STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
TRENTON, NEW JERSEY 08625

SPECIFICATIONS FOR EIGHT PHASE TRAFFIC SIGNAL CONTROLLER
ASSEMBLY FOR A CLOSED LOOP SYSTEM

N. J. Specification No. EB-TSC-8CL   Effective Date: July 1, 2001

New Jersey Department of Transportation Specifications for a Microprocessor Based, Eight Phase Controller Assembly with Internal Time Base Coordination, for use in a Closed Loop Traffic Control System.

The purpose of these specifications is to describe minimum acceptable design and operating requirements for a microprocessor based, eight phase dual ring quad left fully traffic actuated traffic signal controller assembly with internal time base coordination for use in a closed loop traffic control system.

GENERAL - I

1-1   The traffic controller assembly shall consist of a digital controller unit, signal conflict monitor, load switches, filters, flasher, detector card rack with power supplies, relays, connection wiring harnesses and other miscellaneous equipment in a complete and fully wired aluminum weatherproof cabinet. Serial numbers and date of manufacture for controllers shall be engraved into the frame of the controller. Controller modules and boards shall be permanently labeled with serial numbers that shall also be engraved into the frame of the controller.

1-2   The complete controller assembly shall conform to the requirements of current NEMA Standards No. TS-1, Section 1, 2, 5, 6, 8, 10, 13, 14 and 15, except as amended and supplemented hereinafter. The manufacturer must supply certification which includes a copy of the test report by an independent technical laboratory as to equipment compliance with NEMA environmental standards in accordance with NEMA testing procedures.

1-3   Materials not specifically covered in these specifications shall be in accordance with the accepted standards of the National Electrical Manufacturers Association, The Underwriters Inc., The National Electrical Code, and the American Society for Testing and Materials.

DEFINITIONS - II

2-1   The NEMA Standards referred to in this specification shall be the current NEMA Standards Publication No. TS 1 entitled "Traffic Control Systems". All terms not defined in these specifications shall be as defined in Section 1 of the NEMA Standards.

2-2   Event time is the hour and minute of a 24 hour day. The function shall start at the first second of the minute assigned.

2-3   Day event is turning on or off an output circuit at a specified time. This output need not be external to the controller unit but its effect is the same, the controller will initiate the proper action.

2-4   Coordination plan shall be composed of a programmed cycle length, offset and cycle split.

2-5   Day program is any combination of day events. These events specify which coordination plan is selected.

2-6   Week program is any combination of seven day programs.

2-7   Year program is any combination of fifty-two week programs.

2-8   An exception day shall override the normal day program and utilize a specified day program.

CONTROLLER UNIT AND WIRING HARNESS - III

3-1   A metal case suitable for shelf mounting shall be provided to house the controller unit. It shall be completely equipped and wired to provide eight phase dual ring quad left operation.

3-2   The controller unit shall be microprocessor based.

3-3   All modules shall utilize digital timing in the control logic and shall utilize line frequency as a base.

3-4   The controller unit shall be furnished with programmable read only memory (PROM) with permanent NEMA control program, as described in current NEMA TS-1 Section 1, 2, 5, 6, 13, 14 and 15. EEPROM, or nonvolatile RAM shall be used to store program variable and sample real time data.

3-5   A menu driven format shall be utilized. The menu format shall preclude the need for programming cards or tables. All data shall be entered utilizing the keyboard supplied on each controller.

3-6   All ROM's, EEPROM's, nonvolatile RAM's and microprocessor shall be installed in IC sockets. As an alternate, IC's that contain software programming may be installed without sockets if the IC's are installed on a removable card. If a card is utilized, one spare card shall be provided with the first unit supplied under each contract or proposal to which this specification applies. One additional card shall be provided with every five units supplied thereafter under each contract.

3-7   The controller unit shall be equipped for and be capable of immediate eight phase semi-actuated, fully actuated, and volume density operations. All phases must be equipped with concurrent pedestrian timing. All liquid crystal displays and keyboards necessary to achieve programming requirements shall be mounted on the front panel of the unit.

3-8   In addition to the eight phase dual ring quad left operation specified hereinbefore, the controller unit shall be equipped and wired for immediate use of sequences depicted in diagram #1 of the specifications. Sequence #3 shall only be supplied when required to provide the timing sequence in the contract documents to which this specification applies.

3-9   The controller unit must be capable of omitting any phase, by programming a "no phase" or a phase omit through the keyboard entry. This phase omit feature shall omit a phase during startup and normal operation.

3-10   The maximum DC voltage generated within the controller unit shall not exceed 50 volts.

3-11   If extender boards are necessary for testing or repair, two extender boards for each type of printed circuit board shall be provided with the first unit supplied under each contract or proposal to which this specification applies. One additional extender board for each type of printed circuit board shall be provided with every five units supplied thereafter under each contract.

3-12   An internal diagnostic routine shall be incorporated in the software program. It shall be exercised using the resident processor and shall be capable of check all memory elements. When a fault is detected an appropriate message shall be displayed.

3-13   A 25 pin RS 232C connector for the printer port shall be provided for interconnecting to a printer. It shall transmit (data, letters, headings, etc.) to a printer at 1200 baud. The printer shall be able to receive ASCII coded data. All controller unit timing, operational data, preemption data, coordination program data, time base data, system data, and reports shall be transmitted to the printer. The unit to printer transmissions shall not interrupt normal controller unit operation.

3-14   Total solid state circuitry shall be employed in the controller unit. All components shall be identified by the industry standard except manufacturer's LSI Devices.

3-15   Liquid crystal displays shall be utilized. The display shall have a backlite for viewing at night. Incandescent indicator lights are not acceptable. As a minimum, the model number and software version shall be displayed.

3-16   In addition to the minimum indicators required by NEMA standards, Section 14, a display menu shall be provided for selection of MAX II green timing.

3-17   All programmable functions shall be performed by keyboard. No foil deletions will be permitted to achieve any programming requirements.

3-18   If ROM replacement is utilized to obtain the four required sequences of operation as hereinbefore specified, the ROM must be supplied and stored within the controller. All ROM's utilized for other sequences of operation, shall be installed in zero insertion force I.C. sockets. If additional ROM's are supplied external to unit, the sockets with ROM's installed must be shipped in static free foam. Each ROM supplied shall be labeled to identify the sequence of operation which it provides.

3-19   The controller unit shall be capable of being programmed to start or initialize in accordance with NEMA TS 1-14.3.4.1. Unless otherwise specified in the contract documents, controller units shall be programmed to initialize in artery green.

3-20   Manual control operation shall utilize Manual Control Enable and Interval Advance.

3-21   All controller units shall contain all necessary wiring and circuitry to produce eight internally generated overlaps (4 NEMAN and 4 unused peds). Program options shall be provided to allow the timing of yellow change and red clearance to be determined by the terminating parent phase and by independent adjustment for each overlap. Independent adjustment programs shall also provide for green extension. Overlaps shall be programmable by keyboard.

3-22   Programs shall be provided that allow overlap green and yellow outputs to be suppressed, switched to its' red state, as determined by the following conditions:

   A.   If a suppression phase is green, the overlap is red.

   B.   If in a suppression phase and the phase next is a suppression phase, the overlap will remain red.

   C.   In all other conditions, the suppression phase does not alter the overlap. Variations in program, which result in the same operation outlined above, will be permitted.

3-23   All controller units shall be capable of being programmed for dual or single entry mode of operation.

3-24   A guaranteed three second minimum Yellow Clearance shall be provided.

3-25   Internal preemption shall be incorporated into the controller program. All data for preemption shall be entered through the keyboard. The unit shall provide a minimum of 4 preemption sequences, with one priority sequence. The unit shall also provide a lower priority sequence for bus and transit preemption. A minimum of one sequence shall have keyboard inputs for memory on/or memory off.

The following shall be the minimum acceptable parameters for each preemption routine:

PARAMETER	DEFINITION
Delay Time	Delay prior to start of pre-emption
Hold/Inhibit Time	Time to hold active phase or to omit all other phases
Min/Walk/PCL Time	Selects new or aborts active minimum and/or walk time
PED Clear Time	Selects new or aborts minimum and/or walk PCL time
EVP/Hold Phase(s)	Selects phase(s) to service pre-emption
Dwell Time	Guaranteed pre-emption time
Exit Calls	Calls phase(s) to be called and serviced following pre-emption

3-26   An input and the circuitry required to accomplish MUTCD flash shall be incorporated into the controller unit.

3-27   Harnesses for "A", "B", "C" and "D" Connectors, and Monitor Harnesses shall have a nylon braided expandable self-fitting cable sleeving.

3-28   Cables shall be used for interfacing between all panels including police panel. Cable shall have a PVC Jacket rated for 300 volts. The conductors shall be minimum 18 AWG Stranded Annealed Copper Wire with PVC Insulation Rated for 300 volts minimum and shall be rated for use at 221 °F.

3-29   Each detector input shall be capable of being programmed for stretch and delay timing. Program shall also include inhibit of stretch and delay during selected phases and or intervals.

3-30   It shall be possible to upload/download all controller program data through and industry standard RS232C I/O port with a laptop computer. It shall also be possible to edit all controller programs stored within the laptop computer without the need to be connected to a controller unit (stand-alone capability).

COORDINATION TIMING AND FUNCTIONAL REQUIREMENTS - IV

4-1   The controller unit shall be capable of coordinated operation in a closed loop traffic control system in conformance with New Jersey Department of Transportation Specifications No. EB-CL-1 and No. EB-CL-2. When installed at a group of intersections, the coordinated system shall result from the direction of the on-street master via a single mode fiber optic interconnect cable. The unit shall be capable of internal time base coordination to aid in the implementation of coordination plans generated by the on-street master. In the event of a failure of the on-street master or interconnect cable, the internal coordinator shall provide the synchronizing signals from

an internally stored coordination plan, using a precise clock as reference. A battery or capacitive backup voltage source shall be provided with the internal coordinator circuitry. In the battery backup mode time is to be maintained within ± 0.005%.

4-2   The coordination plan shall be, as a minimum, based on a time of the year program. The time of the year shall be set to the time of day, day of week, and week of the year.

4-3   The controller unit shall display, as a minimum, the day of week, hour, minutes and seconds, using military time. The controller unit shall, upon request from the keyboard, display output status and coordination plan data. The coordination plan data shall be capable of being scanned without affecting the plan in operation.

4-4   The internal coordinator shall automatically adjust for daylight savings time including automatic annual adjustments. This requirement shall be accomplished by a programmable function, programmed to the first Sunday in April and the last Sunday in October. As an alternate, to this requirement the manufacturer may accomplish this function in ROM. However if legislation changes the effective dates for daylight savings time, the manufacturer must supply a revised ROM implementing the change.

4-5   The internal coordinator shall be capable of implementing coordination plans containing, as a minimum:

A.   * Four cycles

B.   * Four splits per cycle (Total 16 Splits)

C.   * Three offsets per cycle (Total 12 Offsets)

D.   Eight permissive periods per split

E.   Eight force-offs per split

F.   One pedestrian permissive period per permissive period

G.   One dwell period per cycle

*Sixteen timing plans consisting of one cycle length per timing plan; one split per timing plan; and three offsets per timing plan may be provided in place of parameter a, b, and c above, or forty-eight timing plans, each consisting of its own cycle length, split and offset may be provided. However, an input/output map program must be provided to provide program correlation between the two methods.

4-6   The controller unit shall contain memory for storage of the coordination plans. The programming of this memory shall be accomplished through data entry utilizing the keyboard. All data shall be displayed for verification before it is entered.

4-7   The coordination plans shall be programmable in one second increments to any value between the following limits:

	FUNCTION	SECONDS
1)	Cycle Length	30 - 255
2)	Offset	0 - 255
3)	Splits	0 - 255
4)	Maximum Dwell	0 - 255
5)	Permissive Periods	0 - 255

4-8   The internal coordinator shall automatically "smooth" the change in offset and cycle length when a change is required by a new coordination program. The method of smoothing shall comply with Paragraph 4-9 or shall be programmable and the options shall include:

DWELL: The internal coordinator shall not permit the controller unit to dwell at its dwell point by more than the programmed period of time until offset is reestablished.

SMOOTH WAY: The internal coordinator shall shorten or extend the cycle length by no more that 50% until offset is reestablished.

4-9   The internal coordinator shall automatically "smooth" the change in offset and cycle length when a change is required by a new coordination program. The method of smoothing shall be that the internal coordination will select a background cycle based on supplied minimum and maximum cycle lengths. The cycle length selected will achieve the new offset in the smallest number of cycles possible and then implement the background cycle required by the coordination plan in effect. The smooth way method shall be utilized unless otherwise specified in the contract documents.

4-10   Transfer from one cycle to another shall occur at the end of the cycle in effect.

4-11   The internal coordinator shall be capable of having the phase association for the force-offs, and permissive periods programmable from the keyboard.

4-12   The force-off function shall terminate the right-of-way on the programmed phase or phases, and shall be maintained until the green of that phase terminates.

4-13   The internal coordinator shall be capable of providing permissive periods as follows:

A.   During each permissive period, the coordinator will allow the controller to leave the coordinated phase(s) and selectively respond to vehicle and/or pedestrian calls from allowable phase(s). The allowable phase(s) for each permissive period shall be programmable.

B.   The start and end of vehicle permissive periods shall be programmable through the keyboard. A pedestrian permissive period shall start with the vehicle permissive period for the associated phase. The end of the pedestrian permissive period shall be determined by a duration that is programmed with the keyboard.

C.   Permissive periods shall provide for the release and application of phase omits as programmed.

D.   Once the coordinated phase(s) has terminated, all internal omits associated with permissives shall be removed and the controller permitted to service the remaining phase in a normal manner. The controller unit shall not yield on subsequent permissive periods in the same cycle.

4-14   As an alternate to Paragraphs 4-11, 4-12 and 4-13, the coordinator may "automatically" provide for servicing and terminating phases through internal calculations based on the minimum green intervals, vehicle clearances, pedestrian walk and clearance intervals and the minimum and maximum cycle lengths supplied. Controllers utilizing automatic calculations shall provide an additional program to allow for a simple yield type of coordinated operation. That is, one release period occurring for approximately 3% of the cycle whereas the coordinated phase(s) shall terminate and opposing calls are allowed to be serviced.

4-15   A "D" multi-terminal receptacle shall be mounted on the front of the controller unit. The inputs and outputs for the coordination shall be wired through this receptacle. All closed loop functions shall also be wired through this receptacle. A multi-terminal plug shall be provided to mate with the receptacle. The plug shall have all active functions completely wired and terminated on a sub panel in the location shown on Drawing No. P-23-CL.

4-16   The controller shall have, as a minimum sufficient output combinations to indicate:

A.   Cycle 1 thru 4

B.   Offset 1 thru 3

C.   Split 1 thru 4

4-17   The controller shall have, as a minimum sufficient input combinations to call the following:

A.   Flash

B.   Cycle 1 thru 4

C.   Offset 1 thru 3

D.   Split 1 thru 4

4-18   When the controller unit is used in a closed loop system, the internal time of day coordination plan shall be in effect during the following conditions:

   A.   Loss of system input or communications.

   B.   When directed by the on street master unit to select a particular coordination plan.

   C.   When manually selected using the keyboard.

4-19   When the controller unit is used in a closed loop system, free operation shall be in effect during the following conditions:

   A.   When preemption is in effect.

   B.   When flash is in effect.

   C.   During manual operation.

4-20   The data base for the TBC shall be capable of supporting at least 10 day plans with no less than 150 event times distributed over the 10 day plans, 8 week plans assignable throughout the 52 weeks of the year, and at least 10 exception days. The exception day program may select "special days" or relate to an individual "normal" day plan.

4-21   Sync reference time shall be programmable or preset to midnight in order to provide a common point in time to reference the sync pulse for the cycle timers.

4-22   All unused green time from the actuated phases which do not time to their maximum or are skipped shall revert to the beginning of highway green. If the programmed pedestrian time exceeds the programmed split value or max green time, the amount of time exceeded shall be subtracted only from the coordinated phase (highway green).

4-23   The coordination plan shall be structured to allow the selection of cycle/ offset/split combinations from the T.O.D. program or hardwire interconnect as indicated below:

C1/01/(S1)	C2/01(4)/ S1(5)	C3/01(7)/ SP1(9)	C4/01(10)/SP1(13)
(S2)	S2(6)	SP2(10)	SP2(14)
(S3)	S3(7)	SP3(11)	SP3(15)
(S4)	S4(8)	SP4(12)	SP4(16)
C1/02/(S1)	C2/02(5)/S1(5)	C3/02(8)/SP1(9)	C4/02(11)/SP1(13)
(S2)	S2(6)	SP2(10)	SP2(14)
(S3)	S3(7)	SP3(11)	SP3(15)
(S4)	S4(8)	SP4(12)	SP4(16)

C1/03/(S1)	C2/03(6)/S1(5)	C3/03(9)/SP1(9)	C4/03(12)/SP1(13)
(S2)	S2(6)	SP2(10)	SP2(14)
(S3)	S3(7)	SP3(11)	SP3(15)
(S4)	S4(8)	SP4(12)	SP4(16)

CLOSED LOOP SYSTEM REQUIREMENTS - V

5-1   The controller assembly shall operate and perform all functions required by a Closed Loop Traffic Signal Control System as required by New Jersey Department of Transportation Specifications No. EB-CL-1 [and No. EB-CL-2.] The controller assembly shall perform all functions and operate with an On-street Master that conforms to New Jersey Department of Transportation Specification No. EB-OSM-1.

5-2   System Counting Detectors - The controller shall preprocess the detector data. An on-street master microcomputer shall sample the preprocessed detector data in intervals not to exceed once per second.

5-3   System Speed Detectors - The controller shall preprocess the detector data. An on-street master microcomputer shall sample the preprocessed detector data in intervals not to exceed once per second.

5-4   System Sampling Detectors - The controller shall preprocess the detector data. An on-street master microcomputer shall sample the preprocessed detector data in intervals not to exceed once per second.

5-5   Detector Capability - Each controller shall preprocess the detector data for a minimum of eight counting and/or sampling detectors.

5-6   Printout Capability - The controller shall have the capability of outputting data to a printer, including the system status and information stored in RAM. A printer shall be provided for this function with the first unit supplied under each contract or proposal to which this specification applies. An additional printer will be provided with every five controller units supplied thereafter under each contract, to a maximum of five printers.

5-7   Remote Reset Capability - The time and date of coordination module shall be resettable from the an on-street master microcomputer.

5-8   Security Code - A security code capability shall be included in the controller unit. This code shall prevent any change to the data or to the mode of operation unless the current security code is first entered. The security code access shall be automatically rescinded after a period of time greater than 30 minutes. A means shall be provided to change or to remove the security code protection.

5-9   Coordinated Phase Control - It shall be possible to change the coordinated phase(s). The command to do this shall originate in the operator and/or maintenance console and be passed to local intersections via the on-street master.

5-10   The system shall provide maintenance reports for the following:

A.   Loss of Communications

B.   Communication Reestablished or Repaired

C.   Controller Malfunction

D.   Special Function Failure

E.   Detector Failure and Repair

F.   Cabinet Door Open

G.   Monitor Flash - Voltage or Conflict

H.   Monitor Status

I.   Manual Flash

J.   Loss of Cabinet Ventilation

K.   Change of Operation Due to Detector Failure

L.   Manual Control Enabled

MULIT-ARTERIAL TRAFFIC CONTROL SYSTEM REQUIREMENTS - VI

6-1   The controller assembly shall operate and perform all functions required by a Multi-Arterial Traffic Control System as required by the current New Jersey Department of Transportation Specification No. EB-MATS-1. The controller assembly shall perform all functions and operate with an On-street Master that conforms to current New Jersey Department of Transportation Specification No. EB-OSM-1.

MANUAL CONTROL MODE - VII

7-1   System manual control shall be accomplished through the on-street master keyboard. The controls shall conform to the requirements of current New Jersey Department of Transportation Specification No. EB-OSM-1.

7-2   Manual control shall also be accomplished through the controller unit keyboard. The controls shall, as a minimum, include the following:

A.   Control to load or alter data Control to read data

B.   Control to restart program

C.   Control to clear memory in time clock

D.   Control to manually select cycle, split and/or offset

E.   Control to load remotely all intersection data from the maintenance console

F.   Print control to allow printing of time clock information

G.   Print control to allow printing of timing and coordination information

SYSTEM CONTROL MODE - VIII

8-1   The controller shall be controlled from the operator and/or maintenance console via the dial-up modem communications link and an on-street master. The system control of the controller shall, as a minimum, include the following:

A.   Print control for local intersection information

B.   Control of a system wide sync Control of backup program copy operation

C.   Control to load or alter data

D.   Control to read data Control to restart program

E.   Control to reset the time clock

F.   Control to manually select cycle, split and/or offset

G.   Control to initiate catch-up routine

PRIORITY OF CONTROL - IX

9-1   The order of priority of control from the highest to the lowest is as follows:

A.   Manual Control (from the on-street master)

B.   Manual Control (from the operator and/or maintenance console)

C.   Time Clock Control

UPLOADING CAPABILITY - X

10-1   The controller unit shall have the capability of uploading system and timing data from a closed loop on-street master. The system operator using the maintenance console keyboard shall have the capability of entering the timing and system data via the keyboard into the RAM memory.

10-2   The controller unit shall have the capability of uploading system and timing data from a closed loop system operator and/or maintenance consoles using the keyboard.

10-3   The information to be transmitted shall include all interval times as defined in the NEMA Standards No. TS-1, Section 14. The Min Green, Yellow, Red and Ped Clearance times shall be subject to predefined minimums.

10-4   In addition to the interval time, the following parameters shall also be capable of being uploaded:

    A.   Offset times (3)

    B.   Force Off Associations and times

    C.   Permissive Phase Associations and times

    D.   Time Clock information Time, Day and Date

    E.   Security Code

    F.   Detector Delay

    G.   Initialization Phases(s) and Interval(s)

    H.   Last Car Passage Control

    I.   Dual Entry Operation

    J.   Offset Seeking Mode

    K.   Dwell Time

DOWNLOADING CAPABILITY - XI

11-1   The controller unit communications module shall have the capability of downloading all of the data via the on-street master to the operator and/or maintenance console. The data that shall be available for downloading is specified in subsection 11. During the uploading operation, the normal interconnected operation may be suspended.

COMMUNICATIONS INTERFACE - XII

12-1   The communications interface port shall provide full duplex operation using a 4 wire interconnect or leased lines. The communications module shall comply with part 68, FCC docket 19528.

12-2   The data rate shall be a minimum of 1200 bits per second ± 0.01% asynchronous.

12-3   The modulation shall be time division multiplex/frequency shift keying (TDM/FSK).

12-4   The communications module shall function with a line impedance of 600 ohms ± 10% meeting the requirements of Bell 3002 unconditioned.

12-5   The communications module shall provide a RS-232-C interface via a DB-25S connector.

12-6   The front panel of the controller unit shall contain a LED indicator which shall indicate the carrier status.

FIBER OPTIC DATA INTERFACE - XIII

13-1   The controller shall be capable of communication with an on-street master utilizing a single mode fiber optic communications link. This will be accomplished by using a fiber optic data interface unit which will be provided and connected the controllers RS 232 output and to the fiber optic interconnect. An internal single mode fiber optic interface maybe provided as an alternate to this requirement, however it must be provided with a shelf mounted chassis and power supply. This will provide for the operation of the interconnect while the controllers is removed for service.

13-2   The fiber optic data interface unit shall be capable of operating in a full duplex mode of operation, employing asynchronous RS-232 data link protocols up to 9600 baud rate. The RS-232 signals shall be converted to light and transmitted from interface unit to interface unit until the light is reconverted to RS-232 electrical signals at another closed loop controller. The unit shall have a data speed of 100 to 24000 baud.

13-3   The fiber optic data interface unit shall contain two pairs of optical emitters and optical receivers with "ST" connectors. The unit shall contain LED's that indicate the current state of the unit and indicate if the unit is receiving or transmitting data. The unit shall provide daisy chain operation over both fiber optic cables, regenerating the signal prior to transmission to subsequent modems.

13-4   The fiber optic data interface unit shall be powered from an external or internal power supply and contain a battery backup for 24 hours of operation.

13-5   The fiber optic data interface unit shall operate on a wave length of 1500 nanometers for a distance between controllers of a minimum of 2.8 miles.

13-6   The fiber optic data interface unit shall have a data sensitivity of 0 dBm maximum and -40 dBm minimum.

13-7   The fiber optic data interface unit shall also include a lightguide interconnection/ cross connection unit. The unit will allow the termination of the fiber optic interconnect cable in the cabinet and the connection of fiber optic jumper assemblies to the interface.

DATA TRANSFER REQUIREMENTS - XIV

14-1   The controller unit shall be capable of transferring program pre-emptions controller, coordination, time clock) data to another controller via the controller unit "D" connector or RS 232 connectors.

14-2   A cable shall be provided for the purpose of transferring coordination data. One cable shall be provided with the first unit supplied under each contract or proposal to which this specification applies. An additional cable shall be provided with every five units supplied thereafter under each contract.

14-3   The controller unit shall be capable of transferring program (controller, coordination, time clock) data to and from a portable laptop computer. Software shall be available for this function and shall be provided with the first unit supplied under each contract or proposal to which this specification applies. The Department shall be given the right to make copies of the software.

LOAD SWITCHES - XV

15-1   All load switches shall be the three circuit type conforming to the requirements of NEMA TS-1, Section 10, and be equipped with 3 input indicator lights.

15-2   All load switches shall utilize optically isolated encapsulated modular solid state relays. Discrete components on circuit boards are not acceptable.

15-3   Each optically isolated encapsulated relay utilized in the load switch pack shall have a minimum rating of 25 amps at 120 volts AC.

15-4   A minimum of eight three circuit load switches shall be furnished. If additional load switches are necessary to provide the timing and sequence of operation required by the contract to which this specification applies, the additional load switches must be furnished.

CONFLICT MONITOR - XVI

16-1   The conflict monitor shall be a stand alone Type 12 and conform totally with the requirements of current NEMA Standard TS-1, Section 6.

16-2   All pins of the connector plug shall be wired and terminated on a cabinet mounted terminal block per Part 5 of the specification. Channel assignments shall be wired to their corresponding phase. For example, channel 1 to phase 1, channel 8 to phase 8, overlap A thru overlap D shall be channel 9 thru channel 12 respectively. Detection of a failure mode shall cause the monitor to trigger, de-energize its output relay contacts, and place the intersection in flash. Once the monitor triggers, it shall assume one of two states:

   A.   Non-Correcting state - The monitor cannot return to normal operation without manual or input reset. Non-Correcting failures shall be stored in memory and shall retained through an indefinite power interruption until power is once again restored and the unit is reset, maintaining the output relay de-energized until such time as the reset occurs.

   B.   Self Correcting state - The monitor may return to normal operation if the condition causing the failure is corrected.

16-3   Indicator lights or liquid crystal displays shall be provided for all channels in order to display the active channels.

16-4   The start delay relay shall be utilized to provide power to the controller mechanism. Upon monitor power-up and no failure condition is detected or in memory, the start delay relay will energize an adjustable period of 0 - 15 seconds after power-up. This minimum period shall be programmable by means accessible on the front panel of the monitor.

16-5   A programmed diagnostic package must be available for use with the monitor unit, and will be required to be supplied. One diagnostic package shall be provided with the first unit supplied under each contract or proposal to which this specification applies. One additional package shall be provided with every five units supplied thereafter under each contract. The program must be capable of checking all monitor operations. All internal wiring, connections and integrated circuit socket for the diagnostic chip must be furnished and installed in the unit for immediate use.

16-6   The monitor shall be able to detect presence of conflicting green, yellow, or walk signal voltages on the AC field terminals (full or 1/2 wave) between any two or more non-compatible channels. Conflict shall always be considered a non-correcting failure.

16-7   The conflict monitor shall, as a dip switched option, be capable of monitoring for the absence of proper voltage on all inputs (including red) of a channel. Therefore, a Red Failure condition shall be detected and the monitor will trigger if at least one input per channel is not at the proper voltage level. Red failure shall always be considered a non-correcting failure.

16-8   The monitor shall initiate flashing operation as a result of over-current protection operation, absence of AC+ to the monitor, or a failure of the monitor power supply. The monitor shall also provide an internal "watch dog" circuit for purposes of monitoring the central processor unit. If the processor fails to periodically cycle the monitor shall initiate flashing operation .

16-9   The monitor shall provide a means of displaying the real time status of operating parameters such as time and date, compatibility card programming, functional inputs, and the on/off status of dip switches.

16-10 The monitor shall provide a setable internal 99 year clock. The clock shall automatically adjust for daylight savings time. This requirement shall be accomplished by a programmable function. As an alternate to this requirement, the manufacturer may accomplish this function in ROM. However if legislation changes the effective dates for daylight savings time, the manufacturer must supply a revised ROM implementing the change.

16-11 The monitor shall store in nonvolatile memory and shall be retained through indefinite power interruption an event log. A minimum of 140 events shall be logging by time and date of occurrence. As a minimum, the log shall contain the following events:

A.   Power on/off occurrences

B.   Failures and type (Conflict, Red Fail, etc.)

C.   Display indications active at time of failure

D.   Monitor resets and type (manual vs. input)

E.   Exit failure occurrences (i.e. self correction)

F.   Dip switch changes

G.   Last time/date set

H.   Message overflow

I.   Last printout

16-12 The monitor shall provide a means of initiating a printout sequence. The printing shall not disrupt the normal operation of the monitor. The printout would make use the same printer and cables as required in paragraph 3-13 with A4 paper (8.5" x 11"), 80 column format. The report shall contain as a minimum the following:

A.   Intersection Identification (7 digit number, Route number and intersection cross street)

B.   Current time and date

C.   Date and time of last printout

D.   Current status of dip switches

E.   Current status of input modifiers

F.   Current status of compatibility card programming

G.   Event log as stipulated in 16-11

16-13 The conflict monitor shall be furnished and wired to provide inputs to the closed loop system that When operating in a closed loop system or controller direct dial environment, the monitor shall be capable of interfacing with the controller unit for purposes of data exchange. The data exchange shall provide the ability to, via the controller unit, remotely upload the monitor event log, dip switch settings, and compatibility card programming information to the operator console.

16-14 The conflict monitor shall be furnished and wired to provide inputs to the closed loop system that the controller is in monitor flash. The input shall also provide a distinction as to type of failure either a voltage or signal conflict.

CABINET-AUXILIARY EQUIPMENT - XVII

17-1   The enclosed controller mechanism shall be housed in an aluminum cabinet (Grade 50-52-H32) fabricated in accordance with sketch attached to and forming a part of this specification, identified as Drawing No. P-21. Dimensions of the cabinet furnished must meet or exceed all minimum dimensions shown. Cabinets not conforming will not be approved. The cabinets shall be of adequate size to house the maximum size eight phase controller as specified by NEMA.

17-2   All surfaces of the cabinet shall be clean, free of holes or blemishes, smooth without burrs and with exterior corners rounded. The cabinet shall not be painted.

17-3   A thermostatically controlled fan with a minimum 100 CFM airflow for ventilation screened against the entrance of dust and foreign matter, shall be furnished and mounted in the top of the cabinet and completely wired and interconnected. The fan shall be wired to provide an input to the closed loop system that the cabinet ventilation has failed. A failure of the ventilation is to be reported when the temperature in the cabinet exceeds 120 °F. The value of this temperature shall be adjustable from 70 °F to 131 °F.

17-4   A replaceable 12" x 16" x 1" filter for incoming air shall be provided.

17-5   Sixteen load switch bases shall be provided and wired to accommodate the eight phase signal operation, four programmable overlaps and four concurrent pedestrian indications. Stacking of load switch bases is not permitted.

17-6   A silk screen or permanent label of the inputs and outputs shall be provided on at least one vehicle and one pedestrian load switch base, as shown on the attached diagram #3. All load switch bases shall also be identified as to the phase or operation for which they are programmed. If permanent labels are used, a sample must be submitted before acceptance. All lettering on all panels shall be no smaller than 3/32 " in height.

17-7   In addition to the signal load relays and monitor unit, a solid state two circuit flasher with six transfer relays (Magnecraft Type W2IACPX-2, Midtex Type 136-62T200 or AEMCO Type 136-4995) shall be furnished and mounted in the cabinet and completely wired. The flasher shall conform to NEMA TS-1, Section 8, and shall be a Type 3 flasher. The flasher shall be equipped with Neon or LED indicators representative of the flasher outputs. Transfer relays shall be rated at 20 amps per circuit.

17-8   Flash transfer relays shall be so wired as to be de-energized for flashing operation and shall be in close proximity to load relays, flashers, and field terminals. Flasher outputs and connections for transfer relays shall be provided and terminated on terminal blocks for programming of Flash 1 or Flash 2 outputs. The load on both circuits of the flasher should always be balanced. Unless otherwise specified in the contract to which the specification applies, phase, overlap and flash programming shall not be completed.

17-9   The following components shall be provided and mounted on a sub-panel protected by a polycarbonate cover, isolated from the main back panel, and completely wired, through its own terminal block. The terminal block should be easily accessible, and as

described here within for signal field terminal blocks. Panel shall conform to diagram #5. All panels shall be a minimum of 1/8" thick aluminum.

A.   A mercury plunger type signal bus relay shall be installed through which the AC plus to the signal bus shall be provided when the relay is energized.

B.   A plug-in "power off" relay with a clear polycarbonate dust cover. This relay, Struthers-Dunn Type A283XBXC1, Potter or Baunfield Type KUP14A11 or AMRON Type MK2P2, shall be of such design and so connected that if the power is interrupted, the relay shall de-energize and remain de-energized until reset, denoting an interruption, but will allow the control mechanism to return to operation when current is restored. This relay shall be reset manually only, and is to be of the two-pole double-throw type, one pole for resetting and one pole for the installation of a telltale miniature lamp which shall be furnished with the equipment.

C.   The cabinet control wiring and control equipment shall be protected with a circuit breaker of proper rating located within the controller cabinet. A separate circuit breaker shall be provided for the flash operation. Breaker type should be comparable to an E frame circuit breaker.

D.   A 120 volts AC single phase surge protector shall be installed as a precautionary measure against possible damage resulting from voltage surges on all incoming power lines. The 120 volts AC single phase surge protector shall incorporated a series choke at a maximum clamp voltage of 340 volts at 20 kiloamps with a 5 nanosecond response. In addition, the surge protector shall have the capability of removing high energy surges and block high speed transients. The surge protector shall comply with the following specifications:

          Peak Current: 20 times at peak current
          Occurrences: 20000 amps (8x20 microseconds waveshape)
          Minimum Series Inductance: 200 microhenries
          Continuous Series Current: 10 amps
          Temperature Range: -40 °F to +185 °F

If required by the contract to which the specification applies, a surrestor shall be installed for all communication lines. The surrestor shall comply with the following specifications:

          Peak Surge Current: 10 kiloamps (8x20 microsecond waveshape)
          Occurrences at 2,000 amps: 50 typical
          Response time < 5 nanoseconds
          Operating Temperature: -40 °F to +185 °F
          Primary Protector: Three   element   gas   tube, 10   kiloamps, 8X20
                  microseconds per side.
          Secondary Protector: Solid state clamps, 1.5 kilowatts minimum

All components, circuits and accessories considered necessary by the manufacturer to adequately protect the controller assembly and associated

equipment from damage due to voltage surge shall be furnished. All devices shall be readily accessible for ease of replacement and not mounted behind any panel or enclosure.

E.   A radio interference filter, shall be connected as to completely filter controller and auxiliary equipment, and shall have a minimum rating of 50 amps.

F.   Three copper ground bars with brass terminal bolts capable of handling #10 wire and having a minimum of 12 terminal connecting points shall be provided and labeled AC-, chassis and logic ground.

AC-, chassis and logic ground shall be isolated from each other throughout the assembly, including any auxiliary sub-panels. AC- and logic ground bars shall be mounted on insulators.

G.   An additional fourth copper ground bar mounted on insulators shall also be provided on the lower portion of the power panel, having a minimum of 24 terminals, electrically connected to AC- for field wiring.

H.   Spacing between ground bars on the power panel shall not be less than 1-1/2 inches apart.

I.   All connections between the power panel and any other panel shall only be through terminal blocks on each panel.

J.   Two subpanel power cables shall terminate directly to the power panel not to adjacent subpanels or to the backpanel.

K.   A UL-approved convenience outlet shall be installed, and it shall be required to have ground fault protection incorporated.

L.   Terminal block for incoming power shall be a two terminal block rated at 50 amps and shall have a minimum barrier height of 3/4 inches and utilize 10-32 x 5/16 inch screws.

17-10 A one piece detector/coordinator panel shall always be provided and shall conform to the attached diagram #4. All panels shall be a minimum of 1/8 inch thick aluminum. All detector rack and coordinator wiring harnesses shall be terminated on this panel. Terminal blocks utilized shall be of the double row barrier type rated at 30 amps and of one solid unit. Terminal blocks shall be spaced ¼ inch apart. Two pedestrian isolation circuits designed for a 12 volts AC input shall be supplied.

17-11 All conductors, including spares, from the controller unit, conflict monitor, load switches and all other auxiliary equipment shall be terminated on interface terminal blocks in the cabinet and be identified. All terminal connections shall be marked with a number and NEMA function. All labeling must be silk screen or permanent labels. If permanent labels are used, a sample must be submitted for acceptance.

17-12 The following items shall be installed on a panel behind the small door, in the recess of the door-in-door.

     A.   Switch for automatic/manual operation.

     *B.   Switch for automatic/flashing operation.

     *C.   Switch for signals only "on" and "off".

     D.   A manual cord consisting of six feet of rubber insulated cord and a weatherproof normally open momentary contact.

     *During signal off and flashing operation from the Police panel, the controller shall not be de-energized. An external restart shall be applied and held during this operation. Signal flash has priority over signal off.

17-13 The outgoing traffic controller signal circuits shall be of the same polarity as the line side of the power supply; the common return of the signal circuits shall be of the same polarity as the ground side of the power.

17-14 Field terminals utilized in the cabinet assembly shall be of the double row high type barrier blocks. They shall be rated at 50 amps and shall have a minimum barrier height of 5/8 inches and shall utilize 8-32 X 5/16 inch screws as a minimum. Field terminal blocks shall be mounted horizontally at a minimum of 10 inches from the bottom of the cabinet. At each output for connection of signal wire on the field terminal blocks, a lug connector, with spade and set screw, shall be attached. The plug connector shall be UL listed, intended to hold up to 6-#14 AWG individual wires. The lug connector shall be capable of handling #14 -16 AWG wire. All connections to the field terminal blocks from load switch bases and flash transfer relay bases shall be made with vinyl insulated spade connectors. Soldering of any connections to field terminal blocks shall not be permitted.

17-15 Sufficient terminal blocks rated at 50 amps shall be supplied to terminate spare field conductors (maximum 3 conductors per terminal), as required by the contract which this specification applies.

17-16 All cabinet doors shall incorporate hinges and hinge pins utilizing stainless steel. Fastening of hinges to doors and cabinets shall be made using stainless steel pop-rivets or stainless steel nuts and bolts. Welding of hinges to cabinets and doors shall not be permitted.

17-17 The cabinet door shall be provided with a switch to provide an input to the closed loop system that the cabinet door is opened. A separate terminal on the system panel shall be provided for this function.

17-18 The use of printed circuit boards in any part of the cabinet design will not be permitted.

17-19 All MS connectors to controller and monitor shall be complete with MS cable clamp. Example: the amphenol MS clamp type MS3057A.

17-20   A fluorescent fixture supplied with a lens or shield and a 20 watt, Type T-12, 430 milliamp lamp and rapid start, high power factor ballast shall be supplied and installed in the top front portion of the cabinet. A switch shall be installed on the inside of the cabinet door on or near the police panel so that the lamp can be extinguished manually.

17-21   Cabinet layout shall be designed, as per drawing number P-23-CL.

17-22   As an alternate to copper ground bar, a tin plated ground bar utilizing 5/16-24 x 3/8 inch screws shall be utilized. The tin plated ground bar shall be capable of handling #14-4 AL-CU wire and have a minimum of 12 connecting points.

17-23   The detector card rack shall be made of anodized aluminum and be capable of accommodating standard 4.5" x 6.875" detector and power supply cards.

17-24   The detector card rack shall be positively fasten to the upper shelf of the controller cabinet utilizing a method for easy removal.

17-25   Twenty-two Pin Cinch Jones 50-44A-30M connectors designed for keys between contacts B and C, M and N shall be provided for dual power supplies and eight 24 volts DC, 130 milliamp (maximum) detector cards.

17-26   The interface harness connections at the loop detector card rack shall be either soldered or mechanically installed. If mechanically installed, some positive method of locking the connector to the rack shall be provided. The conductors for the interface harness shall be 22 AWG stranded annealed copper wire, with insulation rated for 300 volts. The interface harness shall exit detector rack near the detector panel. The wire in the harness shall be individually twisted pairs for loop inputs.

17-27   Dual power supplies to power eight 24 volt DC, 130 milliamp (maximum) detector cards shall be supplied per controller assembly.

17-28   The power supplies for the detector card rack shall have a regulated output voltage.

TRAINING - XVIII

18-1   As part of the closed loop system and prior to the observation period, training shall be provided for the Department's engineering and maintenance staff, at a facility provided by the Department, as follows:

   A.   Maintenance Training - The training shall be provided for a minimum of 32 hours for a minimum of 10 maintenance personnel. The training shall include the operation of the system, maintenance and repair of on-street master, etc.

   B.   Engineering Training - The training shall be provided for a minimum of 8 hours for a minimum of 20 engineering personnel. The training shall include a complete demonstration of the system, emergency procedures, operation, trouble procedures and equipment operation.

C.   Operation Training - The training shall be provided for a minimum of 32 hours for a minimum of five (5) operation personnel. The training shall include the operation of the system and subsystem.

18-2   Training shall also be provided for all software. The training will be given to a minimum of ten (10) engineering personnel and will provide for a minimum of 40 hours of training each. The engineer will approve the training by the Engineer.

18-3   The schedule and the content of all training shall be submitted for approval.

INSTRUCTIONS AND GUARANTEES - XIX

19-1   One set of complete schematics and maintenance manual including detailed theory of operation, of the controller unit, monitor and auxiliary equipment shall be supplied with each controller assembly furnished.

19-2   One reproducible blackline Diazo mylar (4 mil thick) A1 size (22" x 36") and two prints of the schematic wiring diagram for the cabinet back panel and auxiliary equipment shall be supplied with each controller assembly furnished. The schematic wiring diagram shall contain the information in at least 1/4 inch lettering.

A.   Contract and bid dated.

B.   Model and number of all equipment.

C.   Intersection location.*

* When not applicable, the diagram shall have the work "location" and a blank space where the intersection can be added.

19-3   No changes or substitutions in these requirements will be acceptable unless authorized in writing. Inquiries regarding this specification shall be addressed to the Manager, Office of ITS Engineering, New Jersey Department of Transportation, P.O. Box 613, 1035 Parkway Avenue, Trenton, New Jersey 08625.
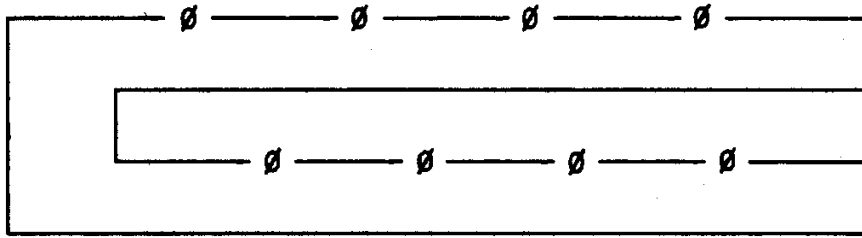
19-4   The complete control and auxiliary equipment shall carry a two (2) year guarantee from the date of delivery against any imperfections in workmanship or materials. Any tests or repairs made by a manufacturer or representative shall be documented on the New Jersey Department of Transportation "Equipment Failure Analysis and Report Form" and returned with units when warranty repaired. The Department will attach a copy of this form to all returned equipment. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number and circuit number. All warranty repairs must be made within thirty days upon receiving equipment.

19-5   The company agrees upon the request of the Manager, Office of ITS Engineering to deliver to the Office, a sample of the control equipment to be supplied in compliance with these specifications for inspection and test before acceptance. After completion of the test, the sample shall be returned.
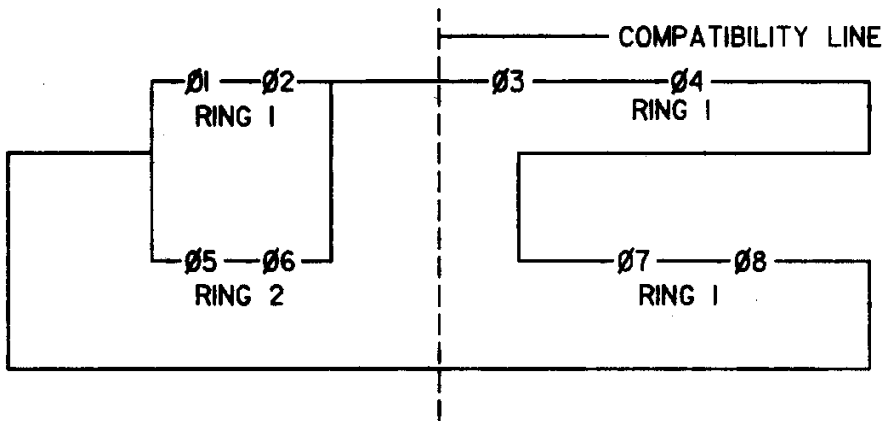
19-6   The company shall furnish any and all equipment which they deem necessary for safe and reliable field operation of the control equipment.

19-7   Controllers furnished under this specification must be current production equipment and of recent manufacturer, identical models of which are field operational. Untried or prototype units shall not be considered for acceptance.

19-8   In the event of a software revision made to the controller program after the unit has been tested and approved according to this specification. The supplier must submit to the Office of ITS Engineering a letter from the manufacturer explaining the changes, and the reasons for the changes.

EIGHT PHASE SEQUENTIAL OPERATION
SEQUENCE #1

Ø ——— Ø ——— Ø ——— Ø

Ø ——— Ø ——— Ø ——— Ø

SEQUENCE #2

——— COMPATIBILITY LINE

Ø1 — Ø2   Ø3 ——— Ø4
RING 1   RING 1

Ø5 — Ø6   Ø7 ——— Ø8
RING 2   RING 1

SEQUENCE #3

——— COMPATIBILITY LINE

Ø1 — Ø2 ——— Ø3 ——— Ø4
RING 1

Ø5 ——— Ø6   Ø7 — Ø8
RING 2   RING 1

DIAGRAM No. 1

VOICE CIRCUIT

TO ON STREET MASTER
LINE 1 LINE 2 LINE 3 LINE 4

LEASED LINE GND
RED GREEN YELLOW BLACK

DIAL UP LEASED LINE
(MASTER LOCATION ONLY)

LEASED LINE TERMINAL BLOCK (MASTER LOCATION ONLY)

CIR.#1 CIR.#2 CIR.#3 CIR.#4 CIR.#5 CIR.#6 SPARES SPARES
TIP RING TIP RING TIP RING TIP RING TIP RING TIP RING

INTER-CONNECT TERMINAL BLOCK

LOOP DET. #1 DET. #2 DET. #3 DET. #4 DET. #5 DET. #6 DET. #7 DET. #8

SYSTEM DETECTOR TERMINAL BLOCK

SYSTEM LOOP DET. #1 DET. #2 DET. #3 DET. #4 DET. #5 DET. #6 DET. #7 DET. #8

SYSTEM DETECTOR TERMINAL BLOCK

CAB. VENT. DOOR OPEN MAN. CONT. MAN. FLASH SPARE FUNC.#1 SPARE FUNC.#2
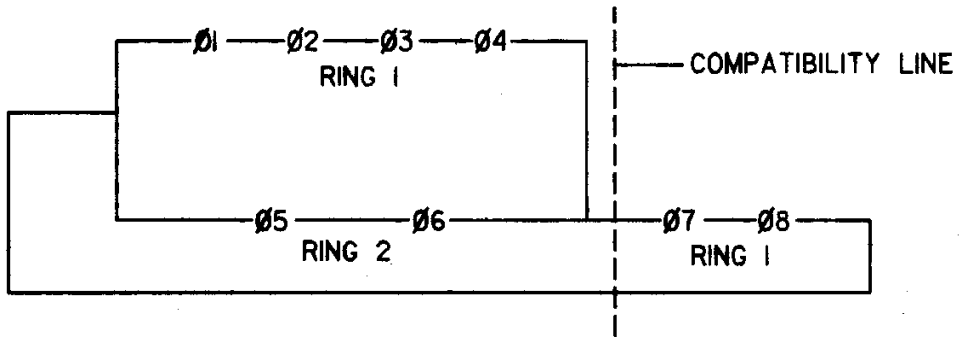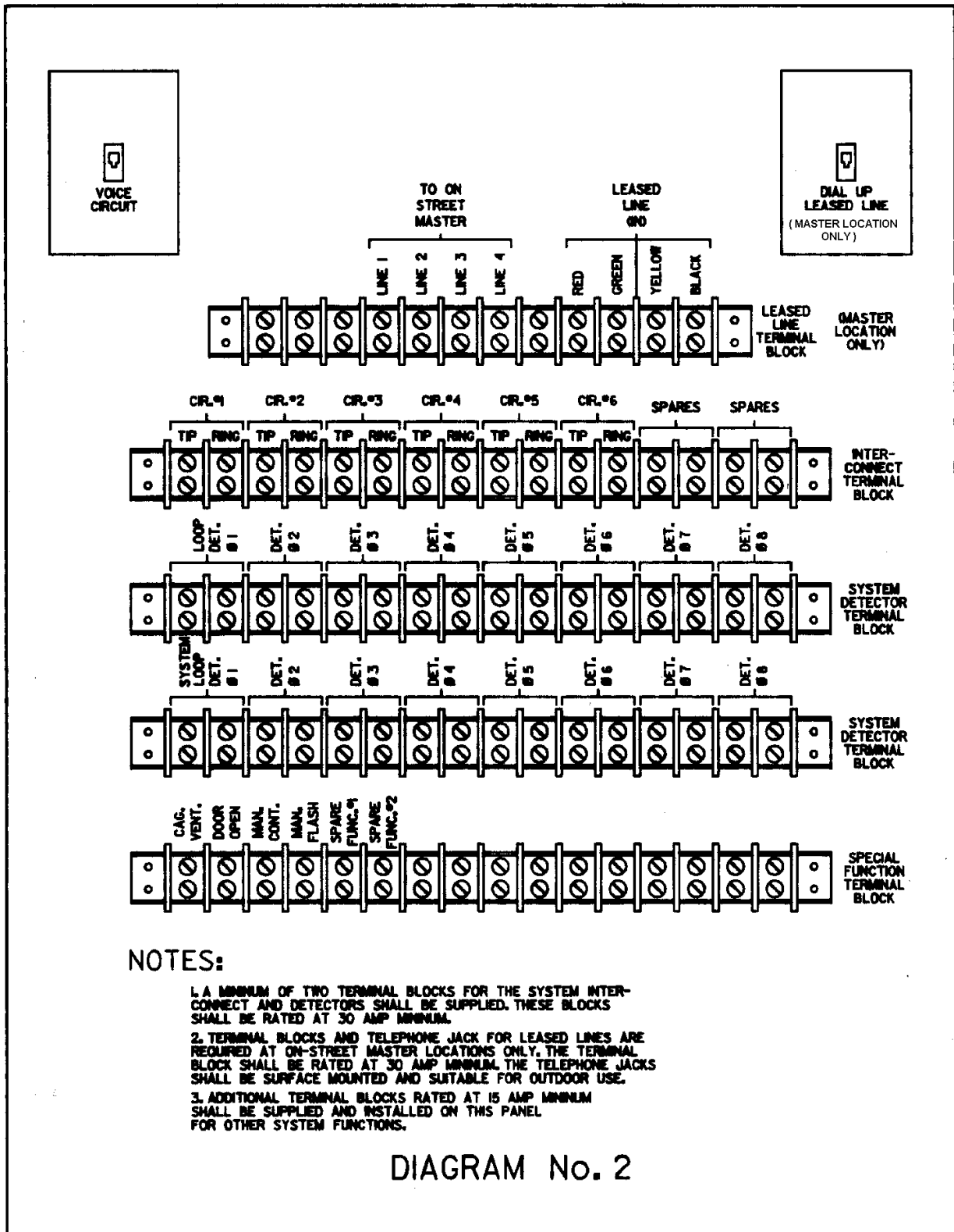
SPECIAL FUNCTION TERMINAL BLOCK

NOTES:

1. A MINIMUM OF TWO TERMINAL BLOCKS FOR THE SYSTEM INTER-CONNECT AND DETECTORS SHALL BE SUPPLIED. THESE BLOCKS SHALL BE RATED AT 30 AMP MINIMUM.

2. TERMINAL BLOCKS AND TELEPHONE JACK FOR LEASED LINES ARE REQUIRED AT ON-STREET MASTER LOCATIONS ONLY. THE TERMINAL BLOCK SHALL BE RATED AT 30 AMP MINIMUM. THE TELEPHONE JACKS SHALL BE SURFACE MOUNTED AND SUITABLE FOR OUTDOOR USE.

3. ADDITIONAL TERMINAL BLOCKS RATED AT 15 AMP MINIMUM SHALL BE SUPPLIED AND INSTALLED ON THIS PANEL FOR OTHER SYSTEM FUNCTIONS.

DIAGRAM No. 2

SILK SCREEN PRINTS IDENTIFYING
INPUTS AND OUTPUTS OF
PEDESTRIAN AND VEHICLE LOAD SWITCHES

FRONT VIEW

**PEDESTRIAN
LOAD SWITCH**

115
VAC
D W
OUT
NO
CONN
WALK
OUT
24V
DC
AC
COM

CHAS
GND
NO
CONN
D W
IN
NO
CONN
WALK
IN
NO
CONN

FRONT VIEW

**VECHICLE
LOAD SWITCH**

115
VAC
RED
OUT
YEL
OUT
GREEN
OUT
24V
DC
AC
COM

CHS
GND
NO
CONN
RED
IN
YEL
IN
GREEN
IN
NO
CONN

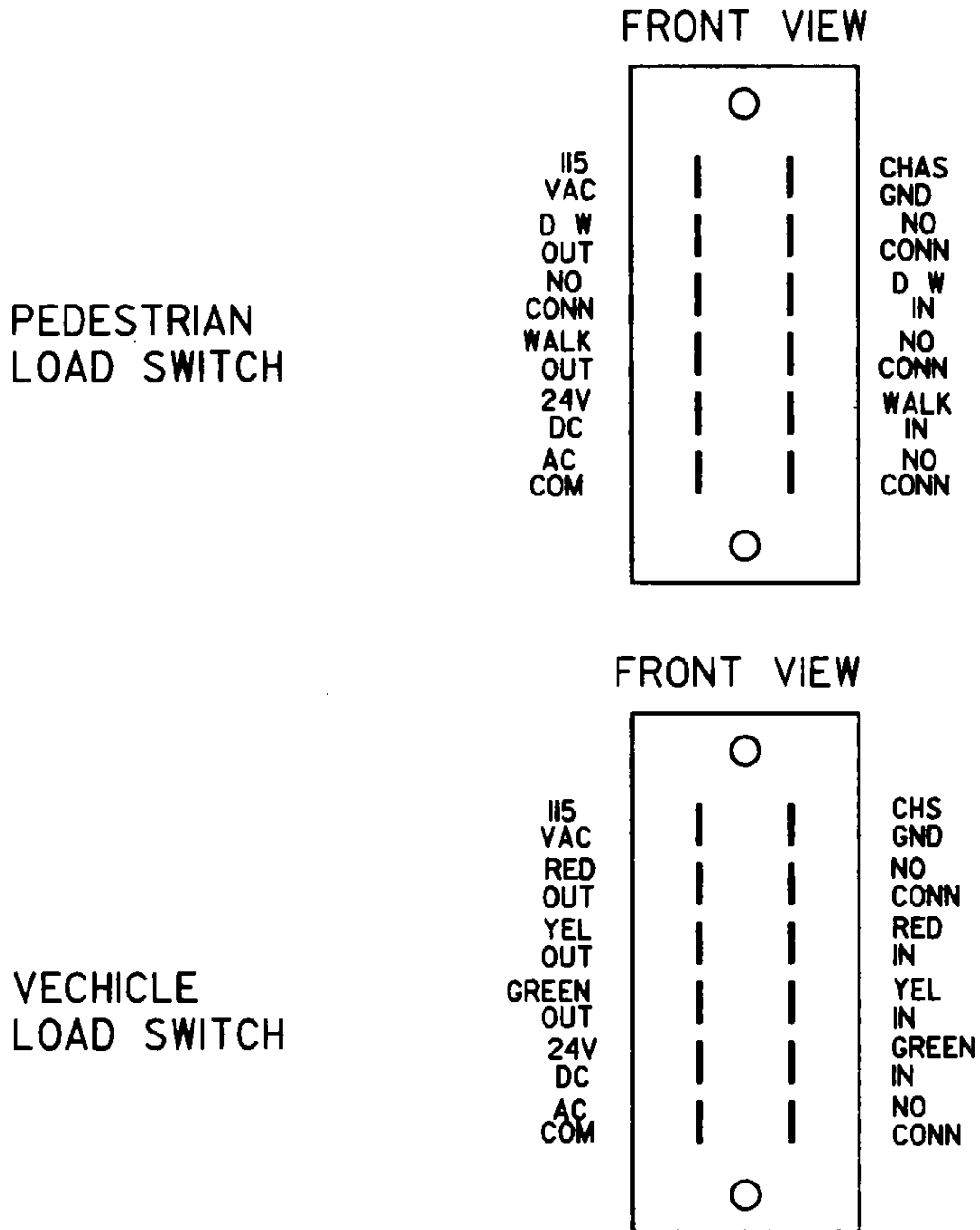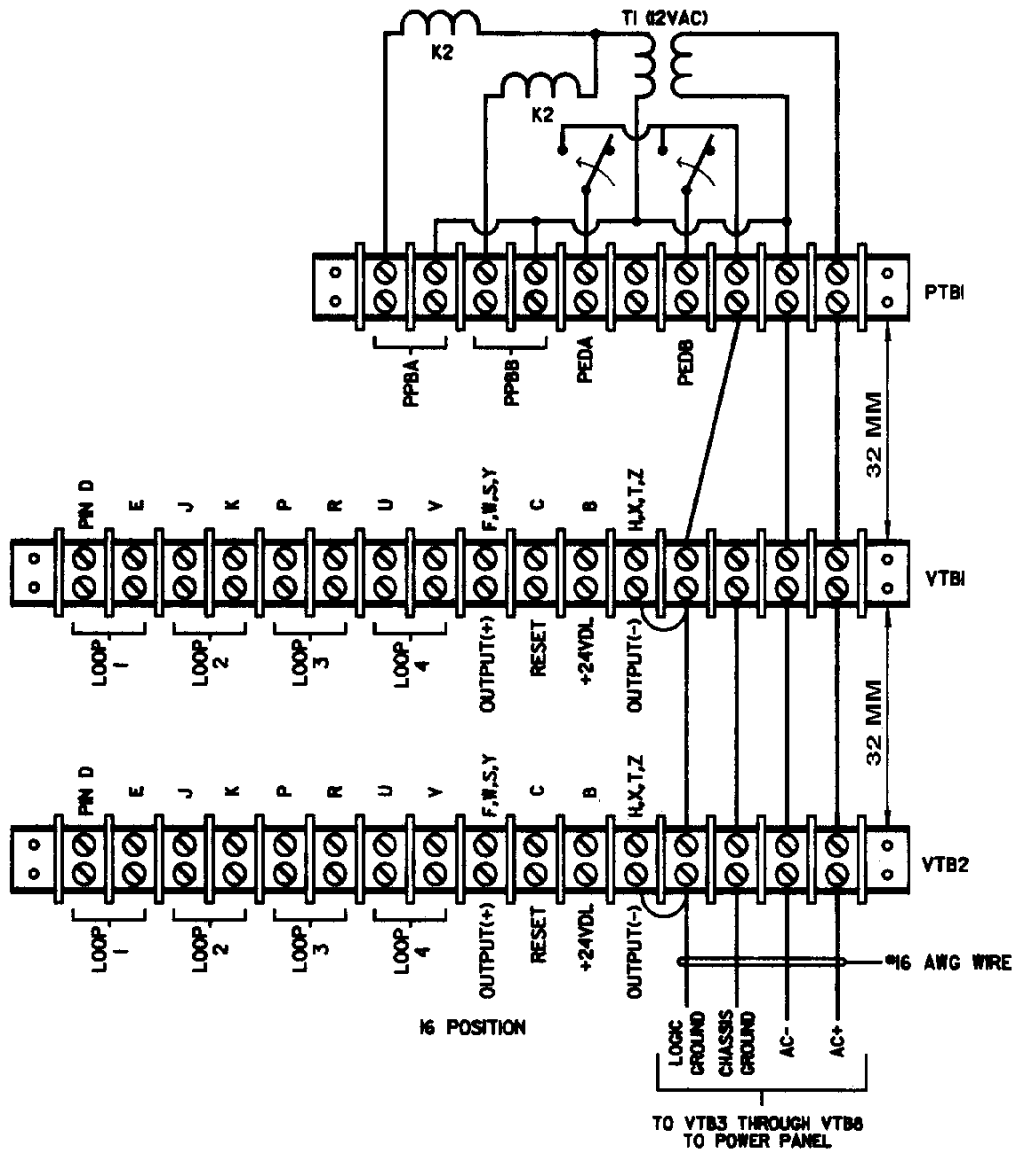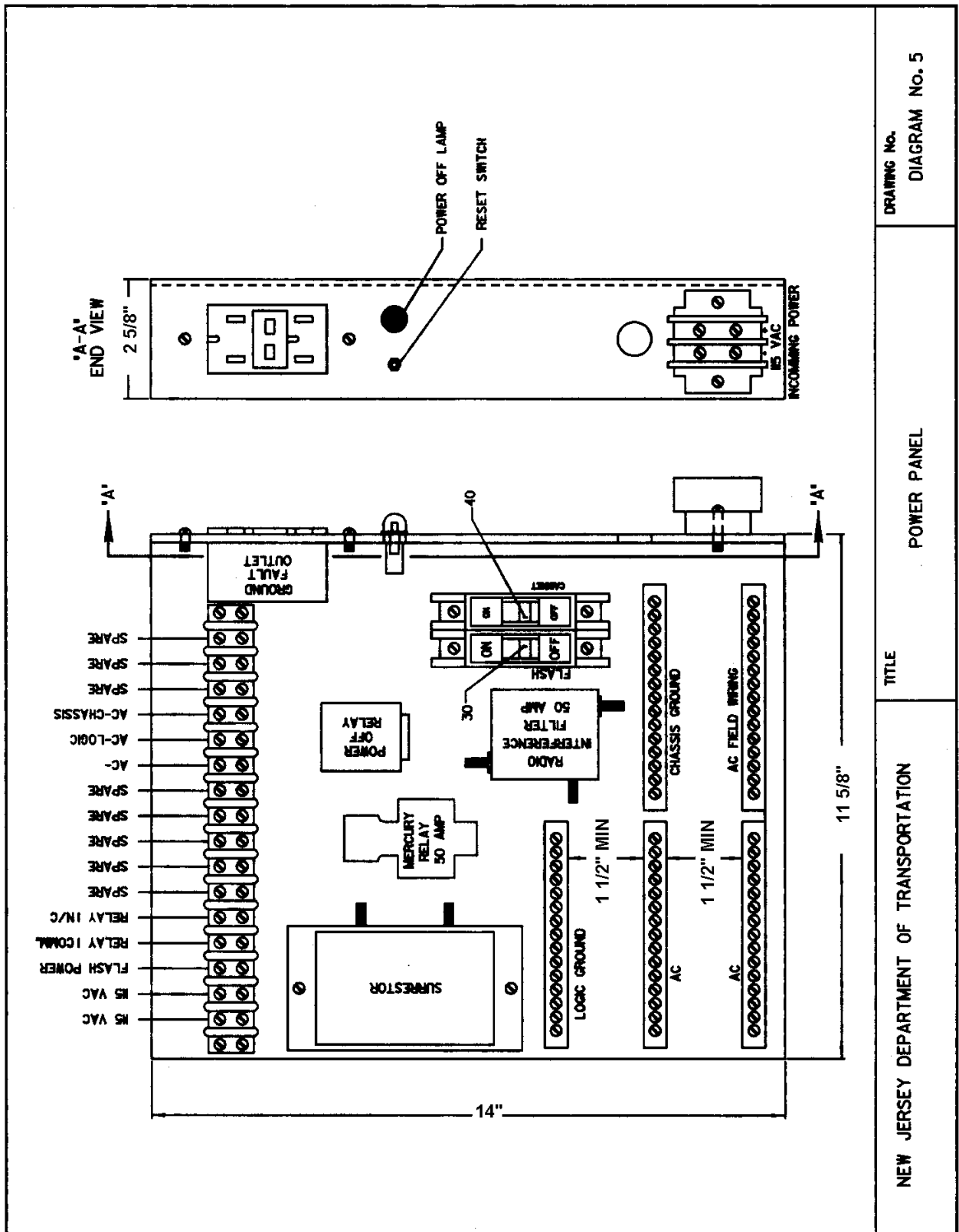## DIAGRAM No. 3

DETECTOR PANEL

NOTES:

1. A MINIMUM OF 8 VEHICLE DETECTOR TERMINAL BLOCKS SHALL
   BE SUPPLIED. THESE BLOCKS SHALL BE RATED AT 30 AMP MIN.

2. TWO GROUND BARS WITH BRASS TERMINAL BOLTS CAPABLE OF
   HANDLING #10 WIRES AND HAVING A MINIMUM OF 12 TERMINAL CONNECTING
   POINTS SHALL BE PROVIDED BELOW THIS PANEL FOR SPARE FIELD WIRES.

DIAGRAM No. 4
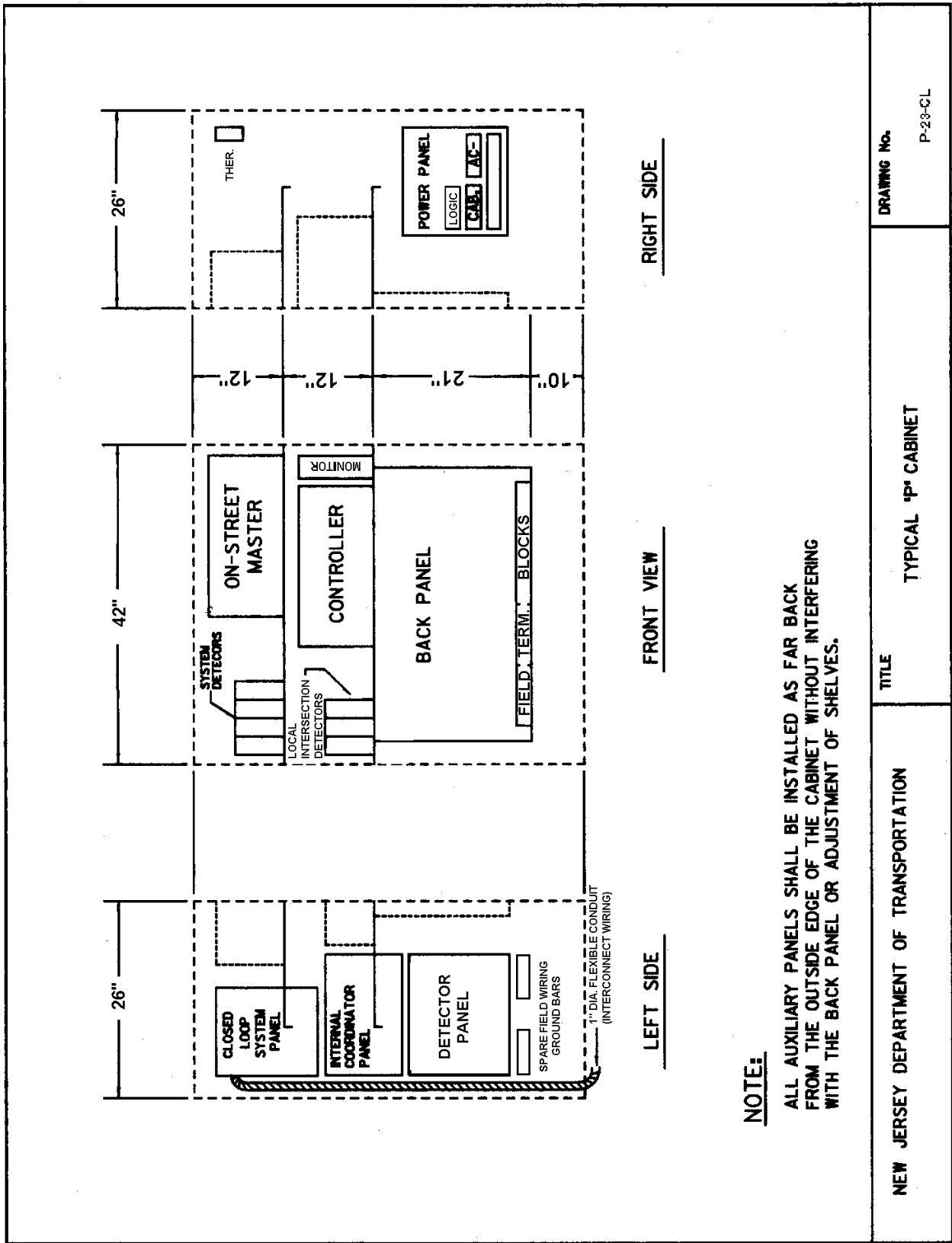
POWER OFF LAMP
RESET SWITCH

"A-A"
END VIEW
2 5/8"

115 VAC
INCOMING POWER

"A"

"A"

GROUND
FAULT
OUTLET

CABINET

FLASH

ON

OFF

40

30

POWER
OFF
RELAY

RADIO
INTERFERENCE
FILTER
50 AMP

MERCURY
RELAY
50 AMP

SURRESTOR

SPARE
SPARE
SPARE
AC-CHASSIS
AC-LOGIC
AC-
SPARE
SPARE
SPARE
SPARE
SPARE
RELAY 1N/C
RELAY 1COMM.
FLASH POWER
115 VAC
115 VAC

CHASSIS GROUND

AC FIELD WIRING

LOGIC GROUND

AC

AC

1 1/2" MIN

1 1/2" MIN

11 5/8"

14"

DRAWING No.
DIAGRAM No. 5

TITLE
POWER PANEL

NEW JERSEY DEPARTMENT OF TRANSPORTATION

RIGHT SIDE

FRONT VIEW

LEFT SIDE

THER.

POWER PANEL
LOGIC
CAB.
AC

ON-STREET MASTER

CONTROLLER

MONITOR

BACK PANEL

FIELD TERM. BLOCKS

SYSTEM DETECTORS

LOCAL INTERSECTION DETECTORS

CLOSED LOOP SYSTEM PANEL

INTERNAL COORDINATOR PANEL

DETECTOR PANEL

SPARE FIELD WIRING GROUND BARS

1" DIA. FLEXIBLE CONDUIT (INTERCONNECT WIRING)

26" 42" 26"

12" 12" 21" 10"

NOTE:

ALL AUXILIARY PANELS SHALL BE INSTALLED AS FAR BACK FROM THE OUTSIDE EDGE OF THE CABINET WITHOUT INTERFERING WITH THE BACK PANEL OR ADJUSTMENT OF SHELVES.

NEW JERSEY DEPARTMENT OF TRANSPORTATION

TITLE   TYPICAL "P" CABINET

DRAWING No.   P-23-CL

SCREENED VENT
SEE NOTE #9

MINIMUM DIMENSIONS
OF CABINET

STN. STL. HINGE & PIN
SEE NOTE #7

MIN.

42"
MIN.

26"
MIN.

SEE NOTE #6   SEE NOTE #3
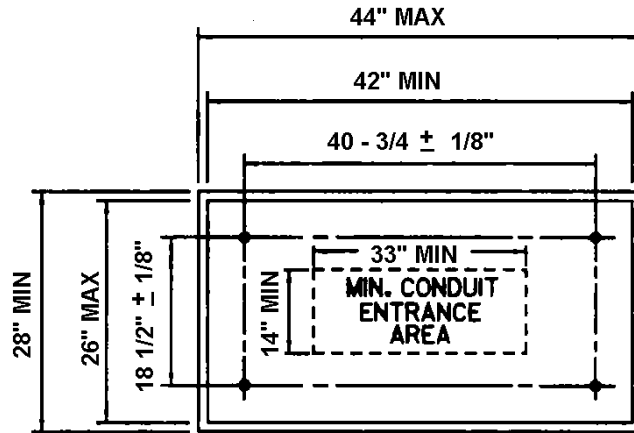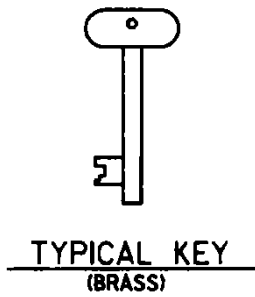VENTS

NOTES:

1. CABINET SHALL BE FABRICATED OF 1/8" THK. ALUM. THE CABINET TO BE MOUNTED WITH THE ANCHOR BOLT CONFIGURATIONS SHOWN. IF BASE ADAPTER PLATES ARE USED THEY SHALL BE 1/4" THK. ALUM. AND SHALL BE CONSTRUCTED TO MEET THE MINIMUM CONDUIT ENTRANCE AREA.

2. EACH DOOR SHALL BE FITTED WITH A GASKET TO INSURE DUST TIGHT & WEATHERPROOF PROTECTION UNDER ALL WEATHER CONDITIONS.

3. MANUAL CONTROL WEATHERPROOF MOMENTARY CONTACT SWITCH CONNECTED TO 6 ft REINFORCED CORD STORED IN RECESS BEHIND SMALL DOOR IN LARGE DOOR.

4. INSTALL TWO ADJUSTABLE SHELVES.

5. SMALL DOOR SHALL BE SECURED WITH A SUB-TREASURY LOCK #0357S AND KEYED ALIKE FOR #10 AS MANUFACTURED BY THE AMERICAN HARDWARE CO. NEW BRITIAN, CONN. THE SHANK LENGTH OF KEY SHALL BE AS SHOWN. PROVIDE (2) KEYS.

6. LARGE DOOR SHALL BE SECURED WITH A CCL LOCK #15481RS WITH A MATCH #2 KEY TO BE SUPPLIED TO NEW JERSEY DEPARTMENT OF TRANSPORTATION. FOR DOOR AND LOCK DETAILS, SEE SHEET 2 OF 2.

7. WITH THE EXCEPTION OF LARGE DOOR LOCK DETAILS, ALL CABINET DIMENSIONS ARE APPROXIMATE.

8. THE LARGE DOOR MUST BE SECURED AT THE TOP AND BOTTOM OF THE CABINET BY A LOCKING BAR.

9. ALUMINUM VENT WITH SCREEN SHALL BE INSTALLED UNDER FRONT LIP ABOVE DOOR.

10. THERMOSTAT TO BE INSTALLED IN TOP OF CABINET.

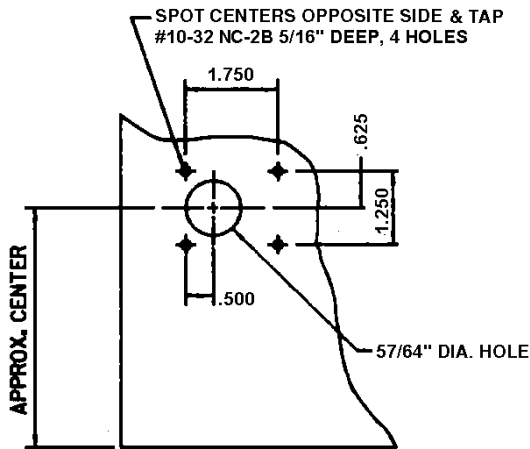11. THE MAIN DOOR HANDLE SHALL ROTATE INWARD.

NEW JERSEY DEPARTMENT OF TRANSPORTATION	
TITLE CONTROLLER CABINET TYPE "P" FOR FOUR AND EIGHT PHASE CONTROLLER	
SHEET 1 OF 2	DRAWING No. P-21

TYPICAL KEY
(BRASS)

44" MAX
42" MIN
40 - 3/4 ± 1/8"
28" MIN
26" MAX
18 1/2" ± 1/8"
14" MIN
33" MIN
MIN. CONDUIT ENTRANCE AREA

ANCHOR BOLT SLOT LOCATIONS

SPOT CENTERS OPPOSITE SIDE & TAP
#10-32 NC-2B 5/16" DEEP, 4 HOLES
1.750
.625
1.250
.500
APPROX. CENTER
57/64" DIA. HOLE

DOOR LOCK DETAIL

FIELD TERMINAL BLOCK
50 AMP., HIGH TYPE BARRIERS
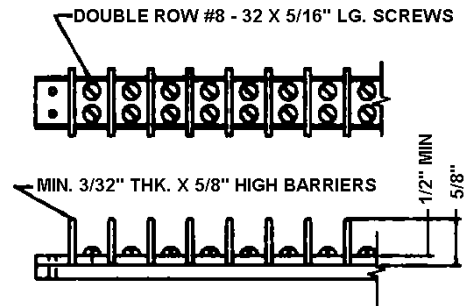
DOUBLE ROW #8 - 32 X 5/16" LG. SCREWS

MIN. 3/32" THK. X 5/8" HIGH BARRIERS
1/2" MIN
5/8"

NEW JERSEY DEPARTMENT OF TRANSPORTATION	
TITLE CONTROLLER CABINET TYPE "P" FOR FOUR AND EIGHT PHASE CONTROLLER	
SHEET 2 OF 2	DRAWING No. P-21