FHWA REGION NO.	STATE	PROJECT NO.	YEAR	SHEET NO.	TOTAL SHEETS
7	KANSAS	87N 0064-01	1997	90	130

TRAFFIC SIGNAL EQUIPMENT

01. TYPE 170 TRAFFIC SIGNAL CONTROLLER SYSTEM

Each Type 170 Traffic Signal Controller System shall meet the applicable specifications detailed in FHWA-IP-78-16 "Type 170 Traffic Signal Controller System - Hardware Specifications" as well as the additional requirements noted below:

A. Controller Unit

The Model 170 controller unit shall contain a single MPU with at least 2K of RAM memory on a separate board apart from the Input/Output logic board.

Output interface - The output interface shall consist of a minimum of 80 bits of buffered storage. Output data shall be latched at the time of writing from the MPU. This interface shall provide an NPN open collector output capable of driving up to 40 volts DC and sinking up to 100 milliamperes. A logic state one from the MPU shall be presented as a grounded collector (0 to 2 volts), and a logic state zero presented as an open circuit. Once a port is written into, the data will remain present and stable until either another port is written into it, or until the power is turned off. The state of these output ports at the time of power up or power down shall be an open circuit.

Provide adjustable AC threshold voltage indicator on power supply.

All IC's integral to controller unit shall be socket mounted.

The Model 170 controller shall include a Model 412B2 System memory module of same manufacturer as specified in Traffic Signal Control Equipment Specifications published by the California Business, Transportation and Housing Agency, Department of Transportation (Caltrans), January, 1989 edition. The specifications are available from the Caltrans Publication Unit, telephone (916) 445-3520. The Model 412 System Memory Module shall include lithium cell for backup power to retain data in the volatile RAM devices. The lithium cell shall be replaceable and switched to disconnect cell while module is not in use. Switch to be accessible without removing system memory module. The Model 412 System Memory Module to be provided with WAPITI Micro Systems W4IKS Program (latest revision) on 27256 EPROM.

B. Conflict Monitor

The Model 210 conflict monitor(s) supplied shall meet requirements outlined in Chapter 3 of the Traffic Signal Control Hardware Specifications detailed in FHWA-IP-78-16 published by the Federal Highway Administration and dated December, 1978, and the following requirements:

1. Any dark signal head (that is, loss of signal output to field terminals) shall cause the monitor to trip.

2. Any yellow time less than 2.8 seconds shall cause the monitor to trip.

3. The green, yellow and red indications for each phase shall be brought into the monitor individually and shall be monitored separately with respect to a loss of signal on any of the three inputs per channel.

4. The monitor shall have the required circuitry to allow the early detection of a conflict caused by a green or yellow signal "hang up" (that is, any green or yellow output which shall remain on when the controller has transferred to a yellow or all red output) by starting the fault timers as soon as yellow appears with the corresponding green still energized. The monitor shall not wait until a conflicting green is displayed to time the conflict. This shall preclude the presentation of a conflicting signal display at the intersection.

5. During the "all red" clearance period (if used), the monitor shall check all inputs for faulty signal display and shall react to these faulty indications during the all red clearance period.

   Since during this period the only inputs that should be active would be the reds, the monitor shall detect any faults such as red/green, red/yellow, green/yellow and green/red/yellow.

6. The monitor shall be capable of monitoring for incorrect signals applied at the field terminals of each vehicular movement (green, yellow, red). Should a voltage be present on more than one, or none, of the inputs (green, yellow, red) of a channel, the unit shall begin timing the duration of this condition. If this condition exists for less than 700 milliseconds, the unit shall not trigger. If this condition exists for 700 milliseconds or more, but less than 1,000 milliseconds, the unit may or may not trigger.

7. When the unit triggers, it shall cause the output relay contacts to transfer. These contacts shall remain in this state until the unit is reset by the activation of the panel control, or the activation of the external reset input. Power interruption shall not reset the conflict monitor when it has been triggered by detection of a faulty load switch output.

8. The minimum indicators shall be as follows:

   a. Power - shall be illuminated when the 24VDC input from the controller is present and the AC+ is applied to the monitor.

   b. Watch Dog Error - shall illuminate when the monitor detects a watch dog error.

   c. Conflict - shall illuminate when a conflict has been detected by the monitor.

   d. Red Failure - shall illuminate when a red failure has been detected by the monitor.

   e. Switch Fail - shall illuminate when a faulty load switch has been detected by the monitor.

   f. PCA - shall illuminate when the program board if not installed or is not installed properly.

   g. PIAF - shall illuminate when the unit has detected a failure and then experiences a power interruption.

   h. The monitor shall include signal status indicators. These indications (one per channel) shall illuminate when a proceed signal is present on the corresponding channel during normal operation. If the unit trips due to a conflict, the signal status shall lock up, displaying the status of each channel at the time the conflict occurred. Should the monitor trip due to the absence of red or a faulty load switch output, the signal status indicators shall display the channel (channels) which is (are) at fault.

   i. Yellow - shall illuminate when a short yellow time has been detected.

9. If the monitor detects a load switch fault condition, the switch failure indicator shall be illuminated and the signal status indicators will display the exact channel of the load switch that failed.

10. The red inputs shall be brought into the monitor via a front panel connector.

11. The Red Enable shall be brought into the monitor via the same front panel connector as the red inputs.

12. A Red Interface Adapter shall be wired in and tested. Red interface block to be programmable without the use of tools or the lowering of any access panels.

13. Conflict monitor to be capable of monitoring four (4) red, yellow and green outputs from the Model 420 auxiliary output file.

14. Communications software shall be compatible with W4IKS software.

C. Detectors

The Model 222 Two-Channel Loop Detector as specified in Chapter 4 FHWA-IP-78-16 shall provide for a "failsafe" continuous output in response to an open loop or open lead-in wire.

Each detector unit shall provide sixteen sensitivity settings via thumbwheel switches.

Each detector unit shall be provided with a test switch position to verify loop system integrity. The open loop test position shall indicate a previous fault via the front panel indicator. **The memory shall remain intact and can be queried repeatedly. Existing detections shall not be reset and the memory shall only be reset by removing and reinserting the detector unit.**

Each detector unit shall provide for selection of delay time of 0 to 30 seconds in 2.0 second increments and/or extension time of 0 to 7 1/2 seconds in 0.5 second increments or off if no timing is desired.

Each timer (delay and extension) shall be provided with buffer circuitry to enable or disable the timer based on an external signal output. Each channel shall include an external input to gate the timing. Provide for cross-talk elimination with only one channel on at a time while scanning.

D. Controller Cabinet

The Model 332B Cabinet and Model 336A Cabinet cabinets shall meet the applicable specifications detailed in the Caltrans Specifications* as well as additional requirements that follow. The cabinets shall be unpainted natural aluminum. The output file must be capable of flashing all 8 phases red or yellow. The three-point locking mechanism shall be fabricated so that it may be actuated by rotating a removable 5/8 inch hex key. The hex socket and locking cam shall rotate on a 3/4 inch minimum diameter shaft.

The socket and shaft shall be field-replaceable with common tools. The socket head shall be protected from being rotated with a pipe wrench or similar tool. One aluminum hex wrench shall be provided with each cabinet.

The cabinet assembly shall be provided with a Power Distribution Assembly (PDA) number 2 and the circuit option (Section 6.4.3.9 of the Caltrans Specifications*).

All #8 conductors from service panel (TBS) and mercury contactor to signal bus and main equipment bus shall be 133 strand #29 AWG electronic hook-up wire.

A hybrid power line surge protection device such as the EDCO Surrestor SHA-1210 or equal shall be furnished in each controller cabinet. The protector shall be installed between the applied line voltage and earth ground. The surge protector shall be capable of reducing the effects of transient voltages apllied to the AC line. The protector shall be mounted inside the PDA#2. The Equipment Line Out shall provide filtered power to the controller, 24 VDC power supply, input file and conflict monitor through shielded cable or twisted pair to the units AC plus and AC minus inputs.

The protector shall include the following features and functions:

Maximum AC line voltage: 140 VAC.

Twenty pulses of peak current, each of which will rise in 8 microseconds and fall in 20 microseconds to one-half the peak: 20,000 Amperes.

The protector shall be provided with the following terminals:

Main line (AC Line first stage terminal).

Main Neutral (AC Neutral input terminals).

Equipment Line Out (AC Line second stage output terminal, 10 Amps.).

Equipment Neutral Out (Neutral terminal to protected equipment).

GND (Earth connection).

The Main AC line in and the Equipment Line out terminals shall be separated by a 200 Microhenry (minimum) inductor rated to handle 10 Amp AC Service.

The first stage clamp shall be between Main Line and Ground terminals.

The second stage clamp shall be between Equipment Line Out and Equipment Neutral.

Each cabinet shall be furnished with a communications terminal block, C2P harness and connector, voice jack harness, and voice jack, conforming to the requirements detailed in the Caltrans Specifications*.

TBO/Communications Termination Block - This terminal block will serve as the termination block for the communication conductors, overvoltage protection devices, and the termination points for the C2P harness and conductors. Install over voltage protection ground bus and hard wire to eqipment ground bus with #8AWG wire.

C2P Harness and Connector - A four-conductor, jacketed cable shall be attached to the terminal block with locking spade lugs. The cable shall terminate in a standard C2P connector and shall be routed through the cabinet and be of sufficient length to reach the C2S connector on the back of the 170 controller unit when the unit is installed in the equipment rack.

Voice Jack Harness - A two-conductor twisted, jacketed cable shall be attached to the terminal block with locking spade lugs. The cable shall be routed to the voice jack.

Voice Jack - A voice communications jack shall be installed with solder lugs extending out of the side of the jack housing and shall have a cover.

Each terminal on output terminal blocks to be marked as per phase function.

Jumper I 13-K to I 13-E to I 12-E to I 12-K to I 16-2.

Provide Fiberglas disposable filters in lieu of metal filters.

The lifting eyes shall be removable.

Interchangeability of the Isolation Relay and Logic Relay shall not be possible.

Flash blocks to be accessible without lowering or opening any service panels and marked as per phase.

Red interface adapter to be programmable without tools.

NO.	DATE	REVISIONS	BY	APP'D
3				
2				
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KANSAS DEPARTMENT OF TRANSPORTATION

ADDITIONS TO TRAFFIC SIGNAL SPECIFICATIONS

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SHEET NO. OF	SCALE	APP'D	
DESIGNED	DETAILED	QUANTITIES	TRACED
DESIGN CK.	DETAIL CK.	QUAN. CK.	TRACE CK.