

INVITATION FOR SEALED BID

Bid 01-526

Description: NEMA CONTROL CABINETS

Department: PUBLIC WORKS

NIGP Commodity Code(s): 550-89-00-000-0

Total pages including this page is 31

NOTE: FAXED BID WILL NOT BE ACCEPTED

Important Instruction – Read Carefully:

If you have obtained these bid specifications from either of:
City of Tulsa's Fax-on-Demand (918-596-1171) or
City of Tulsa's Web-site : www.cityoftulsapurchasing.org

you must notify the buyer Darlene Donica of your intent to bid by e-mail ddonica@ci.tulsa.ok.us in order to receive addenda. The buyer will always acknowledge your e-mail for your records. All addenda will be posted on fax-on-demand and the web-site.

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Pay special attention to those pages with a reference to the following notes:

Note #1: Signature of authorized agent required

Note #2: Signature of an authorized agent and notarized required

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Your bid response should follow the same format listed above plus any additional format requested in the body of the bid invitation.

**INVITATION FOR SEALED BIDS
TO
City of Tulsa**

200 CIVIC CENTER, ROOM 109, TULSA, OKLAHOMA 74103

Bid number and date of bid opening must appear on the lower
left outside corner of bid envelopes and all related containers.

DATE OF OPENING: MARCH 21, 2002

BID NUMBER: 01-526

BID MUST BE IN THE CITY CLERK'S OFFICE AT THE ABOVE ADDRESS BY 5:00 P.M. THE DAY PRECEDING THE "DATE OF OPENING" SHOWN ABOVE.

BIDS WILL BE OPENED AT 8:30 A.M. IN THE CITY COUNCIL ROOM ON THE DAY SPECIFIED UNDER "DATE OF OPENING."

PUBLISHED IN THE TULSA DAILY COMMERCE AND LEGAL NEWS: March 8, 2002

Bid must be accompanied by bidder's bond, cashier's check or certified check in the amount of: NONE

PLEASE READ TERMS AND CONDITIONS ON THE NEXT PAGE BEFORE COMPLETING BID DOCUMENTS

THE FOLLOWING SECTION MUST BE COMPLETED BY BIDDER

Delivery will be made in not more than _____ days after receipt of order.

Payment terms _____ % _____ days.

City of Tulsa may increase quantity of order at the unit price bid for _____ days. (Bidder to Specify Days) I have examined the terms and specifications and the instructions to bidders herein and agree, provided I am awarded a contract, to provide the above described items for the sum shown in accordance with the terms and specifications stated herein. All deviations are in writing and attached hereto.

Enclosed is a BID BOND ; CASHIER'S CHECK; Certified Check in the amount of \$ _____, which I agree the City of Tulsa may retain as liquidated damages in the event of my failure to comply with the terms of this bid.

MUST BE SIGNED BY AUTHORIZED AGENT TO BE VALID

FIRM NAME _____ by _____
(Signature)

STREET _____ TITLE _____

CITY STATE _____ ZIP CODE _____ PHONE NUMBER _____ DATE _____

GENERAL TERMS AND CONDITIONS OF BIDS

THESE ITEMS APPLY TO AND BECOME A PART OF THE BID.

NO EXCEPTIONS TO THESE TERMS & CONDITIONS WILL BE CONSIDERED.

1. **BIDS MUST BE SUBMITTED ON THIS FORM ONLY INCLUDING A SIGNATURE OF AN AUTHORIZED AGENT.** Each bid shall be placed in a separate envelope. Be sure envelope is completely and properly identified and sealed, showing the bid number and date in the lower left hand corner. Bids must be time stamped in the office of the City Clerk by 5:00 P.M. on the day before date of opening.
2. No bidder may withdraw his proposal for a period of thirty (30) days after the date and hour set for the opening of bids.
3. All prices shall be quoted F.O.B. Tulsa, Oklahoma, and delivery to City of Tulsa location shall be without additional charge.
4. The bidder shall attach the manufacturer's name of the equipment or material to be furnished, type, model numbers, manufacturer's descriptive bulletins and specifications. All guarantees and warranties should be clearly stated. This data shall be in sufficient detail to describe accurately the equipment or material to be furnished. Manufacturer's specifications, in respect to the successful bidder, shall be considered as part of his contract with the City of Tulsa.
5. The bidder shall show in the proposal both the unit prices and total amount, where required, of each item listed. In the event of error or discrepancy in the mathematics, the unit prices shall prevail.
6. Any exceptions or deviations from written specifications shall be shown in writing and attached to the bid form.
7. Each bidder agrees to comply with the terms of Title 5, Chapter 1, of Tulsa, Oklahoma Charter and revised ordinances relating to equal employment opportunity.
8. **THE ENCLOSED FORMS REGARDING NON-COLLUSION AND FINANCIAL INTEREST MUST BE SIGNED, NOTARIZED, AND RETURNED WITH THE BID.**
9. The City of Tulsa reserves the right to reject any and all bids, to waive any technicalities in the bidding, and to award each item to different bidders or all items to a single bidder.
10. All bids must be accompanied by bidders bond, cash, certified or cashier's check in the amount shown on the face of the bid form. This amount shall be retained by the City of Tulsa as liquidated damages in the event the successful bidder (or bidders) fails to execute a contract, if required. The bidder agrees that said amount is presumed to be the damages sustained by the City due to the impracticability and extreme difficulty in fixing the actual damages. The office of the City Clerk will return the bid deposits to the unsuccessful bidders, after a contract has been awarded or all bids have been rejected.
11. In the event cash discounts are offered by the bidder, the discount date shall begin with the date of invoice, the date of receipt of all material covered by the purchase order, or the date of receipt by the City of Tulsa of the original copy of the purchase order with properly executed Affidavit of Claimant, whichever is the later date.
12. Direct purchase of certain items of equipment or material by the City of Tulsa are exempt from Federal Excise Tax and Oklahoma Sales Tax. In such cases the bidder shall quote prices which do not include Federal Excise Tax and Oklahoma Sales Tax. The City of Tulsa will furnish executed exemption certificates upon presentation by the bidder at the time of purchase.
13. Bid must show number of days required for delivery under normal conditions. Failure to state delivery time obligates bidder to complete delivery in fourteen (14) calendar days. Unrealistically short or long delivery promises may cause bid to be disregarded. Contractor must keep Purchasing Department advised at all times of status of order. Default in promised delivery or failure to meet specifications authorizes the Purchasing Agent to purchase supplies elsewhere and charge full increase of cost and handling to defaulting contractor. Consistent failure to meet delivery promises without valid reason may cause removal from bid list.
14. Bidder agrees to defend and save City of Tulsa from and against all demands, claims, suits, costs, expenses, damages and judgments based upon infringement of any patent relating to goods specified in this order or the ordinary use or operation of such goods by City or use or operation of such goods in accordance with bidders direction.
15. If the bid requires a written contract, the successful bidder shall execute a written contract with the City of Tulsa and return the required bonds and insurance certificates within ten (10) days after submission of contracts to said bidder by the City.

BIDDER AFFIDAVIT - TITLE 74 O.S. (1974 SUPP.) 85.22-85.25

STATE OF _____ COUNTY OF _____

_____, of lawful age, being first duly sworn on oath says
Authorized Agent

1. (s)he is the duly authorized agent of _____, the bidder submitting the competitive bid which is attached to this statement, for the purpose of certifying the facts pertaining to the existence of collusion among bidders and between bidders and municipal officials or employees, as well as facts pertaining to the giving or offering of things of value to government personnel in return for special consideration in the letting of any contract pursuant to the bid to which this statement is attached.
2. (s)he is fully aware of the facts and circumstances surrounding the making of the bid to which this statement is attached and has been personally and directly involved in the proceedings leading to the submission of such bid; and
3. neither the bidder nor anyone subject to the bidder's direction or control has been a party;
 - a. to any collusion among bidders in restraint of freedom of competition by agreement to bid at a fixed price or to refrain from bidding,
 - b. to any collusion with any municipal official or employee as to quantity, quality or price in the prospective contract, or as to any other terms of such prospective contract, nor
 - c. in any discussions between bidders and any municipal official concerning exchange of money or other thing of value for special consideration in the letting of a contract.

SIGNATURE OF AUTHORIZED AGENT

Subscribed and sworn to before me this _____ day of _____, 20_____.

Signature of Notary Public

MY COMMISSION EXPIRES

The Bidder Affidavit must be completed, signed by an authorized agent, and notarized.

CONTRACTOR/BIDDER INFORMATION SHEET

**To be completed by all Bidders
For Contracts with the City of Tulsa
(Please print or type)**

Project No. or Description _____

Full Name of Bidder _____

Legal Identity
(Corporation, Partnership,
Individual, etc.) _____

Address _____

Telephone No. _____

FAX No. _____

Taxpayer Identification Number _____

Contact Person _____

Phone No. _____

Fax No. _____

E-mail address _____

Webpage Address _____

Price Sheet Summary

Vendor Name: _____ Signature: _____
Date: _____

You will be able to obtain a copy of the Bid Summary on the City of Tulsa's Purchase-Net Fax-on-Demand and Website shortly after bid opening.

BID 01-526

<u>Qty.</u>	<u>Description</u>	<u>Unit Cost</u>	<u>Total Cost</u>
6	Eight Phase Nema Control Cabinets	\$ _____	\$ _____

Cabinets shall come with 16 load switches, 1 NEMA Plus Plus 12 Ch. Monitor, 6 Flash Transfer relays, wired with Traconex D/E cables, a 14 position card rack, a PED isolator Model 244, 1 NEMA flasher, g&G suppressor HS-PSP-120-60A-RJ.

Cabinets shall be anodized or clear powder coated outside.

Cabinets shall be powder coated white inside.

Cabinets shall come less controller

For questions please contact: Jim Wilson @918-596-9764

BID 01-526
NEMA CONTROL CABINETS
PUBLIC WORKS DEPARTMENT

INTENT:

It is the intent of this bid to secure, on a competitive basis, a source(s) of supply for furnishing **Nema Control Cabinets** for the City of Tulsa, Public Works Department.

ALTERING BIDS:

Bids cannot be altered or amended after submission deadline. Any interlineation, alteration, or erasure made before opening time and date must be initialed by the signer of the bid, guaranteeing authenticity. Bids must be submitted in ink or typewritten. Penciling will not be accepted.

PRICING:

Bid prices, unless otherwise specified, must be net, including transportation and handling charges fully prepaid by vendor to destination and subject only to cash discount for prompt payment of invoice.

DELIVERY:

Delivery time must be stated in days in the appropriate spaces of the cover sheet. Indefinite terms such as “promptly”, “without delay”, etc., will not be given consideration. Failure to indicate delivery time shall be cause for rejection of the bid.

BIDDER AFFIDAVITS:

Each bidder shall accompany his bid with a fully executed and notarized copy of the attached **Non-Collusion Affidavit** and the **Interest Affidavit**. Failure to do so shall be cause for rejection of the bid.

ADDENDA AND INTERPRETATIONS:

If it becomes necessary to revise any part of this bid, a written addendum will be provided to all the bidders. The City of Tulsa is not bound by any oral representations, clarifications, or changes made in the written specifications by City of Tulsa employees unless such clarification or change is provided to bidders in written addendum form from the Purchasing Division.

AWARD OF BID:

The bid shall be awarded to the firm whose proposal is responsive to the bid and is most advantageous to the City, considering the factors identified in the bid and Section 406E of Title 6, The Purchasing Ordinance set forth below:

406E. AWARD OF CONTRACT

1. Authority in the Mayor. The Mayor shall have the authority to award Contracts within the purview of this chapter.
2. Lowest Secure Bidder. Contracts shall be awarded to the lowest secure Bidder meeting specifications. Bid Specifications may include a point System for evaluating the lowest secure bid. In determining "lowest Secure bidder", in addition to price, the following factors shall be considered:
 - a. The ability, capacity and skill of the bidder to perform the contract or provide the service required;
 - b. whether the bidder can perform the contract or provide the service promptly or within the time specified, without delay or interference;
 - c. the character, integrity, reputation, judgment, experience and efficiency of the bidder;
 - d. the quality of performance of previous contracts or services;
 - e. the previous and existing compliance by the bidder with laws and ordinances relating to the contract or service;
 - f. the sufficiency of the financial resources and ability of the bidder to perform the contract or provide the service;
 - g. the quality, availability and adaptability of the supplies or contractual services to the particular use required;
 - h. the ability of the bidder to provide future maintenance and service for the use of the subject of the contract;
 - i. where an earlier delivery date would be of great benefit to the requisitioning agency, the date and terms of delivery may be considered in the bid award, and
 - j. the number and scope of conditions attached to the bid.
 - k. If a point system has been utilized in the bid specifications, the number of points earned by the bidder.

December, 2001

SPECIFICATION FOR TSI TRAFFIC SIGNAL CONTROLLER WITH INTERNAL TIME
BASE COORDINATION AN)/OR MASTER CABINET.

1.0 GENERAL

- 1.1 The intent of this specification is to describe the minimum acceptable design and operation requirements for a modular, solid state, full-actuated traffic signal controller assembly.
- 1.2 The cabinet assembly (master or secondary) shall include the controller weatherproof cabinet, load switches, flashers, conflict monitor and alternating current line filters, as well as any accessories described herein.
- 1.3 The cabinet assembly shall meet the requirements of this specification and the NEMA Standard Publication No. TSI-1983 and any subsequent NEMA approved revision as referenced herein.
- 1.4 Controller timing shall be accomplished by digital methods and shall utilize power line frequency as a base.
- 1.5 Any exceptions to or deviations from this specification shall be clearly described in the bidders proposal.
- 1.6 Each bidder shall submit the names of two governmental agencies (preferably municipalities) which have taken delivery of equipment equivalent to that which is to be supplied under this bid.
- 1.7 The City of Tulsa may require a sample of any proposed equipment for inspection, testing and evaluation prior to the award of the bid. Such sample shall be delivered to the address specified by the Traffic Engineer within the fifteen calendar days following notification by the Traffic Engineer that a sample is required. The sample shall include the controller units, wiring diagrams, installation instructions and any accessories which may be required by the Traffic Engineer. The specifications and testing period shall not exceed thirty working days following the receipt to the sample. If required, the sample shall be provided at no cost to the City of Tulsa.
- 1.8 The supplier shall provide three (3) complete sets of instructions, five (5) manuals containing operation maintenance instructions and five (5) complete sets of controller wiring diagrams and schematics for each type of controller supplied. One set of Mylar cabinet wiring diagrams and schematics copied from the master drawings shall be supplied. The wiring diagrams and schematics shall be standard 'D' sized drawings.

- 1.9 The supplier shall provide a training seminar for the [raffle Engineering personnel within thirty (30) calendar days after the delivery of the 2 first units. The seminar shall cover the installation, maintenance and repair of the controller, as well as the theory of controller operation. The seminar shall consist of a minimum of twenty-four (24) classroom hours of instruction. This applies to equipment presently not being utilized by the City of Tulsa.
- 1.10 The manufacturer and supplier shall warrant the equipment against defects in design, workmanship and material for a period of two (2) years after delivery of the entire order. Repair and/or replacement of any defective units or components during this period shall be at no cost to the City of Tulsa. The supplier shall bear all costs, including shipping costs.
- 1.11 All software changes and updates applicable to equipment furnished under this specification shall be furnished for and/or installed on equipment at no cost to the City of Tulsa for a period of twenty-four (24) calendar months from the date the equipment is accepted.
- 1.12 Upon delivery, the equipment will be inspected by an authorized agent of the City of Tulsa, prior to payment. Any equipment which fails to comply with the requirements of this specification will be returned to the supplier at the supplier's expense.
- 1.13 The successful bidder shall provide, prior to delivery, certification from an independent testing laboratory that the controller assemblies are in compliance with NEMA Standards Publication TSI-1983 or the latest NEMA approved revision thereof

2.0 ENVIRONMENTAL STANDARDS

- 2.1 The cabinet assembly shall perform within the limits of environmental and operating conditions established in Section 2, Part I of NEMA Standards Publication No. TSI-1983 and any subsequent NEMA approved revisions of the publication.

3.0 INTERFACE STANDARD

- 3.1 The controller shall comply with the requirements of Section 13 of NEMA Standards Publication No. TSI-1983 and any subsequent NEMA approved revision of the publication. The controller shall also comply with the additional requirements described in this specification.
- 3.2 The controller shall have the number of input functions and terminals specified in Table 13-1 of NEMA Standards Publication No. IS 1-1983. Each input function shall be accessible through an external terminal block.

- 3.3 The controller shall have the output functions and terminals specified in Table 13-2 of the NEMA Standards Publication No. TSI-1983. Each output function shall be accessible through an external terminal block.

4.0 PHYSICAL STANDARDS

- 4.1 The nomenclature used in this specification is in accordance with the definition in Section 14, Part 1 of NEMA Standards Publication No. TSI-1983.

4.2 The controller, master controller and conflict monitor shall comply with requirements of Section 14, Part 2 of NEMA Standards Publication No. TSI-1983 and any subsequent NEMA approved revision to this publication, in addition to the following requirements:

- 4.2.01 The controller shall be modular design. The design of the controller shall permit removal or replacement of a module without unplugging or removing obstructions for accessibility. Special tools shall not be required to remove or replace modules.
- 4.2.02 Modules shall not use layered construction of printed circuit boards which would prevent reasonable access to the components within the module.
- 4.2.03 The modules providing control or operational function in one controller shall be interchangeable with the same module in all other controllers of the same manufacturer which provided the same traffic signal control or operation.
- 4.2.04 All circuit components shall be amply de-rated with regards to heat dissipating capacity and rated voltage so that, with maximum ambient temperature and maximum applied voltage, the controller assembly shall maintain its programmed function.
- 4.2.05 All plug-in printed circuit assemblies shall be constructed so that they may be readily removed without unsoldering connections. All plug-in printed circuit assemblies used for the same function shall be interchangeable between controller units. The circuit components shall be standard production types which are readily available from any industrial electrical supply house. All components on the printed circuit boards shall have their circuit reference symbols clearly marked on the board or be identifiable by referencing to pictorial assembly drawings. All printed circuit boards shall be made from NEMA FR-4 glass-epoxy or equal.
- 4.2.06 The NEMA connectors on the controller shall have a metallic shell. The controller unit shall be enclosed in a high impact plastic case or a sheet metal enclosure with a suitable protective finish. The model and serial number shall be stamped or etched on the outside of the enclosure.
- 4.2.07 Programming the controller shall consist of establishing all timing intervals and selecting the special modes of operation by using a keyboard which is directly

accessible from the front of the controller. An EEPROM device shall be used to retain memory of these controller functions. In addition to the front panel keyboard, a programming device, separate from the controller, may be used for uploading and downloading all controller timing information.

- 4.2.08 The controller's timing, decision-making and control elements shall utilize a stored program microcomputer. The microcomputer shall include, as a minimum, a microprocessor unit (MPU) and a programmable read-only memory (PROM) and a read-access memory (RAM), which together store the programs and data required to operate the MPU.
- 4.2.09 The maximum allowable frame size of controllers shall be as follows:
 - A. 2 phase or 8 phase 14" H x 14.5" W x 14" D
- 4.2.10 All circuit boards, including back panel, shall be moisture and fungus proof.
- 4.2.11 The controller display shall have a minimum of 4 lines with each line capable of a 40-character display.

5.0 SIGNAL CONTROLLER STANDARDS

- 5.1 The controller shall comply with the requirements of Section 14, Part 3, of NEMA Standards Publication No. TS1-1983 and any NEMA approved revision to this publication, as well as the additional and/or revised requirements of this specification. Code shall not be used in timing and/or data entry.
 - 5.1.1 If phase timing is terminated on a reducing gap, the Green interval shall terminate if Last Car Passage is not selected and a memory call shall be placed on that phase. If Last Car Passage is selected, the remaining portion of the set passage time in effect will time out before Green interval is terminated. If another vehicle actuation occurs on that phase while the Last Car Passage is timing, a memory call shall be placed on that phase.
- 5.2 Controllers with four (4) or more phases shall contain an alternate timing plan stored in memory for the purpose of initializing controller timing and phase operations. The timing plan shall be as specified in Table I.
- 5.3 The controller shall be provided with indication as specified in TSI-1983, Section 14, Part 3.6 and also the following functions:
 - A. Vehicle Call Memory
 - B. Reason for phase termination (gap out, manout, force off, etc.)
 - C. Max II Timing
- 5.4 When required, overlaps shall be provided in accordance with TSI-1983, Section 14, Part 3.7, with the following additions and/or revisions:

- 5.4.1 All overlaps shall be implemented by internal logic. The use of external logic will not be acceptable.
- 5.4.2 Timed overlaps allows an overlap to proceed to Vehicle Clearance after the parent vehicle phase has cleared. While the overlap is clearing, the controller will advance to the end of clearances in the active phase(s) in the active ring(s) and indicated Red Dwell. The overlap Green, Yellow, Red are operator adjustable.
- 5.4.3 The generation of control for standard overlap signal indications for controllers of less than four (4) phases shall be internal and not programmable. Overlap outputs shall be provided for three (3), (red, yellow, green) overlap load switch drivers for each of three (3) overlaps signals.
- 5.4.4 The generation of control for standard overlap signal indications for controllers of four (4) or more phases shall be programmable and shall provide G-Y-R load switch drivers for each of four (4) overlaps signals.
- 5.4.5 If programming boards are used for overlap signal control, the boards shall be readily accessible from the front of controller unit without removing the unit from the cabinet. Programming boards shall contain no components other than wire jumpers, which shall be soldered in place.
- 5.4.6 The standard overlaps shall be capable of being programmed as “negative overlaps” when the negative overlap function is enabled the control of all four overlaps are as follows:
- Overlap output is “Red” for the phases programmed to make up standard overlap.
 - Overlap displays a “Green” during all non-programmed phases
 - Overlap displays a “Yellow” when going from non-programmed phases to programmed phases
- 5.4.7 The controller shall have special function outputs. This option converts the 8 NEMA pedestrian clearance output of the controller into 8 special function outputs. The special function outputs shall be user defined and may be controlled by the time-of-day program. When the function is enabled the first three special function outputs parallel the three special function connector.
- 5.5 The controller shall be capable of time based coordination.
- 5.5.1 The Time base coordination unit shall be internal to the controller and shall meet the requirements of this specification and all applicable requirements of NEMA Standards Publication No. TSI-1983 and any approved revisions to the publication.

- 5.5.2 The Time base coordination unit shall be equipped with an internal clock which shall utilize the 60 Hz power frequency as a time base. The clock shall be easily set to any week, day, and minute. The “day” time shall reset to zero at 0000 hours each day. It shall be possible to enable or disable the Daylight Savings Time program.
- 5.5.3 The coordination unit shall provide a minimum of six (6) cycle lengths, variable in one-second increments from 30 through 240 seconds, with 5 offsets per cycle and 3 splits per cycle.
- 5.5.4 At a minimum, the Time base coordination unit shall use HOLDS, FORCE OFFS, PHASE OMITTS, PED OMITTS , AND MAX II to control each ring, phase, and timing function of the controller.
- 5.5.5 The end of offset timing shall mark the beginning of the Main Street phase green.
- 5.5.6 The timing of each controlling function, i.e. CYCLE LENGTH, OFFSETS, HOLD, FORCE OFF, etc. shall be programmed, or set, through a keyboard or similar device on the front panel of the controller. These functions programmed to occur separately or in combination during a selected cycle shall constitute a timing plan.
- 5.5.7 It shall be possible to program any timing plan “on” or “off” during any minute of the day to allow coordination or free operation of the controller. During free mode, the controller shall operate in a normal manner without regards to HOLD, FORCE OFFS, etc. from the coordinating unit.
- 5.5.8 A Day Plan shall consist of all timing plans occurring over a 24-hour period. Each Day Plan shall consist of at least five (5) timing plans (excluding free operation). It shall be possible to program ten (10) different Day plans.
- 5.5.9 A Week Plan shall consist of any combination of the ten (10) Day Plans. It shall be possible to program ten (10) different Week Plans, each of which may be implemented in any week of the year.
- 5.5.10 It shall be possible to program at least five (5) different special event Day Plans. It shall be possible to implement any special event Day Plan in any week of the year.
- 5.5.11 It shall be possible to override the program selected by time-of-day by manually selecting any other program or free operation through Keyboard entry.
- 5.5.12 In normal operating mode, the unit shall display the current day, hour and minute and status of active cycle and the controlling commands. The unit

shall also display when the unit is coordinated and “in step”. An indicator shall be provided to show system “synch” approximately three (3) seconds per cycle.

5.5.13 Through keyboard control, it shall be possible to display the following information:

- A. Week of Year
- B. Day or Week Plan currently implemented
- C. Day and time of each programmed output change
- D. Seconds countdown of cycle length in effect
- E. Stored programming of special event Day Plan
- F. Stored programming of offsets, permissive periods and forced offs
- G. Stored cycle lengths.

5.5.14 Data entered on the coordination plans shall be edit checked for obvious errors before it is loaded into permanent program memory. As it is loaded, the data package shall be checked for errors. If no errors are found the data may be loaded into memory. In the event that an error is detected, an error message should be displayed on the front panel. The following checks shall be made and an appropriate error message generated if the test fails:

- a. Minimum phase time is greater than the split time for the phase. The minimum is the greater of the Walk plus Ped Clear, Minimum Green, Max added initial, or the Conditional Minimum Green.
- b. Minimum green time plus yellow clearance plus red clearance greater than 255 seconds for the phase to be changed.
- c. Walk time plus walk clearance plus yellow clearance plus red clearance greater than 255 seconds.
- d. No Main Street green phase
- e. Main Street green phase not on the same side of the barrier.
- f. More than one Main Street green phase in a ring (either phase 3 & 4 or 7 & 8).
- g. More than one Main Street phase in a ring (either phase 1 & 2, or 5 & 6).
- h. Offset greater than cycle length for dial to be changed.
- i. Shrinkage and expansion times equal 0 for dial to be changed.
- j. Shrinkage and expansion time greater than cycle length of dial to be changed.
- k. Sum of splits for ring one does not equal sum of splits for ring two (on the same side of the barrier) for dial to be changed.
- l. No check flag set.
- m. Main Street green phase omitted (MSG phase splits at 0)
- n. Manual cycle timer resync attempt while in interconnect mode.
- o. Expansion time plus cycle length greater than 255 seconds for dial to be changed.
- p. Yield period greater than Main Street green phase split time.

- q. A permissive start time is greater than the cycle length for dial to be changed.
- r. Cannot change Main Street green phase definition while in CRD run mode.
- s. Dial entry cannot equal 0.
- t. Offset entry cannot equal 0.
- u. Solid entry cannot equal 0.

5.5.15 The controller shall provide a method of setting offsets by field observation at the intersection. This shall operate as follows:

- a. Select the dial for which the offset is to be set.
- b. Select the offset to be set
- c. Enable the feature
- d. When the desired offset point arrives, enter the event, and the selected offset value of the background cycle shall be placed in the memory for that dial.

5.5.15.1.1 This feature shall be available to obtain offset values when none are available, or for checking calculated values. By observing arriving platoons and using this feature, an offset value shall be obtained that reflects the actual travel from adjacent intersections.

6.0 MASTER CONTROLLER STANDARDS

6.1 The Master Controller shall have the following parameters:

A. OUTPUTS

- Six Cycle Lengths
- Five Offsets
- Three Splits
- Free or Coordinated
- System Flash
- Special Function Selection
- On Line Command
- Synch Output
- 48 IPL (Intersection Plans)

B. INPUTS

- Six Dual Selections
- Five Offset Selections
- Three Split Selections
- Free Selection
- System Flash Selection

- Remote Synch
- 16 Sampling Detectors
- On Line Command
- Special Function

6.2 The Master Controller shall be capable of handling a minimum of 16 sampling detectors and 31 interconnections.

6.3 The Master Controller shall operate the traffic signal system in one of four levels of control. These levels are:

Level Four = Traffic Responsive

Level Three= Time-of-day

Level Two= Operator Manual Selection

Level One= External Wired Inputs

7.0 SOLID STATE LOAD SWITCHES

7.1 All load switches shall meet the requirements for Section 5 of NEMA Standards Publication No. TSI-1983 and any NEMA approved revisions to this publication. Load switch shall be compatible with the 170-output load bay.

7.2 Indicator lights for all load switches shall be on the input side of the load switch. An indicator light for each circuit shall be provided in each load switch.

7.3 All load switches shall be twenty-five (25) ampere "Triple-Signal Load Switch" type 200.

7.4 Cabinets with five (5) or more phases shall be furnished with sixteen (16) load switches and a sixteen (16) position load bay. There shall be eight (8) load switches for vehicle phases, and four (4) for overlaps and four (4) for pedestrian intervals.

8.0 SOLID STATE FLASHER

8.1 A socket-mounted, two-circuit, solid state, alternating flash control device shall be provided. The solid state flasher shall meet the requirements of Section 8 of NEMA Standards Publication TSI-1983. Flasher shall be compatible with the 170 cabinet.

8.2 All flasher shall be "Type 3", dual circuit type with twenty five (25) amperes per circuit.

8.3 An indicator light shall be provided for each circuit of the flasher

8.4 A programming means shall be provided to alter whether flashing red or yellow appears on the output field terminals to the signal heads. Programming shall be possible by installing either "red" or "yellow" MOLEX connectors between the load switches and the field terminal block.

8.5 The output of the flasher shall be wired to give the following:

Flasher Circuit 1	Phases 2, 3, 6, 7 & OL 1, OL 2
Flasher Circuit 2	Phases 1, 4, 5, 8 & OL 3, OL 4

9.0 CONFLICT MONITOR

9.1 Each cabinet shall be provided with a conflict monitor which meets the requirement of Section 6, of NEMA Standards Publication TSI-1983 and the additional requirements described in this section. Monitor shall be NEMA Plus Plus.

9.2 All monitoring for conflicts shall be done on the field side of the cabinet field wiring terminals.

9.3 Each channel can be individually enabled for plus function monitoring.

9.4 The red, yellow, green, and walk of each phase shall be monitored individually. The loss of a lamp load shall cause the monitor to trip.

9.5 The detection of continuous green signal on after the yellow signal is energized or a yellow signal on after red is energized shall cause the monitor to trip.

9.6 The monitor shall detect short or missing yellow interval

9.7 If the absence of a red signal is monitored, the conflict monitor shall indicate on which phase the red was absent.

9.8 If reset is continuously applied, it will be ignored after two (2) seconds.

9.9 The line voltage shall be monitored to detect when the AC power is insufficient to provide proper operating line voltage (brown-out). A low voltage indications shall show a voltage below 92 volts.

9.10 Twenty-four (24) volt power shall be monitored for lwo voltage:

A voltage greater than +22 volts applied to both of the +24 VOLT MONITOR inputs shall be recognized by the unit as adequate for proper operation of the controller assembly.

A voltage greater than +18 volts direct current applied to either of the +24 VOLT MONITOR inputs shall be recognized by the unit as inadequate for proper operation of the controller assembly.

9.11 The LCD display shall indicate the following failure:

- Conflict
- Red Fail
- Switch Fail
- 24 Volt 1 or 2
- CVM
- Short Yellow Timing
- Skipped Yellow
- Program Card Ajar
- Low AC Voltage (Brown-out)

9.12 The monitor shall include a standard alphanumeric LCD (Liquid Crystal Display) to present detailed information about the monitor status, setup, and diagnostic functions. The unit shall have a user-friendly menu-driven interface for all monitor functions. Therefore the monitor shall not use "codes" to display failures.

9.13 The monitor shall store into memory each time a fault occurs. This memory shall contain at least the records of the last twenty (20) faults and the last ten (10) power outages. At a minimum, each record shall provide the following information:

1. Type of fault
2. Time and date of the fault
3. Channels involved in the fault
4. Complete channel status at time of the fault
5. Time of reset

9.14 The fault history shall be reviewed through the LCD display. It shall also be possible to obtain a fault history printout through an RS232 connection.

10.0 TRANSFER RELAY

10.1 Socket mounted transfer relays shall be provided to switch the field output power from the local switches to the flashing control device when commanded by the conflict monitor or manual flash select. Transfer relays shall use a Cinch-Jones 8 pin socket, Midtex, Part No. 136-62T3A1 or AEMCO, Part No. 136-4992 or equivalent. The number of transfer relays shall be:

- A. 2 Phase 1 transfer relay
- B. 8 Phase w/4 OL 6 transfer relay

11.0 CABINET

- 11.1 The controller unit and all accessories shall be enclosed in a weatherproof cabinet. The cabinet shall be provided with at least one (1) rigid shelf for 2 phase controller and two (2) rigid shelves for 8 phase controllers and peripheral component equipment. The shelves shall be fabricated from high strength metal and shall be height adjustable. The cabinet size shall be:

	Height	Maximum
A. 2 phase	42"H x 24"W x 15.5"D	42"H x 28"W x 16" D
B. 8 phase	54"H x 44"W x 25"D	55"H x 44"W x 27"D

- 11.2 The cabinet shall be fabricated from sheet aluminum with a minimum thickness of 0.125 inches. The cabinet shall be cleaned, rinsed, and thoroughly treated with a caustic etch. Cabinets shall have an anodized exterior surface. The interior of the cabinet and door shall have a polyester white powder coated finish. All flesh and weld brads shall be removed from the cabinets. All interior panels (detector switch panels, circuits breaker panels, termination panels, etc.) shall have rounded corner and edges and be free from flash and cutting debris. Sharp and/or protruding edge will not be acceptable. The cabinet structure shall be weatherproof and effectively sealed to prevent the entry of dirt or dust.
- 11.3 Cabinets should be either "Base Mount" type for eight (8) phase controllers or "Pole Mount" for two (2) phase controllers. A "Base Mount" cabinet shall be designed for mounting to a concrete foundation with the bottom of the cabinet substantially open. The cabinet mounting bolt holes shall be internal and located as shown on the attached "Mounting Drawing". "Pole Mount" cabinets shall be supplied with a slipfitter type adapter for mounting on a four (4) inch diameter pedestal. A three (3) inch diameter hole and four (4) bolt holes as shown on the attached "Mounting Drawing" shall be provided for "Pole Mount" cabinets. The adapter shall mount to the cabinet base by the four (4) holes and fasten to the pedestal by four (4) square head set screws. The bottom of the "pole Mount" cabinet shall be essentially flat and have no vertical bracing members. The bottom of the "Pole Mount" cabinet shall be double thickness.
- 11.4 A single cabinet door shall be provided at the front of the cabinet. The door shall include substantially the front area at the front of the cabinet. No "Police Panel" shall be provided. The door shall be provided with a catch mechanism to hold the door open at two (2) positions: 90 deg. (+10 deg.) and 180 deg. (+10 deg.). Each door shall be provided with a standard size pin tumbler #2 lock. Two keys shall be provided.
- 11.5 The cabinet shall be provided with a thermostatically controlled cabinet vent fan and intake and exhaust vent openings. The intake vent opening

shall be designed to permit their full area to be used for air to enter the cabinet. A commercially available standard size air conditioning type filter shall be used to cover the full surface area of each intake vent opening. The filter shall be 12" x 16" for 2 phase or 8 phase controller cabinets. The vent shall be located in the bottom of the cabinet door.

- 11.6 A vent fan shall be located at the inside top of the cabinet and shall be insect-proof, and shall be designed to assure that only a nominal amount of dust, dirt, and moisture will enter the cabinet. Intake and exhaust openings shall be of equal surface area. The exhaust duct shall be an integral part of the cabinet design.

- 11.6.1 The fan shall have a minimum capacity of 100 CFM for two (2) phase cabinets. Eight (8) phase cabinets shall have two (2) fans each having a minimum capacity of 200 CFM. All fan blades shall be metallic. The fan shall be designed to provide to operate reliably over the temperature range of -20 to +165 deg. F (-24 to 74 deg.C). The fan thermostat shall be mounted near the top of the cabinet and shall be adjustable between 90 and 140 degrees F (32 to 60 deg.C)

- 11.7 All controller functions, including those not necessary to provide the specific operation, shall be terminated on terminal blocks on the back panel. The load switch outputs from the controller and all inputs to the load switch shall be on separate terminals and bussed together for normal operation. There shall be terminals on the back panel for all signal circuits and at least six (6) connections for common conductors.

- 11.8 The back panel shall be hinged at the bottom and shall fold down and out from the top for maintenance with all components (load switches, relays, etc.) in place. It shall be possible to gain full access to the back of the back panel in less than two (2) minutes using simple tools. Wire termination points on the back of the back panel shall be numbered or identified to correspond to the labeling on the face of the panel. No printed circuit back panels shall be permitted. No components shall be mounted behind the back panel. RC filter networks for relay coils are exempt from this requirement. The bottom edge of the back panel shall be at least six (6) inches from the "Base Mount" cabinets and at least three (3) inches from the base of the "pole Mount" cabinets.

- 11.9 Field terminal strips shall be located along the bottom of the cabinet and shall be horizontally mounted at a 45 degree angle. The screw size shall be a minimum #10-32 binder head screw. Terminals shall accommodate 3/8 inch lugs. All terminals shall be numbered and identified to correspond with the cabinet wiring diagrams.

- 11.10 The outgoing signal circuits shall be of the same polarity as the line side of the AC service to the cabinet. The signal return circuits shall be common

and of the same polarity as the neutral side of the AC circuit. The neutral side of the AC service shall be grounded to the cabinet.

11.11 The cabinet shall contain a power line termination point and two (2) circuit breakers, type Square D QOU-1--. The controller, conflict monitor, loop detector amplifiers, load switches, flasher, and transfer relays shall be controlled by a breaker with the following capacity:

- A. For two (2) phase controller – 20 amps
- B. For eight (8) phase controller _ 50 amps

All other equipment, i.e., vent fan, receptacle, cabinet light, etc.; shall be controlled by a 20 amp breaker. The unfused side of the power line input and field wiring output shall be grounded to the cabinet panel. The line side of both circuit breakers shall be protected by a G & G Model HS-P-SP-120A-60A-RJ Surge Suppressor “Only”. The HS-P-SP-120A-60A-RJ surge suppressor shall be located near the bottom of the cabinet close to the power panel. The suppressor input connections shall face the bottom of the cabinet. The distance between the input connections and the bottom of the cabinet shall be 7 inches + or – 1 inch.

The plastic cover on the suppressor shall have holes located near the input connections. See “Mounting Drawing”.

11.12 The field pedestrian push button shall be isolated by a GDI 244 dual isolation module.

11.13 On a panel inside the cabinet, there shall be mounted a Signal Off-On Switch, A Signal Flash Switch and a Controller Test Switch. All switches shall be clearly labeled and shall be in the UP position when the signals are in the normal operating condition.

11.13.1 The Signal Off-On Switch shall control the signal lights only and shall not affect normal controller operation.

11.13.2 The Signal Flash Switch shall control the flash transfer relays which isolate the controller and flash operation. When in flashing operation, the switch shall cause the signal indications to flash and shall terminate power to the controller.

11.13.3 The Controller Test Switch shall permit the controller to operate normally when the intersection is in manual flash. The switch shall not cause the intersection to flash

11.14 The switches shall conform to the MIL Standard MUL-S-83731

11.15 DC plus input power shall be removed from the load switches while the signals are in any flashing condition.

11.16 A detector test panel shall be mounted on the inside of the cabinet. For each controller phase, a toggle switch shall be provided to simulate detector input to the controller for each vehicle and pedestrian phase. The switch shall provide "Normal" (up position), "Momentary Input" (down position), and "Detector Disconnect" (center position) operation to the controller.

11.16.1 These switches shall be miniature and conform to MIL-S-83731

11.17 The cabinet shall contain a 14 position wired loop detector card rack.

11.17.1 The card rack assembly shall be hinged at one end and shall be able to swing out for maintenance with all components in place. It shall be possible to gain full access to the rear of the card rack using simple tools.

11.17.2 The card rack assembly shall be supplied with card guides, connectors, and ID strips to accommodate 1.125 inch wide modules.

11.17.3 Each plug-in for each amplifier shall have the following terminal assignments:

- | | | | |
|-----|-------------------------|----|------------------|
| 1. | Channel 1 Delay Inhibit | A. | DC Ground |
| 2. | Channel 2 Delay Inhibit | B. | +24 VDC |
| 3. | Spare | C. | Remote reset |
| 4. | Spare | D. | Ch 1 Loop |
| 5. | Spare | E. | Ch. 1 Loop |
| 6. | Spare | F. | Ch. 1 Output (+) |
| 7. | Spare | H. | Ch 1 Output (-) |
| 8. | Spare | J. | Ch 2 Loop |
| 9. | Spare | K. | Ch 2 Loop |
| 10. | Spare | L. | Chassis Ground |
| 11. | Spare | M. | Spare |
| 12. | Spare | N. | Spare |
| 13. | Spare | P. | Spare |
| 14. | Spare | R. | Spare |
| 15. | Spare | S. | Spare |
| 16. | Spare | T. | Spare |
| 17. | Spare | U. | Spare |
| 18. | Spare | V. | Spare |
| 19. | Spare | W. | Ch 2 Output (+) |
| 20. | Spare | X. | Ch 2 Output (-) |
| 21. | Spare | Y. | Spare |

22. Spare

Z. Spare

11.17.4 Unless indicated otherwise on the requisition, the delay inhibit terminals (terminals 1 & 2) on the plug shall normally be delivered with the left turn phases wired to their respective green. Side streets through phase terminals (terminals 1 & 2) shall be connected to their respective green.

11.17.5 All loop terminals shall be protected by EDCO SRA – 16C – 1 “only” from loop terminal to ground. The minimum terminal block screw for detector loop input shall be #8-32.

11.17.6 The cabinet shall come with a (14) position card rack. The rack shall be wired:

SLOT	PHASE
1	1 5
2	2 6
3	3 7
4	4 8
5	Spare Loop Detector
6	Spare Loop Detector
7	Spare Loop Detector
8	Two or four channel traficon video cards
9	Spare Loop Detector
10	Two or four Channel traficon video cards
11	Opticom M752 Cards
12	Opticom M752 Cards
13	
14	Ped Isolation Module GDI model 244

Note: The vehicle detector outputs shall be programmed from the detector panel.

The common for the push buttons shall be isolated from AC neutral at the 244 isolator card.

11.17.7 The amplifier power supply shall be separate from the rack and provide a minimum of 2.5 amps at 24 volts DC. The power supply shall have a quick disconnect. To mate with:

MS Type Connector model RHIMCO 57094 MTMSA 618-IS 9337 (10 Pins) or equivalent.

11.18 A duplex receptacle of the three-wire grounding type shall be mounted and wired into the cabinet. The receptacle shall be fused and wired as noted in paragraph 10.11.

11.19 The cabinet shall be provided with an interior light and light switch. The light shall be incandescent and shall provide a light output comparable to that of a 60 watt incandescent lamp. The lamp shall be wired as noted on paragraph 11.11.

11.20 A weatherproof chart listing all field terminals and their associated functions shall be mounted inside the cabinet door.

11.21 Cabinet lifting devices, such as hooks or eyebolts, shall be provided on the side at the top of any cabinet weighing more than 100 pounds. The cabinet shall be sealed at the junction of the lifting device to prevent entry of water.

11.22 A number or other identifying symbol shall be placed in a conspicuous location within the cabinet to identify the wiring diagram which corresponds to the cabinet wiring. The same identifying symbol shall be on the cabinet wiring diagram.

11.23 Cabinet panel wiring shall be moisture and fungus proof.

11.24 Isolation relay shall be mounted in diamond controller cabinets where a detector amplifier cabinet is located at the far end of the diamond. These relays shall isolate the direct detector output line from the controller input.

12.0 MASTER CABINET

12.1 The Master Cabinet shall meet all of the requirements of a standard cabinet with the addition of all panels and cables necessary of the Master Controller and Dialup modem.

12.2 Cabinets requiring Video Detection shall come with a Power/Filter Panel. The panel shall be mounted on the top right side of the cabinet. The Panel shall contain One (1) surge suppressor G & G Model HS-120-10A, two (2) dual G 7 G Coaxial connected Surge suppression Devices Model BNC-1.5 Hz, four (4) Fuses Holders Ferraz Shawnut ULTRASAFE catalog number USM11 (1 Pole with indicator).

13.0 DIAGNOSTICS

13.1 The controller shall be provided with a diagnostic program capable of testing and locating any fault in all control inputs and outputs. This program shall consist of a maintenance kit containing the diagnostic PROM, wrap around cable assembly, communication jumper and all extender boards.

13.1.1 The diagnostics shall include, but not be limited to, the following tests:

- A. Real Time Clock
- B. Watch dog Timer
- C. Input/Output Wrap Around Test
- D. RAM Test
- E. Front Panel Display Test
- F. Front Panel Push Button Test
- G. Communications Test
- H. PROM Memory Test

13.2 The diagnostic testing shall be designed to continue to cycle the test until stopped by an error or manually by the operator. Once the automatic testing is halted by an error, the program shall go into a manual mode of operation. The parameters may then be manually entered to change the testing configuration or troubleshoot the problem found.

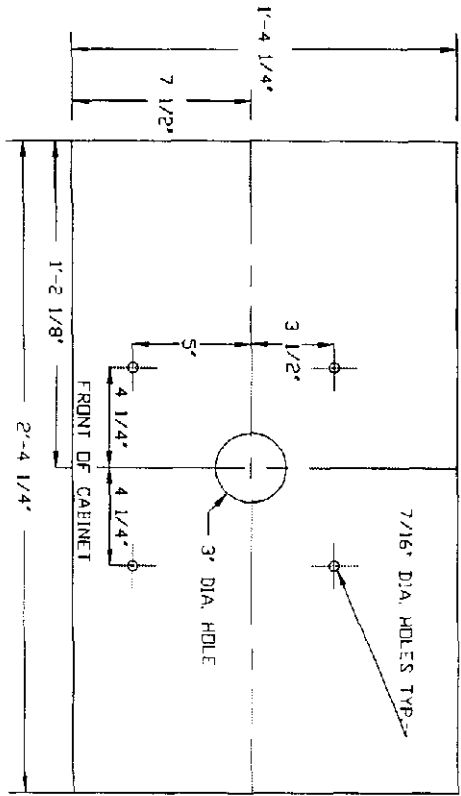
13.3 The operator shall have the option to write and enter a program into RAM and automatically sequence this test with any other test in the software package. This program shall be entered by keyboard.

TRAFFIC-SIGNAL-TIMING-RECORD

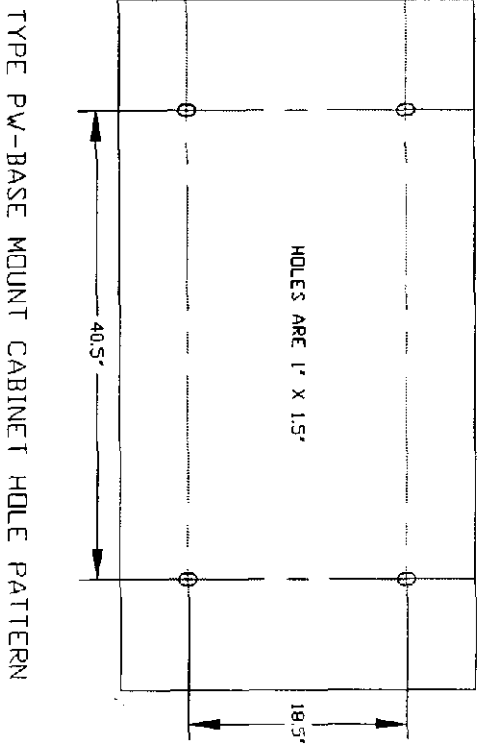
LOCATION CONTROLLER	TABLE 1 Traffic Signal Controller Initialization	INSTALLED W. O. #
REMARKS	Timing Plan Eight Phase - NEMA	INT #

DIRECTION								
STREET NAME								
PHASE	1	2	3	4	5	6	7	8
MINIMUM GREEN, SEC.	5.0	10.0	5.0	10.0	5.0	10.0	5.0	10.0
PED. WALK, SEC		7.0		7.0		7.0		7.0
WALK CLEARANCE, SEC.		15.0		15.0		15.0		15.0
PASSAGE (GAP), SEC.	1.0	3.5	1.0	3.5	1.0	3.5	1.0	3.5
MAX GREEN #1, SEC.	30.0	60.0	30.0	60.0	30.0	60.0	30.0	60.0
MAX GREEN #2, SEC								
YELLOW CLEARANCE, SEC.	3.0	3.5	3.0	3.5	3.0	3.5	3.0	3.5
ALL RED CLEARANCE, SEC.		1.0		1.0		1.0		1.0
RED REVERT, SEC.								
VEH. BEFORE ADDED INITIAL		5.0		5.0		5.0		5.0
SEC. PER VEH. TO ADD TO INITIAL GREEN		1.0		1.0		1.0		1.0
MAX. INITIAL GREEN, SEC.		15.0		15.0		15.0		15.0
TIME BEFORE GAP REDUCTION, SEC.		10.0		10.0		10.0		10.0
TIME TO REDUCE GAP, SEC.		10.0		10.0		10.0		10.0
MINIMUM GAP TIME, SEC.		2.0		2.0		2.0		2.0
CONDITIONAL MIN. GREEN, SEC.	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

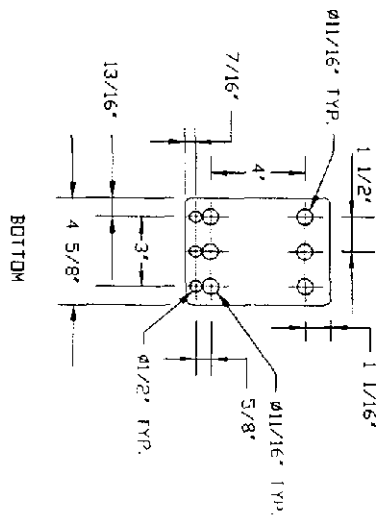
RECALL								
DETECTOR MEMORY								
DETECTOR DELAY, SEC.								
DETECTION TYPE								
LAST CAR PASSAGE								
FLASH	R	R	R	R	R	R	R	R
START UP								



POLE MOUNT CABINET BOTTOM BOLT HOLE PATTERN



TYPE PW-BASE MOUNT CABINET HOLE PATTERN



SUPPRESSOR COVER DRAWING

REVISION	CITY OF TULSA, OKLAHOMA
DATE	PUBLIC WORKS DEPARTMENT
BY	TRAFFIC ENGINEERING SECTION
MOUNTING DRAWING	
SCALE	NONE
DRAWN	JMG
CHECKED	
APPROVED	
DATE	TRAFFIC ENGINEER
12-3-81	
DRAWING NO.	000