable logic controller cabinets typically found in manufacturing plants. The durable black metal housing can be mounted in stacked and/or reversed positions and there is an optional cover available for jumper protection with lockable doors. Strain-relief is accomplished with the patented universal cable clamp and routing guides are included for fiber management.

The WIC-02P accepts two standard CCH connector panels and the WIC-04P accepts four panels or modules. Both housings include splicing provisions for Corning Cable Systems Type 2R or 4R Splice Trays and accept the standard CCH connector panels, CCH pigtail panels or CCH Plug & Play™ Systems connector modules.



Wall-Mountable Interconnect Centers (WIC)

A LANscape®
Solutions Product

specifications |

	Dimensions (H x W x D) cm (in)	Shipping Weight kg (lb)
WIC-02P	33 x 21.6 x 6.6 (13 x 8.5 x 2.6)	2.3 (5)
WIC-04P	33 x 21.6 x 10.4 (13 x 8.5 x 4.1)	2.7 (6)
WIC2-DOOR	33 x 8.9 x 6.6 (13 x 3.5 x 2.6)	0.9 (2)
WIC4-DOOR	33 x 8.9 x 10.4 (13 x 3.5 x 4.1)	1.1 (2.5)

ordering information |

Part Number	Description
WIC-02P	Wall-Mountable Interconnect Center; accepts 2 LANscape® Solutions CCH connector panels or modules, and a maximum of (4) 0.2-in or (2) 0.4-in reduced-length splice trays; supplied with 1 CCH blank panel
WIC-04P	Wall-Mountable Interconnect Center; accepts 4 LANscape Solutions CCH connector panels or modules, and a maximum of (8) 0.2-in or (4) 0.4-in reduced-length splice trays; supplied with 3 CCH blank panels

Accessories

WIC2-DOOR	Jumper Protection Door for the WIC-02P; includes installation hardware
WIC4-DOOR	Jumper Protection Door for the WIC-04P; includes installation hardware
HDWR-LOCK-KIT	Field-Installable Lock; includes 1 lock and key
HDWR-LOCK-KIT-2	Field-Installable Lock; includes 1 lock and key; keyed different from HDWR-LOCK-KIT
CCH-BLNK	Blank Panel, compatible with LANscape Solutions Housings
WCH-STRNRLF-KIT	Cable Strain-Relief Kit for WIC-02P/-04P; includes 1 universal cable clamp (UCC) and mounting bracket

Wall-Mountable Splice Housings (WSH)

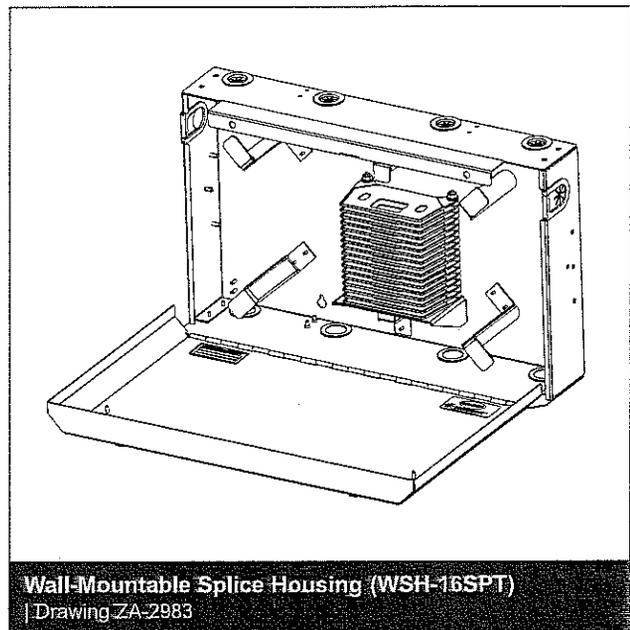
A LANscape®
Solutions Product

features and benefits |

Front door can be used as a work surface	Convenience for splicing
Use with LANscape® Solutions WCH-12P	System compatibility
Provides midspan access capability	System access
Patented universal cable clamp	Cable strain-relief

Corning Cable Systems Wall-Mountable Splice Housing (WSH) provides storage and protection of fiber splices in individually accessible trays. The wall-mountable housing is designed to store the optical fibers being spliced within the tray and can accommodate either (16) 0.2 in (Type 2S or 2R) or (11) 0.4 in (Type 4S or 4R) splice trays. The front door of the housing is a work surface that can support the weight of a fusion splicer and features a lip around the door to help retain loose items.

Multiple cable entry/exit locations are provided on the top and bottom and grommets prevent dust from entering the housing. Depending on the entry location of the cables into the housing, the strain-relief bracket can be moved to a variety of positions. The design also includes the patented Corning Cable Systems Universal Cable Clamp and provisions for mounting an optional grounding kit. The WSH can be used in conjunction with a wall-mountable connector housing (WCH) for termination. The cable entry/exit locations line up with cable entries on the WCH-12P.



Wall-Mountable Splice Housings (WSH)

A LANscape®
Solutions Product

specifications |

	Dimensions (H x W x D) cm (in)	Shipping Weight kg (lb)
WSH-16SPT	34 x 57 x 13 (13.5 x 22.5 x 5.2)	4.1 (9)
WSH-11SPT-F	34 x 57 x 13 (13.5 x 22.5 x 5.2)	4.1 (9)

ordering information |

Part Number	Description
WSH-16SPT	Wall-Mountable Splice Housing; accepts up to (16) 0.2 in (Type 2S, 2R or 2M) splice trays
WSH-11SPT-F	Wall-Mountable Splice Housing; accepts up to (11) 0.4 in (Type 4S, 4R or 4A) splice trays
Accessories	
GROUND-KIT-2	WSH Grounding Kit; includes a grounding bar and hardware
BKT-ALL-R23-75	Universal Rack-Mount Bracket for 48 cm (19 in) and 58 cm (23 in) equipment racks
HDWR-LOCK-KIT	Lock Kit for front door of housing; contains 1 lock with 2 keys

Note: Splice trays must be ordered separately.

Corning Cable Systems LLC • PO Box 489 • Hickory, NC 28603-0489 USA
800-743-2675 • FAX: 828-901-5973 • International: +1-828-901-5000 • www.corning.com/cablesystems

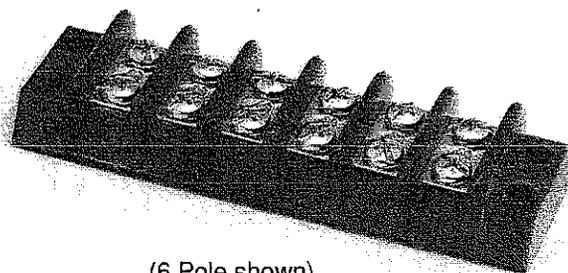
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Product Data Sheet



3XX Series Std

Replace "XX" with 01 through 24 for number of poles
Terminal Block— Closed Back
30 Amps, 600 Volts (AC/DC)



(6 Pole shown)

Copper Wire Only

Wire Range with Wire Binding Screw: #10 - #14 AWG (solid recommended)

Application torque: 20 in. lbs

9/16" Centers

Electrical Ratings:

- 30A with Listed ring lug or unprepared wire, (Based on NEC Table 310-16, 75°C columns)
- 600 Volts AC/DC (UL 1059 Class C, User Group - General Industrial)
- Short Circuit Current Rating: 10,000A (Default)
- Approved for Factory and Field Wiring.

Mechanical Ratings:

- Storage and transportation temperature range: -35°C to 110°C (-31°F to 230°F)*
- Maximum insulator base temperature: 150°C (302°F)* UL RTI
- Flammability rating of insulator base: UL 94V-0
- * Use outside these ratings needs to be judged in the end-use application.

Materials:

- Connector (Contact): Brass, tin plated.
- Insulator base: Phenolic
- Drive screw (Rivet): Stainless steel
- Screw, #8-32 Binder head, Phil-Slot: Steel, nickel plated

Agency Approvals:

- UL Recognized, UL 1059 Terminal Block Standard, File No. XCFR2.E62806
- CSA Certified, CSA C22.2 No. 158, File No. LR19766
- CE compliant, IEC 60947-7-1
- RoHS Compliant

Wire Range:

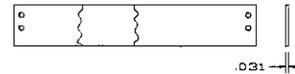
Wire Size	Torque	Copper Wire Stranding Classes - Number of Strands		
		Solid	Class B	Class C
10	20 in. lbs		7	19
12	20 in. lbs		7	19
14	20 in. lbs		7	19

Suggested product mounting hardware: #8 fastener, torque to 15-20 in. lbs.

ACCESSORIES:

- Printing (for printing options, see Terminal Block Printing on website)

- Marking strips - sub mounted, black only (FB) (For Printing Options, see section on website)



- Marking strips – top mounted, white only (SW)

- Cover – top mounted. Order CW (white) or CB (Black). Can be printed. See website.



- Phil-Slot Brass Screw (PSB)

Edco PC642 Series

Zone/Loop/Data

■ Surge Protection
For Business-Critical Continuity™

Edco PC642 Series Surge Suppressor

The Edco PC642 Series surge suppressor is a two-pair pair (four wire) module implementing three-stage hybrid technology. This module addresses over-voltage transients with gas tubes and silicon avalanche components. In addition, sneak and fault currents are mitigated with resettable fuses (PTCs). The PTCs increase resistance several orders of magnitude when over-currents exceed safe levels. A normal state resumes when over-currents are removed. The ability to self-restore in this manner significantly increases suppressor performance and survivability.

The Edco PC642 card edge module is gold-plated, double sided and is designed to mate with the the Edco PCB1B gold-plated female terminal connector (sold separately). When snapped together, the data circuits “pass thru” the protector in a serial fashion from the four “Field Side” terminals to the four “Electronics Side” terminals. Terminals 1 or 10 of the PCB1B must be attached to Building-Approved Ground per Edco Technical Bulletin # 2015.



EDCO PCB1B BASE SOLD SEPARATELY

Features



- Three-stage hybrid protection
- Sneak/fault current protection
- Resettable fuses – PTCs
- Low capacitance option
- Plug-in module
- Requires Edco PCB1B base
- Fast response time
- UL listed 497B
- PC642PTU (Pass Thru Unit) available for troubleshooting
- 5 year warranty

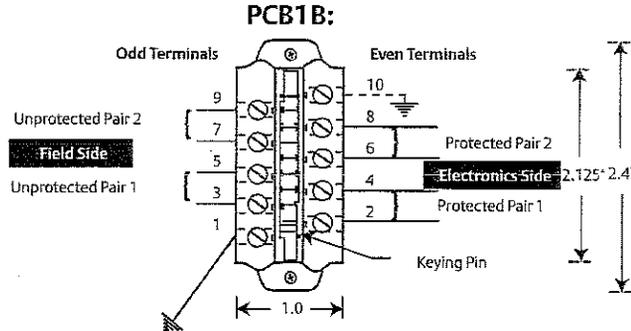
General Technical Specifications

Operating Voltage	5, 12, 18, 24, 30, 36, 43, 52, 180 VDC
Clamping Voltage	8, 15, 20, 30, 36, 43, 50, 60, 200 VDC
Operating Current	0.15 A
Peak Surge Current	10 kA (8 x 20 μ s)
Frequency Range	0 to 20 MHz
Insertion Loss	< 0.1 dB at 20 MHz
SPD Technology	GDI, SAD, w/ Series PTC
Connection Type	Terminal block w/ compression lugs Terminals accept up to 10 AWG
Operating Temperature	-40°C to +85°C
Dimensions (Inches)	2H x 1W x 2.5L (PC642 + PCB1B Base)
Weight	1 oz
Certifications	UL 497B, ISO 9001:2000

Caution: The hybrid design of this product includes series-resistance. Do not place this product in service on any signal line capable of supplying more than 150 milliamperes continuously.

Installation Instructions

Terminal Assignments



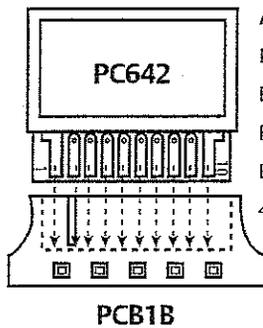
Ground Terminal 1 or 10 to Building Approved Ground.
 DO NOT daisy chain grounds. NOT intended for shield termination.
 Install ground in accordance with all applicable codes.

Read and Understand These Instructions:

These protectors are intended for indoor use on communication loop circuits which have been isolated from the Public Switch Telephone Network.

The communication loop circuits shall not be exposed to accidental contact with the electric light or power conductors. The protectors shall be installed per the applicable requirements of the National Electric Code, ANSI/NFPA 70.

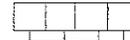
Ordering Information



APPLICATION:

RS485, RS422:	PC642C-008LC & PCB1B
RS423, Token Ring:	PC642C-008LC & PCB1B
RS232:	PC642C-020 & PCB1B
E-NET, 10 BASE T:	PC642C-030LC & PCB1B
4-20ma:	PC642C-036 & PCB1B

How to Specify the Appropriate Model

PC642C - 

VOLTAGE CLAMP

8 Volts	0	0	8
15 Volts	0	1	5
20 Volts	0	2	0
30 Volts	0	3	0
36 Volts	0	3	6
43 Volts	0	4	3
50 Volts	0	5	0
60 Volts	0	6	0
*200 Volts	2	0	0

*Not UL Listed

no suffix
 stage 2 clamp
 each line-to-ground

D
 stage 2 clamp
 line-to-line only

X
 stage 2 clamp line-to-line
 and each line to ground

LC
 low capacitance option stage
 2 clamp line-to-line and each
 line to ground

Emerson Network Power.
 The global leader in enabling
 Business-Critical Continuity™.

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- DC Power

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- Racks and Integrated Cabinets
- Services
- Surge Protection

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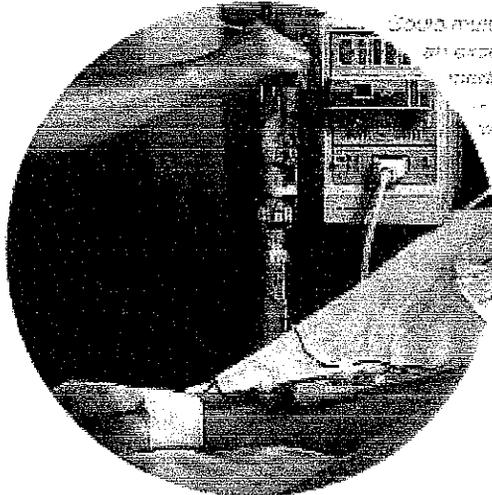
www.emersonnetworkpower.com



Multimode & Large Core Couplers

Multimode Fused Bidirectional Couplers

Capable of operating over a broad wavelength range (i.e. 850nm and 1300nm), Gould multimode fused couplers can be used within fiber optic instrumentation, sensor systems and local area networks. Additionally, Gould multimode and large core couplers are manufactured and tested under fully-filled launch conditions. An underfilled launch may affect coupling ratio.



Gould multimode couplers are an excellent choice for medical equipment applications. They are available in a variety of configurations and package styles.

Gould Multimode Coupler Specifications

	SERIES 2	SERIES 3
Insertion Loss	≤ 3.7dB	≤ 4.5dB
Insertion Loss (underfilled)	≤ 4.5dB	≤ 5.5dB
Port Configuration	1x2 or 2x2	
Package Style	Cables in package style 12 and 32 are not available in 2x2 configurations.	

Options:

Fiber Types: Graded Index 50/125, Corning 62.5/125, other fiber sizes and types are also available.

Product Number:

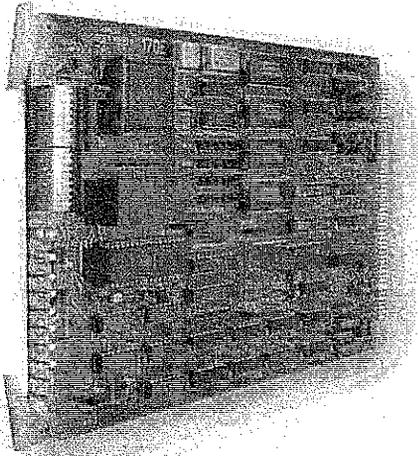
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Series	Fiber type	Port configuration	Package style	Connector style
2 or 3	1 - 50/125µm 12 - 50/125µm 25 - 62.5/125µm (step index fiber)	1 - 1x2 2 - 2x2	11 21 25 or 32	0 or none See page 20

Large Core Couplers

These devices deliver high coupled power levels and are insensitive to operating wavelengths. Large core couplers are excellent for sensor applications including: medical application laser delivery, harsh environments and industrial process control. A variety of fiber types are available from 200/230µm and larger. Call our sales engineers for details.

Model HC11 Central Processing Unit (CPU) Board



Features

- Replaces 6800 CPU Board in 170E controller
- Uses 68HC11F1 Micro-Processor Unit (MPU) clock frequency of 8MHz
- Provides 64K EPROM and 32K ZRAM
- Uses four Asynchronous Communication Interface Adapters (ACIA) currently supported by Caltrans
- 412C Feature and Location switches are provided
- LED to indicate correct operation
- All power supplies are transorb protected on the board
- Battery-backed clock timing chip (optional)

Description

The Model HC11 CPU Board is designed to replace the 6800 CPU board used in the current 170E controllers. The HC11 easily replaces the 6800 CPU by simply removing the 6800 CPU board and sliding the new Model HC11 CPU Board in the same slot.

Features

The HC11 is code-compatible with the 6800 CPU, uses the same communications chips (6850), and uses the same reset, NMI, and start-up circuitry. It is necessary for the software vendor to modify the start-up vector routines. The HC11 CPU Board provides 32K by 8-bit of contiguous ZRAM, 32K by 8-bit of EPROM, plus an additional 32K by 8-bit of bank-switched EPROM all on the HC11 board. A real-time clock option is available. There is a user-defined memory map for software developers to follow as well as

a 4K by 8-bit jumper option to allow transfer of data to a remote dual-port location. Feature and Location switches, normally found on the 412C PROM module, are located on the HC11 CPU Board. There is a software-controlled LED indicator located on the front of the HC11 to monitor operations in addition to a jumper that allows either a 32K or 128K by 8-bit EPROM in a Zero-Insertion Force (ZIF) socket. All power supplies are protected by transorbs on the HC11 CPU Board.

Applications

The HC11 CPU Board may be used for all applications originally contained on the 6800 CPU Board. The HC11 CPU Board provides a means for 170 customers to continue using the 170E controllers without the added expense of purchasing high-cost replacement units. In addition, soft-

ware developers can append many new features with the additional 32K bank-switched EPROM and the 32K of contiguous ZRAM memory.

Feature & Location Switches

Feature and Location switches are provided on the front portion of the HC11 CPU Board. These switches are in the same position as found on the 412C PROM module. Each switch is an eight-position front reading dip switch. The Feature switch is addressed at \$700A and the Location switch is addressed at \$7000. Each switch is directly connected to Port E and Port A of the HC11 MPU.

MPU

The MPU is a Motorola 68HC11 F1 or equivalent. The MPU operates at a crystal frequency of 8MHz with a 2.0MHz bus speed.





EPROM

The HC11 CPU Board has a ZIF socket that is jumper-selectable to house either a 32K or a 128K by 8-bit EPROM. When the 128K part is installed, the program has access to an extra 32K by 8-bit via bank switching. The bank is activated by a write-to location \$7002 which causes memory to go to the upper 64K of the 128K EPROM. The status of the bank switch is read on the Interrupt Request (IRQ) status register (bit six). The EPROM is mounted in a ZIF socket.

Communications

Four ACIA chips are installed on the HC11 CPU Board. These are the 6850 devices required by the Caltrans specification. These ACIAs operate at a clock frequency of 6.144 MHz. An IRQ status register is provided as specified by Caltrans.

ZRAM

The HC11 CPU Board has a 32K ZRAM with continuous locations from \$0000-6FFF and 7600-7FFF which provides the software developer with 32K by 8-bit of zero power RAM. When an optional clock chip is desired, a Dallas 1644 may be installed in the ZRAM position. Clock addresses are in the I/O map locations at \$7FF8-7FFF. In addition, a jumper selection allows the switching of location \$6000-6FFF (4K) to remote dual-port RAM. The status of the jumper position is read on the IRQ status register (bit five).

LED Indicator

There is one LED indicator located on the front portion of the HC11 CPU Board. This LED is controlled via a software output from Port G (bit 3) of the HC11 MPU.

HC11-Based 170 Memory Map

LOCATION	BLOCK SIZE	FUNCTION
0000-5FFF	24K	170 RAM
6000-6FFF	4K	RAM
7000-73FF	1K	CONFIG REG +
7400-75FF	512 BYTE	RAM I/O
7600-7FFF	2K	RAM
8000-FFFF	32K	EPROM

NOTES
CPU BOARD RAM
INT/EXT SELECTABLE DUAL PORT RAM
INITIATE IMMEDIATELY ON START UP
EXTERNAL I/O FUNCTIONS
CPU BOARD RAM
CPU BOARD PROM MEMORY

DETAILED BLOCK ALLOCATION		
LOCATION	BLOCK SIZE	FUNCTION
700A	1 BYTE	SWITCH
7000	1 BYTE	SWITCH
7002	1 BYTE	BANK SELECT
7002	1 BYTE	STATUS INDICATOR
7000-705F	96 BYTES	CONFIG REG.
7060-73FF	1K (-96)	RAM
7400	1 BYTE	DTA MINUTES
740F	1 BYTE	DTA SECONDS
7401-740A	10 BYTES	I/O
7410-7417	8 BYTES	ACIA
7500-7507	8 BYTES	DPR
75FF	1 BYTE	IRQ/STAT
7600-7FF7	2K	RAM
7FF8-7FFF	8 BYTES	RESERVED

NOTES
FEATURE SWITCH/HC11 PORT E
LOCATION SWITCH/HC11 PORT A
PROM BANK SWITCH SELECT HC11 PORT G - BIT 1
HC11 PORT G - BIT 3 1=ON
68HC11 CONFIG REGISTERS
68HC11 RAM
I/O DTA READ MINUTES
I/O DTA READ SECONDS
I/O READ AND WRITE
SERIAL PORTS 1-4
DUAL PORT SEMAPHORES
60 HZ. RESET AND IRQ STATUS
CPU BOARD RAM
RESERVED CLOCK/CALENDAR OPERATION