SECTION 685-19

TELEMETRY RECEIVER
(EMERGENCY VEHICLE PREEMPTION RECEIVER)

Optically Activated Data-Encoded Traffic Signal Priority Control System

685-19.1 SYSTEM DESCRIPTION:

The Emergency Vehicle Preemption Receiver shall be the same make and model number that the City of Tallahassee has installed within Tallahassee / Leon County. That is all functions electrically, physical size and type of hardware utilized shall be identical to that currently in use.

The required priority control system shall employ data-coded optical communication to identify the presence of designated priority or probe vehicles. A record of the vehicle by classification and identification number shall be created. In priority vehicle mode, the data-encoded optical communication shall request the traffic signal controller to advance to and/or hold a desired traffic signal display selected from phases normally available. In the probe vehicle mode, no traffic signal priority shall be requested -- only a record of the probe vehicle's presence is generated.

The priority control system shall consist of a matched system of optical emitters, optical detectors, optical detector cable, phase selectors and system software.

The emitter shall generate an infrared, data-coded optical signal. The optical signal shall be detected and recognized by the optical detectors at or near the intersection over a line-of-sight path of up to 762 meters (2,500 feet) under clear atmospheric conditions. The phase selector shall process the signal from the detector to ensure that the signal (1) has the proper base frequency, (2) is correctly data-encoded and (3) is within user-settable range. If these conditions are met, the phase selector shall determine by the data-encoded message whether to (1) generate a priority control request for the approaching priority vehicles and to record the presence of those vehicle(s) by classification and identification number or (2) to record the presence of an approaching probe vehicle(s) by classification and identification number.

The system shall require no action from the vehicle operator other than to turn it on. The system shall operate on a first-come, first-served basis. Higher priority request shall override lower priority request. The system shall interface with most traffic signal controllers with compromising normal operation or existing safety provisions.

685-19.2 MATCHED SYSTEM COMPONENTS:

The required priority control data-encoded optical communications system shall be comprised of five basic matched components: (1) optical emitter, (2) optical detector, (3) optical detector cable, (4) phase selector and (5) system software. To ensure system integrity, operation and compatibility, all components shall be from the same manufacturer. The system shall offer compatibility with most signal controllers, e.g., NEMA (National Electrical Manufacturer Association) and the 170 family of controllers. Interfacing to a controller may require the use of an interface card.

(a) Data-Encoded Emitter --- The data-encoded emitter shall trigger the system. It shall send the infrared signal to the detector and shall be located on the priority probe vehicle.

(b) Optical Detector --- The optical detector shall change the infrared signal to an electrical signal. It shall be located at or near the intersection and shall send the electrical signal via the optical cable to the phase selector.

(c) Optical Detector Cable --- The optical detector cable shall carry the electrical signal from the detector to the phase selector.

(d) Phase Selector --- The phase selector shall accommodate data-encoded communication and shall validate, identify, classify and record the signal from the detector. It shall be located within the traffic signal controller cabinet at the intersection and shall request the controller to provide priority to the requesting vehicle and to record the presence of either a priority or probe vehicle.

(e) System Software --- The system software shall be a Windows ™ compliant program. It shall support the system configuration and gathering of operational information.

685-19.3 SYSTEM COMPONENT SPECIFICATIONS

(a) OPTICAL DETECTOR:

(1) The required optical detector shall be a lightweight, weatherproof device capable of sensing and transforming pulsed optical energy into electrical signals for use by the phase selection equipment.

(2) The optical detector shall be designed for mounting at or near an intersection on mast arms, pedestals, pipes or span wires.

(3) Each optical detector shall be supplied with mounting hardware to accommodate installation on mast arms. Additional hardware shall be available for span wire installations.

(4) The optical detector design shall include adjustable tubes to enable their reorientation for span wire mounting without disassembly of the unit.

(5) The optical detector shall accept signals from one or two directions and shall provide single or dual electrical output signal(s).

(6) The optical detector shall be available in three (3) configurations:

(a) Uni-directional with one output channel.

(b) Bi-directional with one output channel.

(c) Bi-directional with two output channels.

(7) The optical detector shall allow aiming of the two optical sensing inputs for skewed approaches or slight curves.

(8) The optical detector shall have a built-in terminal block to simply wiring connections.

(9) The optical detector shall receive power from the phase selector and shall have internal voltage regulation to operate from 16 to 40 volts DC.

(10) The optical detector shall respond to a clear lens data-coded optical emitter at a distance of 762 meters (2,500 feet) under clear atmospheric conditions. If the emitter is configured with a visible light filter, the detector shall respond at a distance of 549 meters (1,800 feet) under clear atmospheric conditions. The noted distances shall be comparable to day and night.

(11) The optical detector shall deliver the necessary electrical signal to the phase selector via an optical detector cable up to 305 meters (1,000 feet) in length.

(b) OPTICAL DETECTOR CABLE:

(1) The optical detector cable shall deliver sufficient power from the phase selector to the optical detector and shall deliver the necessary quality signal from the detector to the phase selector over a non-spliced distance of 305 meters (1,000 feet).

(2) The cable shall be of a durable construction to satisfy the following installation methods:

(a) Direct burial.

(b) Conduit and mast arm pull.

(c) Exposed overhead (supported by messenger wire).

(3) The outside diameter of the optical detector cable shall not exceed 7.62 millimeters (0.3 inches).

(4) The insulation rating of the optical detector cable shall be 600 volts minimum.

(5) The temperature rating of the optical detector cable shall be +75º C (+167º F) minimum,
(6) The conductors shall be shielded with an aluminized polyester and have an AWG # 20 (7 x 28) stranded and individually tinned drain wire to provide signal integrity and transient protection.

(7) The optical detector cable shall have four conductors of AWG # 20 (7 x 28) stranded individually tinned copper, color-coded insulation as follows:

(a) Orange for delivery of optical power (+).

(b) Drain wire for optical detector power return (-).

(c) Yellow for optical detector signal # 1.

(d) Blue for optical detector signal # 2.

(8) The characteristic impedance of the detector cable shall be:

0.6 ohms / 305 meters (1,000 feet)

14.3 µF / 305 meters (1,000 feet)

(9) The shield wrapping shall have a 20% overlap to ensure shield integrity following conduit and mast arm pulls.

(c) PHASE SELECTOR:

(1) The phase selector shall be designed to be installed in the traffic signal controller cabinet and shall accommodate data-encoded signals. It shall be intended for use directly with numerous controllers to include the California/New York Type 170 family of controllers with compatible software, NEMA controllers and other controllers along with the system chassis and suitable system interface equipment and controller software.

(2) The phase selector shall be a plug-in, two or four channel, multiple-priority device intended to be installed directly into a card rack located within the controller cabinet.

(3) The phase selector shall be powered from 115 volt (95 to 135 volts AC), 60 Hz mains and shall contain an internal, regulated power supply that supports up to twelve optical detectors.

(4) Programming the phase selector and retrieving the data stored in it shall be accomplished by using an IBM PC-compatible computer and the system interface software. The connection can be made either directly, via the computer's communication (COM) port, or remotely via a modem. The communication port on the phase selector shall be an RS232 interface located on the front and back of the unit.

(5) The phase selector shall have capability of storing up to 1000 of the most recent priority control calls. When the log is full, the phase selector shall drop the oldest entry to accommodate the new entry. The phase selector shall store the record in non-volatile memory and shall retain the record is power terminates. Each record entry shall include nine points of information about the priority call, as follows:

(a) Classification: Indicates the type of vehicle.

(b) Identification number: Indicates the unique ID number of the vehicle.

(c) Priority level: Indicates whether Command or Advantage priority, or Probe frequency is requested by the vehicle.

(d) Direction: Channel A, B, C or D; Indicates the vehicle's direction of travel

(e) Call duration: Indicates the total time in seconds the priority status is active.

(f) Final greens at end of call: Indicates which phases are green.

(g) Duration of final greens: Indicates the total time of priority greens.

(h) Time and date call ended: Indicates the time a priority status ended, Provided in second, minute, hour, day, month and year.

(i) Maximum signal intensity: Indicates the strongest signal intensity measured by the phase selector during the call.

(j) Priority output active: Indicates if the phase selector requested priority from the controller for the call.

(6) The phase selector will include several control timers that will limit or modify the duration of a priority control condition, by channel, and can be programmed from a PC-type computer. The control timers shall be as follows:

(a) MAX CALL TIME: Will set the maximum time a channel is allowed to be active. It will be settable from 120 to 65,535 seconds in one-second increments. Its factory default must be the maximum time.

(b) CALL EXTENSION TIME: Will set the time a call is held on a channel after the priority signal is no longer being received. It will be settable from one to 255 seconds in one-second increments. Its factory default must be six seconds

(c) CALL DELAY TIME: Will set the time a call must be recognized before the phase selector activates the corresponding output. It will be settable from zero to 255 seconds in one-second increments. Its factory default must be zero seconds.

(7) The phase selector's default values shall be re-settable by the operator using an IBM PC-compatible computer, or manually using the switches located on its front.

(8) The phase selector shall be capable of three (3) levels of discrimination of data-encoded optical signals, as follows:

(a) Verification of the presence of the base optical signal of either 14.03509 Hz ±0.01773 Hz for Command priority, 9.63855 Hz ±0.00836 Hz for Advantage priority or 11.25870 ±0.01141 Hz for Probe frequency.

(b) Determination of when the vehicle is within the predetermined range.

(c) Validation of the optical signal data-encoded pulses.

(9) The phase selector's card edge shall include primary optical detector inputs and power outputs. Two additional detector inputs per channel shall be provided on a from panel connector.

(10) The phase selector shall include one opto-isolated NPN output per channel that provides the following electrical signal to the appropriate pin on the card edge connector:

(a) 6.25 Hz ±0.1 Hz 50% on/duty square wave in response to an Advantage priority call.

(b) A steady ON in response to a Command priority call.

(11) The phase selector shall accommodate three (3) methods of setting the high and low priority optical sensitivity (emitter range):

(a) Using an encoded emitter with range-setting capability.

(b) Using any optical emitter by manipulating the front panel switches.

(c) Inputting the information via the communication port.

(12) The phase selector shall have a solid state POWER ON LED indicator that flashes to indicate unit diagnostic mode and illuminates steadily to indicate proper operation.

(13) The phase selector shall have internal diagnostics to test for proper operation. If a fault is detected, the phase selector shall use the front panel LED indicators to display fault information.

(14) The phase selector shall have a Command (High) and Advantage (Low) solid state LED indicator for each channel to display active calls.

(15) The phase selector shall have a test switch for each channel to test proper operation of Command or Advantage Priority.

(16) The phase selector shall properly identify a Command priority with the presence of 10 Advantage priority data-encoded emitter signals being received simultaneously on the same channel.

(17) The phase selector shall have write-on pads to allow identification of the phase and channel.

(18) The phase selector shall provide one isolated confirmation light control output per channel. These outputs are user configurable through software for a variety of confirmation light sequences.

(19) The NEMA model of the phase selector shall have outputs for the control of NEMA controllers that lack internal preemption capability. This function shall be accomplished through the use of Manual Control Enable, Interval Advance and Phase Omit signals.

(20) The phase selector shall have the capability of recording the presence of a vehicle transmitting at the specified Probe frequency. The phase selector shall at no time attempt to modify the intersection operation in response to the Probe frequency.

(21) The phase selector shall have the capability of providing Advantage priority in a mode where the output to the controller is gated or controlled by timing relationships within the controller cycle.

(22) The phase selector shall have the capability to assign a relative priority to a call request within Command or Advantage priority. This assignment is based on the received vehicle ID class.

(23) The phase selector shall have the capability to discriminate between individual ID codes and to all or deny a call output to the controller based on this information.

(24) The phase selector shall have the capability to log call request by unauthorized vehicles.

(25) The phase selector shall have the ability to command an emitter to relay a received code to the next intersection.

(26) The phase selector shall have the capability of functionally testing connected detector circuits and indicating via front panel LED's non functional detector circuits.

(27) The phase selector shall incorporate a precision real time clock synchronized to the utility AC power line frequency

(28) The phase selector shall include an auxiliary interface panel to facilitate interconnections between the phase selector and traffic controller cabinet wiring.

(d) Card Rack:

(1) The required card rack shall provide simplified installation of a phase selector into controller cabinets that do not already have a suitable card rack.

(2) The card rack shall be factory wired to one connector, located under the card slot, and a terminal block, located next to the phase selector slot, on the front of the card rack.

(3) The card rack connector on the front shall provide for all communications to the traffic controller.

(4)The card rack shall provide labeled terminal blocks for connecting the primary optical detectors to a phase selector.

(e) INTERFACE SOFTWARE:

(1) The priority control interface software shall be provide on 3.5 inch, 1.44 MB diskettes to interface with the phase selector. It shall run on most IBM-compatible computers equipped with at least 512 KB Ram, Windows ™ 95 and color VGA display capability.

(2) The priority control interface software shall accommodate:

(a) setting up and presenting user-determined system parameters.

(b) Viewing and changing setting.

(c) Viewing activity screens.

(d) Displaying and/or downloading records of previous activity showing class, code, priority, direction, call duration, final greens at end of call, duration of final greens, time call ended in real time plus maximum signal intensity, (vehicle location information). This information may be used to reconstruct the route taken by a priority (or probe) vehicle to track the vehicle.

(3) The priority control interface software shall accommodate operation via a mouse or via the keyboard, or in combination.

(4) The priority control interface software shall provide menu displays to enable:

(a) setting of valid vehicle ID classes and codes.

(b) Establishing signal intensity thresholds (detection ranges), modem initialization, intersection name and timing parameters.

(c) Setting of desired green signal indications during priority control operation and upload and download capability to view.

(d) Resetting and/or retrieving logged data and priority vehicle activity.

(e) addressing for each card in a multi-drop connected system.

(f) confirmation light configuration.

(g) NEMA Control Parameters.

685-19.4 RELIABILITY

(A) All equipment supplied as part of the optical priority control system intended for use in the controller cabinet shall meet the following electrical and environmental specifications spelled out in the NEMA Standards Publication TS1 - 1983, Part 2:

(1) Line voltage variations per NEMA TS1 -2.1.2.

(2) Power source frequency per NEMA TS1 -2.1.3

(3) Power source noise transients per NEMA TS1 -2.1.6.1.

(4) Power source high energy transients per NEMA TS1 -2.1.6.2.

(5) non-destructive transient immunity per NEMA TS1 -2.1.8.

(6) Input-Output noise immunity per NEMA TS1 -2.1.7.

(7) Temperature range per NEMA TS1 -2.1.5.1.

(8) Humidity per NEMA TS1 -2.1.5.2.

(9) Shock test per NEMA TS1 -2.1.13.

(10) Vibration per NEMA TS1 -2.1.12.

(b) Each piece of equipment supplied as part of the priority control system intended for use in or on priority vehicles shall operate properly across the entire spectrum of combinations of environmental conditions (temperature range, relative humidity, vehicle batter voltage) per the individual component specifications.

685-19.5 QUALIFICATIONS

(a) The manufacturer of the required optical priority control system shall verify the proven, safe operation of the system's optical communication technology. Upon request, the manufacturer shall produce a list of twenty (20) user agencies having two (2) or more years experience interfacing priority control equipment with solid state digital and/or 170 family programmable controller types.

(b) The manufacturer shall demonstrate the ability to finance ongoing technical support, written product warranties and responsible for product failure.

(C) Upon request, the manufacturer shall produce a copy of its last year and four previous year's corporate financial statements.

(d) The manufacturer shall have an independent quality department that has complete authority to control product integrity and is answerable only to the senior officer of the organization.

685-19.6 RESPONSIBILITIES

(a) The manufacturer of the required optical priority control system and/or the manufacturer's representative shall provide responsive service before, during and after installation of the priority control system. The manufacturer and/or the manufacturer's representative, as consultants to the installer, shall provide certified, trained technicians having traffic systems industry experience and operational knowledge of priority control systems.

(b) The fully responsive bidder shall be required to supply working production components specified in these specifications within 14 calendar days from the bid opening date. Failure to do so will render the bid non-responsive.

(c) Paragraph B, will not be required if, prior to the bid opening, the bidder demonstrated to the city that the equipment meets these specifications.

685-19.7 SUBSTANTIATED WARRANTY

(a) The manufacturer of the required optical control system will warrant that, provided the priority control system has been properly installed, operated and maintained, component parts of a matched component system (See Section 685-19.2) that prove to be defective in workmanship and/or material during the first five (5) years from the date of shipment from the manufacturer will be covered in a documented system-protection plan, plus an added five (5) year warranty for repair or replacement at a fixed deductible charge for a total of ten (10) years of product coverage.

The manufacturer must substantiate its financial ability to respond to warranty claims. The guarantee will be determined in reference to the manufacturer's business assets and financial experience over the preceding five-year period.

(b) In addition, upon request, the manufacturer will provide documentation proving ability to financially support the ten (10) year provisions of the warranty. Documentation will include appropriate financial reports for the previous five business years.

(c) The protection plan will warrant that component parts of a matched component system that prove to be defective in workmanship and/or material during the first five years from the date of shipment from manufacturer will be repaired at no charge, and that extended coverage with a fixed repair deductible will be available for an additional five years.

(d) In total, the warranty coverage must assure 10-year operational functionality and interface compatibility with future components designed for the system.

(e) A copy of the manufacturer's written warranty outlining the conditions stated above will be supplied with the bid.

685-19.8 CERTIFICATE OF INSURANCE

The manufacturer of the required optical priority control system shall provide a certificate of product liability insurance protection for $5,000,000 assuring the priority control user that the manufacturer is insured against civil damages if proven to be at fault for an accident due to equipment failure within the system of matched priority control components. This certificate, however, need no, as is not meant to, provide liability insurance protection to the priority control system dealer, installer or user.

685-19.9 USER SUPPORT SERVICES

The manufacturer of the required optical priority control system shall offer support programs to assist the purchase and implementation of a priority control system program, including:

(a) A preferred lease program to finance purchase of a system.

(b) Public relations assistance to promote the system within the user community.

(c) Intersection survey service to document appropriate equipment interfaces.

(d) Customized proposals to assist the procurement process.

685-19.10 CERTIFICATION

The manufacturer of the required priority control system shall certify that all component products are designed, manufactured and tested as a system of matched components and will meet or exceed the requirements of this specification. The manufacturer shall also submit their product to the Florida Department of Transportation for Certification and eventual issuance of conformance of certification and placement on the approved products list for the State of Florida.