



WARNING!

INSTALLATION OR TROUBLESHOOTING OF THE EQUIPMENT REFERENCED IN THIS DOCUMENT MAY EXPOSE YOU TO AC LINE VOLTAGE AND THE RISK OF ELECTRIC SHOCK OR ELECTROCUTION.

TURN OFF THE AC MAINS AND USE ACCEPTED AND RECOGNIZED SAFETY PRECAUTIONS TO AVOID EXPOSURE TO RISK OF ELECTRIC SHOCK OR ELECTROCUTION. ELECTRIC SHOCK MAY CAUSE SEVERE INJURY OR DEATH.

TOMAR ELECTRONICS

Strobecom II

System Manual (IS0525A-12)

ATTENTION

THE STROBECOM II SYSTEM IS DESIGNED TO AID IN THE TRANSIT OF DESIGNATED VEHICLES THROUGH THE TRAFFIC CONTROL SYSTEM, TO THEIR DESTINATIONS.

IT IS IMPERATIVE THAT THE DRIVERS OF EACH TYPE OF VEHICLE THAT USES THE STROBECOM II SYSTEM BE MADE AWARE OF THE RESPONSE HE CAN EXPECT FROM THE TRAFFIC CONTROL SYSTEM.

IT IS THE RESPONSIBILITY OF THE CUSTOMER TO CONFIGURE THE SYSTEM'S RESPONSE TO EACH VEHICLE TYPE AND TO EDUCATE EACH DRIVER TO EXPECT THE APPROPRIATE RESPONSE FROM THE SYSTEM.

AT NO TIME SHOULD A DRIVER OF A VEHICLE EXPECT THAT HE IS GUARANTEED TO RECEIVE PROTECTED RIGHT-OF-WAY THROUGH TRAFFIC INTERSECTIONS. DRIVERS OF VEHICLES THAT WILL OPERATE OUTSIDE OF THE NORMAL TRAFFIC LAWS AND CONVENTIONS MUST ALWAYS TAKE RESPONSIBILITY FOR ENSURING THE SAFE PASSAGE OF HIS VEHICLE THROUGH AN INTERSECTION REGARDLESS OF THE OPERATION OR NON-OPERATION OF THE STROBECOM II SYSTEM.

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1 Strobecom II System Description

Strobecom II is a state of the art, optical, traffic preemption and priority control system. Unlike previous generations of optical traffic control systems, Strobecom II allows vehicles with varying missions and mission priorities to announce their presence to a traffic control system, and receive customized responses from the traffic control system related to the requesting vehicle's mission.

A fire vehicle approaching an intersection equipped with Strobecom II may receive the right-of-way through the intersection with minimum delay. A municipal bus may only be given more time to pass through an already green intersection after communication with a central computer has determined the bus is late. Municipal service vehicles could simply have their passage through an intersection logged with no response from the traffic control system at all.

A Strobecom II system, employing Tomar optical emitters and optical detectors and signal processor (OSP) cards can preempt intersections at a range from 150 to 2500 feet. Preemption is initiated using signals in two industry standard optical bands. The Emergency Band uses the industry standard high priority carrier frequency and the Transit Band uses the low priority carrier frequency. Use of the industry standard carrier frequencies ensures forward and backward compatibility with existing Strobecom I and other optical preemption systems.

An Emergency Band signal will always be processed more quickly than a Transit Band signal ensuring the fastest traffic system response for vehicles whose missions are most critical.

For Strobecom II systems employing model 2140 or 4140 OSP cards, each signal band can be divided into up to 16 subgroups with different priorities, ranges, and traffic system responses for each subgroup.

For Strobecom II systems employing an OSPOC optical signal processor each signal band is divided into 10 classes, each containing 1000 vehicles, with different priorities, ranges, and traffic control system responses for each class.

A fully expanded Strobecom II system is equipped with a line-locked real-time clock, up to 2 megabits (8 megabits for 4140 and OSPOC) of non-volatile memory, and an RS-232 serial port (2140) or Ethernet port (4140 and OSPOC) port. Up to 14,000 vehicle or event detections along with the time and date of occurrence and other important system information can be stored in non-volatile memory for later retrieval via the RS-232 port (assuming vehicle code table capacity is allocated at 10,000 entries) or Ethernet port (4140 and OSPOC). Logged events have a guaranteed data retention time of 10 years (20 years for 4140 and OSPOC) with or without power applied.

The Strobecom II system consists of two major sub-systems. The emitter sub-system is installed on the vehicle and transmits the preemption initiation signal on the selected optical signal band. The receiver sub-system is installed in the control cabinet at the intersection and detects the signal being emitted by a vehicle, measures its range to the intersection, arbitrates between vehicles competing for the right-of-way and initiates the selected response actions.

The receiver sub-systems are configured using software programs sold separately.

1.1 Emitters

1.1.1 Model 3065/3065-R Emitter System

The Model 3065/3065-R emitter is mounted on a vehicle and transmits vehicle identification information in Tomar's Strobecom II format, to suitably equipped intersections, via optical pulses. The 3065/3065-R includes continuous diagnostic monitoring to ensure its proper operation.

The 3065 emitter is self-contained and modular, consisting of the 3065-HOUSING, RECT-37SWP-C Lamp, EMIT3-CONTCBL, and EMIT3-SWITCH. The RECT-37SWP-C is the only component that requires routine maintenance and is easily field replaceable.

The RECT-37SWP-C consists of a xenon arc tube mounted in a metallized, polycarbonate reflector and then linear vibration welded to an optically clear polycarbonate cover creating a hermetically sealed assembly.

The 3065-HOUSING is a black, glass-filled, UV-stabilized polycarbonate shell. The RECT-37SWP-C is secured into the 3065-HOUSING with four stainless steel screws. Optionally, a RECT-37-VLF visible light filter can be fitted over the lamp, rendering the operating emitter signal virtually invisible.

The 3065-HOUSING contains a power supply that is completely encapsulated in polyurethane, and is equipped with automotive waterproof connectors to ensure a long, stable, life even in the most adverse environmental conditions. The power supply is RFI filtered, polarity protected, and damage proof from mis-wiring during installation.

The 3065-R emitter is designed for use when the emitter power supply and lighthouse need to be mounted in separate locations. It consists of the 3065-R-PS power supply, RECT-37SWP-C lamp, EMIT3-CONTCBL, 3C-WP2 cable, and EMIT3-SWITCH.

The emitter's vehicle code is programmed via a PC compatible computer either at the factory or in

the field. The 3065/3065-R emitter can be reprogrammed thousands of times without disassembly.

The EMIT3-CONTCBL connects the 3065 power supply to the EMIT3-SWITCH, an optional customer supplied door or parking brake switch, and the vehicles electrical power. The 3065-CONTCBL is equipped with a mating sealed connector for attaching to the 3065-HOUSING (3065) or 3065-R-PS (3065-R) assembly.

The EMIT3-SWITCH provides a method of turning the 3065/3065-R emitter on and off and includes an LED that provides positive visual feedback that the 3065/3065-R is on AND operating normally.

1.1.2 Model T792HL/T792HL-R Emitter System

The Model T792HL/T792HL-R emitter is mounted on a vehicle and transmits vehicle identification information in GTT OPTICOM compatible format, to suitably equipped intersections, via optical pulses. The T792HL/T792HL-R includes continuous diagnostic monitoring to ensure its proper operation.

The T792HL emitter is self-contained and modular, consisting of the T792HL-HOUSING, RECT-37SWP-C Lamp, EMIT3-CONTCBL, and EMIT3-SWITCH. The RECT-37SWP-C is the only component that requires routine maintenance and is easily field-replaceable.

The RECT-37SWP-C consists of a xenon arc tube mounted in a metallized, polycarbonate reflector and then linear vibration welded to an optically clear polycarbonate cover creating a hermetically sealed assembly.

The T792HL-HOUSING is a black, glass-filled, UV-stabilized polycarbonate shell. The RECT-37SWP-C is secured into the T792HL-HOUSING with four stainless steel screws. Optionally, a RECT-37-VLF visible light filter can be fitted over the lamp, rendering the operating emitter signal virtually invisible.

The T792HL-HOUSING contains a power supply that is completely encapsulated in polyurethane, and is equipped with automotive waterproof connectors to ensure a long, stable, life even in the most adverse environmental conditions. The power supply is RFI filtered, polarity protected, and damage proof from mis-wiring during installation.

The T792HL-R emitter is designed for use when the emitter power supply and lighthouse need to be mounted in separate locations. It consists of the T792HL-R-PS power supply, RECT-37SWP-C lamp, EMIT3-CONTCBL, 3C-WP2 cable, and EMIT3-SWITCH.

The emitter's vehicle code is programmed via a PC compatible computer either at the factory or in the field. The T792HL/T792HL-R emitter can be reprogrammed thousands of times without disassembly.

The EMIT3-CONTCBL connects the T792HL power supply to the EMIT3-SWITCH, an optional customer supplied door or parking brake switch, and the vehicles electrical power. The EMIT3-CONTCBL is equipped with a mating sealed connector for attaching to the T792HL-HOUSING (T792HL) or T792HL-R-PS (T792HL-R) assembly.

The EMIT3-SWITCH provides a method of turning the T792HL/T792HL-R emitter on and off and includes an LED that provides positive visual feedback that the T792HL/T792HL-R is on AND operating normally.

1.2 Detectors

1.2.1 Model 2090/2091 Series Detector

The model 2090/2091 series detector receives the Tomar Strobecom II format optical pulses from a vehicle emitter and converts them to electrical pulses that are sent via cable to the optical signal processor. Multiple detectors can be paralleled without extra adapters for enhanced pick up around curves or other obstacles.

The optical sensing element at the heart of the detector is a large area silicon photodiode of custom design. Adapted from military technology, the photodiode is protected in a truly hermetic package affording stable long-term performance in all environmental conditions. Unlike competitive detectors, the advanced design of the 2090/2091 nearly eliminates sensitivity to ambient solar radiation.

The detector electronics is encapsulated in polyurethane eliminating any effects from water or vibration. Enhanced protection is also incorporated to reduce the potential for detector damage from electrical transients. All detector connections are protected from damage due to incorrect hook-up to the detector cable.

The detector case is molded from UV stabilized, glass-filled polycarbonate for strength and solar resistance. The detector sight tube is removable to allow cleaning if necessary.

The 2090 series is equipped with a long sight tube, providing a field of view of approximately 13 degrees. The 2091 series is equipped with a short sight tube providing a field of view of approximately 60 degrees.

The 2090-ST/2091-ST detector includes a true self-test function that periodically injects an optical signal into the detector's photodiode. This test signal is decoded by a 2140, 3140, or 4140 OSP and insures that the detector is functioning properly. The 2090-SD/2091-SD detector does not have this advanced self-test function included.

A terminal block with wire clamping screws is included inside the detector for easy interface to the detector cable. No lugs or other wiring devices are necessary for installation.

The detector is mounted using a 1/2" female NPT hub molded into the base of the unit and can be mounted in any orientation. However, if mounted inverted, care must be taken to prevent water from entering the detector and dripping dirt and corrosion onto the detectors terminal block.

Various mounting adapters are available from Tomar for mast arm or span wire mounting. All

Tomar manufactured mounts hold the detector in an upright orientation for maximum resistance to moisture.

1.2.2 Model 4090 Series Detectors

The model 4090 series detector receives the Tomar Strobecom II format optical pulses from a vehicle emitter and converts them to electrical pulses that are sent via cable to the optical signal processor. Multiple detectors can be paralleled without extra adapters for enhanced pick up around curves or other obstacles.

The 4090 series detectors include an emitter type detection feature that equalizes its response to LED and strobe based emitters greatly improving the range of the weaker LED units.

The optical sensing element at the heart of the detector is a large area silicon photodiode of custom design. Adapted from military technology, the photodiode is protected in a truly hermetic package affording stable long-term performance in all environmental conditions. Unlike competitive detectors, the advanced design of the 4090 series nearly eliminates sensitivity to ambient solar radiation.

The detector electronics is encapsulated in polyurethane eliminating any effects from water or vibration. Enhanced protection is also incorporated to reduce the potential for detector damage from electrical transients. All detector connections are protected from damage due to incorrect hook-up to the detector cable.

The 4090-1 is a one-direction, one-channel detector, the 4090-21 is a two-direction, one-channel detector, and the 4090-22 is a two-direction, two-channel detector. All 4090 series detectors provide a tool-less tilt/swivel adjustment, allowing each detector head to be easily and accurately aimed in the desired direction and locked in place.

The detector case is molded from UV resistant, glass-filled Zytel for strength and solar resistance.

The detector sight tube is removable to allow cleaning if necessary.

The 4090 series is equipped with a sight tube providing a field of view of approximately 13 degrees.

4090-x-ST detectors include a self-test feature that periodically inject an optical signal into the detectors photodiode. This signal is decoded by a 2140, 3140, or 4140 OSP confirming that the detector is functioning properly. 4090-x-SD detectors do not include this self-test function.

A terminal block with wire clamping screws is included inside the detector for easy interface to the detector cable. No lugs or other wiring devices are necessary for installation.

The detector is mounted using a 3/4" female NPT hub molded into the base of the unit and can be mounted in any orientation. However, if mounted inverted, care must be taken to prevent water from entering the detector and dripping dirt and corrosion onto the detectors terminal block. Various mounting adapters are available from Tomar for mast arm or span wire mounting.

1.2.3 DETOC Series Detectors

DETOC SERIES DETECTORS ARE COMPATIBLE ONLY WITH THE TOMAR OSPOC OSP OR GTT 200, 500, AND 700 SERIES IR PHASE SELECTORS

A DETOC series detector receives the optical pulses from a vehicle emitter and converts them to electrical signals that are sent via cable to the optical signal processor. Multiple detectors can be paralleled without extra adapters for enhanced pick up around curves or other obstacles.

The optical sensing element at the heart of the detector is a large area silicon photodiode of custom design. Adapted from military technology, the photodiode is protected in a truly hermetic package affording stable long-term performance in all environmental conditions. Unlike competitive detectors, the advanced design of the DETOC

series nearly eliminates sensitivity to ambient solar radiation.

The detector electronics is encapsulated in polyurethane eliminating any effects from water or vibration. Enhanced protection is also incorporated to reduce the potential for detector damage from electrical transients. All detector connections are protected from damage due to incorrect hook-up to the detector cable.

The DETOC1 is a one-direction, one-channel detector, the DETOC21 is a two-direction, one-channel detector, and the DETOC22 is a two-direction, two-channel detector. All DETOC detectors provide a tool-less tilt/swivel adjustment, allowing the detector heads to be easily and accurately aimed in the desired direction and locked in place.

The DETOC detector case is molded from UV resistant, glass-filled Zytel for strength and solar resistance. The detector sight tube is removable to allow cleaning if necessary.

DETOC detectors are equipped with a sight tube providing a field of view of approximately 13 degrees.

A terminal block with wire clamping screws is included inside the detector for easy interface to the detector cable. No lugs or other wiring devices are necessary for installation.

The detector is mounted using a 3/4" female NPT hub molded into the base of the unit and can be mounted in any orientation. However, if mounted inverted, care must be taken to prevent water from entering the detector and dripping dirt and corrosion onto the detectors terminal block. Various mounting adapters are available from Tomar for mast arm or span wire mounting.

1.3 Model 1881 Card Cage and Harness

The model 1881 card cage is used to interface TOMAR optical signal processors with NEMA traffic controllers that do not have built-in card racks.

NEMA controllers with built-in card racks or 170 controllers do not generally require the 1881 card cage.

The 1881 card cage provides all the necessary hardware and harnessing required to allow the wiring of the call outputs of the optical signal processor to the traffic controller inputs.

The 1881 has two 60" long cables which are wired to the controller by the customer.

The first cable carries all 120VAC power wiring, safety ground, and card outputs. The second 60" cable is terminated to a 12 point terminal block that is typically mounted in the wiring compartment of the cabinet. The detectors are then connected to the terminal block.

1.4 Optical Signal Processors

1.4.1 Model 2070 Optical Signal Processor (discontinued - included for information only)

The model 2070 optical signal processor (OSP) resides in the controller cabinet at an intersection and receives the electrical signals from the detector, processes them, arbitrates priority, and places calls to the appropriate controller preempt inputs.

The 2070 OSP is equipped with plug-and-play technology allowing additional signal processor modules to be added to the motherboard in the field with automatic reconfiguration on power up.

Each 2070 motherboard can be equipped with between 1 to 4 signal processing modules providing up to four independent input channels.

All modules on the 2070 communicate with each other via a two wire, inter-module bus allowing fast data transfer while minimizing the connections between modules, enhancing system reliability.

The 2070 OSP card is compatible with NEMA TS-1, NEMA TS-2, type 170, and type 2070 controllers.

All 2070 outputs that connect to controller inputs are optically isolated.

The 2070 is configured to allow any valid emitter to activate the OSP. The 2070 cannot exclude un-coded emitters.

Range for both emergency and transit bands are factory set to maximum but can be set in the field via the 2070 front panel.

Transit band reception can be disabled from the 2070 front panel.

Model 2070 OSP's cannot be upgraded to more feature rich OSP's.

1.4.2 Model 2080/3080 Optical Signal Processor (model 3080 discontinued – included for information only)

The model 2080/3080 optical signal processors (OSP) resides in the controller cabinet at an intersection and receives the electrical signals from the detector, processes them, arbitrates priority, and places calls to the appropriate controller preempt inputs.

The 2080/3080 OSPs are equipped with plug-and-play technology allowing modules to be added to the motherboard in the field with automatic reconfiguration on power up.

Each 2080/3080 motherboard can be equipped with between 1 to 4 signal processing modules providing up to four independent input channels.

All modules on the 2080/3080 communicate with each other via a two wire, inter-module bus allowing fast data transfer while minimizing the connections between modules, enhancing system reliability.

The 2080/3080 OSP cards are compatible with NEMA TS-1, NEMA TS-2, type 170, and type 2070 controllers.

All 2080/3080 outputs that connect to controller inputs are optically isolated. Each output can be disconnected from the controller via a front panel recessed toggle switch. This allows for the isolation of the 2080/3080 from the controller during setup or troubleshooting.

Range for both emergency and transit bands are factory set to maximum but can be set in the field via the 2080/3080 front panel.

Transit band reception can be disabled from the 2080/3080 front panel.

The 2080 (only) is supplied from the factory configured to allow any valid coded or un-coded Strobecom emitter to activate the OSP. Un-coded emitters can be excluded by repositioning a jumper on the control module.

1.4.3 Model 2140/3140 Optical Signal Processor (model 3140 discontinued – included for information only)

The model 2140/3140 series optical signal processor (OSP) resides in the controller cabinet at an intersection and receives the electrical signals from the detector, processes them, logs events, communicates with the traffic control system, and monitors the intersection's response.

The 2140/3140 OSP is modular, consisting of a motherboard, signal processor modules, a communication module, a real-time clock module, and a non-volatile storage module.

The 2140/3140 OSP is equipped with plug-and-play technology allowing modules to be added to

the motherboard in the field with automatic reconfiguration on power up.

Each 2140/3140 motherboard can be equipped with between 1 to 4 signal processor modules providing up to four independent input channels.

The communication module arbitrates between the signal processor modules, logs events, and provides RS-232 communication with the outside world for configuration during install if necessary, and real-time communication with a traffic controller or central system during operation. The RS-232 port can be configured for DTE or DCE operation allowing connection to a wide range of devices directly or via modem.

The real-time clock module provides a non-volatile on board source for time and date stamp information during event logging. The real-time clock can be read and set via the RS-232 port. Battery backup time for the real-time clock module is 10 years with power off. The 2140/3140 real time clock is Y2K compliant and will operate correctly through 2096.

The non-volatile storage module provides up to 2 megabits of non-volatile EEPROM storage for configuration parameters and event logs. Retention time for the non-volatile storage module is 10 years minimum with power off or on.

All modules on the 2140/3140 communicate with each other via a two wire, inter-module bus allowing fast data transfer while minimizing the connections between modules, enhancing system reliability. The inter-module bus expansion connector is included on the front panel of the 2140/3140 allowing the connection of product accessories.

The 2140/3140 outputs that connect to controller inputs are optically isolated. Each output can be disconnected from the controller via a front panel recessed toggle switch. This allows for the isolation of the 2140/3140 from the controller during setup or troubleshooting.

The 3140 cannot uniquely identify optical emitters even if the emitters have been configured by the user to emit coded signals. The 3140 is supplied

from the factory configured for basic high/low priority operation and all ranges are set to maximum. If further configuration is necessary use Strobecom II software package OSPsoft version 4.5 or later, or CONFIG3140.

The 2140 is supplied from the factory configured with all emergency and transit band vehicle codes in the range 0-9999 enabled and assigned to subgroup 15, with the priority for subgroup 15 set to a value of 15 (highest priority). Range for both emergency and transit bands are set to maximum.

If no additional sub-groups are needed and no real-time RS-232 communication is to be used then installation is complete without the use of a computer.

If it becomes necessary to define sub-groups, set sub-group ranges, or activate real-time communication, then the 2140 must be configured locally via laptop computer running the OSPsoft configuration software available separately.

1.4.4 Model 4140 Optical Signal Processor

The model 4140 series optical signal processor (OSP) resides in the controller cabinet at an intersection and receives the electrical signals from the detector, processes them, logs events, communicates with the traffic control system, and monitors the intersection's response.

The 4140 OSP consists of a motherboard and a signal processor module. The signal processor module comes equipped with the ability to process four independent input channels.

Ethernet communications, a line-locked real-time clock, and non-volatile flash storage are built into the motherboard.

The 4140 contains a Lantronix Xport Pro Ethernet module. The Ethernet module provides communication with the outside world for configuration during install, if necessary, and real-time communication with a traffic controller or central system during operation.

The Lantronix website (<http://www.lantronix.com>) should be referenced for documentation and support regarding the Xport Pro Ethernet module. The Xport Pro support page provides complete documentation and tools to assist in initializing and configuring the 4140 Ethernet module.

REFER TO DOCUMENT STROBECOM II 4140 AND OSPOC: GETTING STARTED (IS0592-03) FOR INITIAL NETWORK CONFIGURATION OF THE 4140

The 4140 OSP is field upgradeable via Ethernet communications, either locally or remotely.

The real-time clock provides a non-volatile on board source for time and date stamp information during event logging. The real-time clock can be read and set via the Ethernet port. Battery backup time for the real-time clock module is typically 2 weeks with power off. The 4140 real time clock is Y2K compliant and will operate correctly through 2096.

The non-volatile flash provides up to 8 megabits of storage for configuration parameters and more than 14,000 event logs. Retention time for the non-volatile flash is 20 years minimum with power off or on.

The inter-module bus expansion connector is included on the front panel of the 4140 allowing communications to product accessories.

The 4140 outputs that connect to controller inputs are optically isolated. Each output can be disabled in software via the front panel menu operations.

REFER TO DOCUMENT STROBECOM II 4140 AND OSPOC: FRONT PANEL USER GUIDE (ISO591-05) FOR DETAILED FRONT PANEL OPERATIONS INSTRUCTIONS

The 4140 can uniquely identify optical emitters with codes up to 65000 in both emergency and transit bands.

The 4140 is supplied from the factory configured with all emergency and transit band vehicle codes in the range 0-9999 enabled and assigned to subgroup 15, with the priority for subgroup 15 set

to a value of 15 (highest priority). From the factory, the 4140 is capable of handling all 65000 codes. Range for both emergency and transit bands are set to maximum.

If further configuration is necessary use Strobecom II software package OSPsoft version 4.0 or later.

If no additional sub-groups are needed and no real-time Ethernet communication is to be used then installation is complete without the use of a computer.

If it becomes necessary to define sub-groups, set sub-group ranges, or activate real-time communication, then the 4140 must be configured via a computer with Ethernet connectivity running the OSPsoft 4.0 or later configuration software available separately.

1.4.5 Model OSPOC Series Optical Signal Processor

NOTE

ONLY TOMAR DETOC SERIES AND GTT SERIES 200, 500, AND 700 DETECTORS ARE COMPATIBLE WITH THE OSPOC OPTICAL SIGNAL PROCESSOR.

The model OSPOC series optical signal processor (OSP) resides in the controller cabinet at an intersection and receives the electrical signals from the detector, processes them, logs events, communicates with the traffic control system, and monitors the intersection's response.

The OSPOC OSP consists of a motherboard and a signal processor module. The signal processor module comes equipped with the ability to process four independent input channels.

Ethernet communications, a line-locked real-time clock, and non-volatile flash storage are built into the motherboard.

The OSPOC contains a Lantronix Xport Pro Ethernet module. The Ethernet module provides

communication with the outside world for configuration during install, if necessary, and real-time communication with a traffic controller or central system during operation.

The Lantronix website (<http://www.lantronix.com>) should be referenced for documentation and support regarding the Xport Pro Ethernet module. The Xport Pro support page provides complete documentation and tools to assist in initializing and configuring the OSPOC Ethernet module.

REFER TO DOCUMENT STROBECOM II 4140 AND OSPOC: GETTING STARTED (IS0592-03) FOR INITIAL NETWORK CONFIGURATION OF THE OSPOC

The OSPOC OSP is field upgradeable via the Ethernet communications, either locally or remotely.

The real-time clock provides a non-volatile on board source for time and date stamp information during event logging. The real-time clock can be read and set via the Ethernet port. Battery backup time for the real-time clock module is typically 2 weeks with power off. The OSPOC real time clock is Y2K compliant and will operate correctly through 2096.

The non-volatile flash provides up to 8 megabits of storage for configuration parameters and more than 14,000 event logs. Retention time for the non-volatile flash is 20 years minimum with power off or on.

The inter-module bus expansion connector is included on the front panel of the OSPOC allowing communications to existing product accessories.

The OSPOC outputs that connect to controller inputs are optically isolated. Each output can be disabled in software via the front panel menu operations.

REFER TO STROBECOM II 4140 AND OSPOC: FRONT PANEL USER GUIDE (ISO591-05) FOR DETAILED FRONT PANEL OPERATION INSTRUCTIONS

The OSPOC can uniquely identify optical emitters with codes in classes 0-9 and codes 0 through 999 in each class in both emergency and transit bands.

The OSPOC is supplied from the factory configured with all 0-999 emergency and transit band vehicle codes in all classes enabled and assigned the same priority. From the factory, the OSPOC is capable of handling all possible codes in all classes. Range for both emergency and transit bands are set to maximum.

If no additional configuration is required and no real-time Ethernet communication is to be used then installation is complete without the use of a computer.

If additional configuration is necessary the OSPOC must be configured via a computer with Ethernet connectivity running the OSPsoft version 4.5 or later configuration software available separately.

1.4.6 Model 4080 Series Optical Signal Processor

The model 4080 series optical signal processor (OSP) resides in the controller cabinet at an intersection and receives the electrical signals from the detector, processes them, communicates with the traffic control system, and monitors the intersection's response.

The 4080 OSP consists of a motherboard and a signal processor module. The signal processor module comes equipped with the ability to process four independent input channels.

Configuration jumpers allow general acceptance or rejection of emitter types as well as configuration of confirmation light patterns and behavior.

REFER TO DOCUMENT STROBECOM II 4080 and OSPOC8x Series Configuration and Front Panel User Guide (ISO612-00).

1.4.7 Model OSPOC8x Series Optical Signal Processor

NOTE

ONLY TOMAR DETOC SERIES AND GTT SERIES 200, 500, AND 700 DETECTORS ARE COMPATIBLE WITH THE OSPOC8x OPTICAL SIGNAL PROCESSOR.

The model OSPOC8x series optical signal processor (OSP) resides in the controller cabinet at an intersection and receives the electrical signals from the detector, processes them, communicates with the traffic control system, and monitors the intersection's response.

The OSPOC8x series OSP consists of a motherboard and a signal processor module. The signal processor module comes equipped with the ability to process four independent input channels.

Configuration jumpers allow general acceptance or rejection of emitter types as well as configuration of confirmation light patterns and behavior.

REFER TO DOCUMENT STROBECOM II 4080 and OSPOC8x Series Configuration and Front Panel User Guide (ISO612-00).

1.5 Accessories

1.5.1 Model 2140-GPMON (Use with 2140/3140/4140/OSPOC only)

The Model 2140-GPMON 8-Phase Green Signal Monitor resides in the controller cabinet and is connected to the front panel expansion port of a 2140/3140/4140/OSPOC Optical Signal Processor.

The 2140-GPMON is a plug and play accessory requiring no configuration to install.

The 2140-GPMON allows a model 2140/3140/4140/OSPOC OSP to record the final state of the green indications in an intersection and the time into a preemption event that the final green indications were attained.

Additionally with the 2140-GPMON installed, the 2140/3140/4140/OSPOC OSP will time phases associated with preemption channels to determine the time they normally go green. The 2140/3140/4140/OSPOC OSP can use this information during transit band preempt events to synchronize preemption call timing with intersection timing to mitigate disruptive effects of priority control.

See the OSPsoft manual for details on the effects of the 2140-GPMON and the features it provides.

2 Equipment Installation

A typical intersection of Strobecom II equipment will minimally consist of a model 2070, 2080, 2140, 3080, 3140, or 4140 optical signal processor mounted in the traffic control cabinet and up to four 2000 or 4090 series detectors connected to the OSP via M913 preemption cable. No competitor detector models are compatible with 2070/2080/2140/3080/3140/4140 OSPs.

For the OSPOC/DETOC equipment a typical intersection will minimally consist of a model OSPOC optical signal processor mounted in the traffic control cabinet and up to four Tomar DETOC and/or GTT Series 200, 500, or 700 detectors via M913 preemption cable. Tomar 2000 or 4090 series detectors are not compatible with the OSPOC/DETOC system.

Cable runs of up to 1000 feet may be used between the detectors and the OSP card. Only cable fully meeting the specification of genuine M913 detector cable should be used.

2.1 Model 3065/3065-R Emitter System

REFER TO TOMAR DRAWING #12184-01 FOR EMITTER INSTALLATION AND WIRING PICTORIAL DETAILS.

3065 INSTALLATION

For optimum range and best performance, mount the 3065 emitter on top, or near the top, of the vehicle so that its signal is most likely to be seen over the tops of other vehicles in front.

Drill a 1/2" hole through the surface to which the emitter will be mounted. The mounting surface should be strong enough to adequately support

the emitter and retain the emitter in case of a vehicle accident.

Mounting the emitter to an inadequate surface could allow the emitter to become loose in an accident and possibly impact a vehicle passenger, causing injury.

IT IS THE INSTALLERS RESPONSIBILITY TO INSURE THE EMITTER IS SECURED ADEQUATELY.

If mounted outside the vehicle, drill a 1-1/4" hole to allow the model EMIT3-CONTCBL to pass into the vehicle.

DO NOT CUT THE CONNECTOR ON THIS CABLE OFF. THE CONNECTOR IS NEEDED FOR PROGRAMMING THE EMITTER.

Secure the emitter using the supplied 7/16" stainless steel hardware. Point the emitter in the direction of forward vehicle travel and aim the emitter up just a few degrees to point at the detectors mounted in the intersections.

Engage the EMIT3-CONTCBL connector to the mating connector on the 3065 emitter. This connector is waterproof and can be operated outside the vehicle if desired. Be sure to adequately secure the EMIT3-CONTCBL.

Run the other end of the EMIT3-CONTCBL through the vehicle to the location where the EMIT3-SWITCH will be located. If the EMIT3-CONTCBL penetrates any vehicle panels, take care to protect the cable from abrasion of the insulation.

Mount the EMIT3-SWITCH bracket in a location visible to the operator, using the supplied hardware.

Snap the rocker switch into the EMIT3-SWITCH bracket.

Following Tomar drawing 12184-01, included with this document, connect the EMIT3-CONTCBL to the EMIT3-SWITCH as shown.

Disconnect the vehicle battery and make the final power connections from the EMIT3-CONTCBL,

the included 10-amp fuse, and the vehicles door or parking brake switch (customer supplied), to the vehicles electrical system.

Reconnect the battery and operate the EMIT3-SWITCH to the ON position.

Observe the emitter lamp for flashing, and verify that the indicator LED on the EMIT3-SWITCH is ON steady.

Activate the vehicle door or parking brake, and verify that the emitter stops flashing. The LED in the EMIT3-SWITCH should blink at a slow .5 Hz rate to indicate the 3065 has been disabled.

Return the EMIT3-SWITCH to the OFF position. Installation is complete.

If the LED in the EMIT3-SWITCH flashes at a fast 2 Hz rate during testing, refer to Section 5 - Emitter System Troubleshooting for assistance.

3065-R INSTALLATION

For optimum range and best performance, mount the RECT-37SWP-C lamp on top, or near the top, of the vehicle so that its signal is most likely to be seen over the tops of other vehicles in front.

Mount the RECT-37SWP-C lamp to the vehicle with an appropriate mounting bezel or inside an emergency lightbar. The lamp, connector, and cable are 100% waterproof.

Secure the 3065-R-PS power supply in a suitable location inside the vehicle. THE POWER SUPPLY MUST BE MOUNTED IN SUCH A WAY THAT IT CANNOT BECOME LOOSE AND IMPACT VEHICLE PASSENGERS IN THE EVENT OF AN ACCIDENT.

Engage the EMIT3-CONTCBL connector to the mating connector on the 3065 emitter. This connector is waterproof and can be operated outside the vehicle if desired. Be sure to adequately secure the EMIT3-CONTCBL. DO NOT CUT THE CONNECTOR ON THIS CABLE OFF. THE CONNECTOR IS NEEDED FOR PROGRAMMING THE EMITTER.

Run the other end of the EMIT3-CONTCBL through the vehicle to the location where the EMIT3-SWITCH will be located. If the EMIT3-CONTCBL penetrates any vehicle panels, take care to protect the cable from abrasion of the insulation.

Mount the EMIT3-SWITCH bracket in a location visible to the operator, using the supplied hardware.

Snap the rocker switch into the EMIT3-SWITCH bracket.

Following Tomar drawing 12184-01, included with this document, connect the EMIT3-CONTCBL to the EMIT3-SWITCH as shown.

Disconnect the vehicle battery and make the final power connections from the EMIT3-CONTCBL, the included 10-amp fuse, and the vehicles door or parking brake switch (customer supplied), to the vehicles electrical system.

Reconnect the battery and operate the EMIT3-SWITCH to the ON position.

Observe the emitter lamp for flashing, and verify that the indicator LED on the EMIT3-SWITCH is ON steady.

Activate the vehicle door or parking brake, and verify that the emitter stops flashing. The LED in the EMIT3-SWITCH should blink at a slow .5 Hz rate to indicate the 3065-R has been disabled.

Return the EMIT3-SWITCH to the OFF position. Installation is complete.

If the LED in the EMIT3-SWITCH flashes at a fast 2 Hz rate during testing, refer to Section 5 - Emitter System Troubleshooting for assistance.

2.2 Model T792HL/T792HL-R Emitter System

REFER TO TOMAR DRAWING #14656-00 FOR EMITTER INSTALLATION AND WIRING PICTORIAL DETAILS.

T792HL INSTALLATION

For optimum range and best performance, mount the T792HL emitter on top, or near the top, of the vehicle so that its signal is most likely to be seen over the tops of other vehicles in front.

Drill a 1/2" hole through the surface to which the emitter will be mounted. The mounting surface should be strong enough to adequately support the emitter and retain the emitter in case of a vehicle accident.

Mounting the emitter to an inadequate surface could allow the emitter to become loose in an accident and possibly impact a vehicle passenger, causing injury.

IT IS THE INSTALLERS RESPONSIBILITY TO INSURE THE EMITTER IS SECURED ADEQUATELY.

If mounted outside the vehicle, drill a 1-1/4" hole to allow the model EMIT3-CONTCBL to pass into the vehicle.

DO NOT CUT THE CONNECTOR ON THIS CABLE OFF. THE CONNECTOR IS NEEDED FOR PROGRAMMING THE EMITTER.

Secure the emitter using the supplied 7/16" stainless steel hardware. Point the emitter in the direction of forward vehicle travel and aim the emitter up just a few degrees to point at the detectors mounted in the intersections.

Engage the EMIT3-CONTCBL connector to the mating connector on the T792HL emitter. This connector is waterproof and can be operated

outside the vehicle if desired. Be sure to adequately secure the EMIT3-CONTCBL.

Run the other end of the EMIT3-CONTCBL through the vehicle to the location where the EMIT3-SWITCH will be located. If the EMIT3-CONTCBL penetrates any vehicle panels, take care to protect the cable from abrasion of the insulation.

Mount the EMIT3-SWITCH bracket in a location visible to the operator, using the supplied hardware.

Snap the rocker switch into the EMIT3-SWITCH bracket.

Following Tomar drawing 14656, included with this document, connect the EMIT3-CONTCBL to the EMIT3-SWITCH as shown.

Disconnect the vehicle battery and make the final power connections from the EMIT3-CONTCBL, the included 10-amp fuse, and the vehicles door or parking brake switch (customer supplied), to the vehicles electrical system.

Reconnect the battery and operate the EMIT3-SWITCH to the ON position.

Observe the emitter lamp for flashing, and verify that the indicator LED on the EMIT3-SWITCH is ON steady.

Activate the vehicle door or parking brake, and verify that the emitter stops flashing. The LED in the EMIT3-SWITCH should blink at a slow .5 Hz rate to indicate the T792HL has been disabled.

Return the EMIT3-SWITCH to the OFF position. Installation is complete.

If the LED in the EMIT3-SWITCH flashes at a fast 2 Hz rate during testing, refer to Section 5 - Emitter System Troubleshooting for assistance.

T792HL-R INSTALLATION

For optimum range and best performance, mount the RECT-37SWP-C lamp on top, or near the top, of the vehicle so that its signal is most likely to be seen over the tops of other vehicles in front.

Mount the RECT-37SWP-C lamp to the vehicle with an appropriate mounting bezel or inside an emergency lightbar. The lamp, connector, and cable are 100% waterproof.

Secure the T792HL-R-PS power supply in a suitable location inside the vehicle.

THE POWER SUPPLY MUST BE MOUNTED IN SUCH A WAY THAT IT CANNOT BECOME LOOSE AND IMPACT VEHICLE PASSENGERS IN THE EVENT OF AN ACCIDENT.

Engage the EMIT3-CONTCBL connector to the mating connector on the T792HL emitter. This connector is waterproof and can be operated outside the vehicle if desired. Be sure to adequately secure the EMIT3-CONTCBL.

DO NOT CUT THE CONNECTOR ON THIS CABLE OFF. THE CONNECTOR IS NEEDED FOR PROGRAMMING THE EMITTER.

Run the other end of the EMIT3-CONTCBL through the vehicle to the location where the EMIT3-SWITCH will be located. If the EMIT3-CONTCBL penetrates any vehicle panels, take care to protect the cable from abrasion of the insulation.

Mount the EMIT3-SWITCH bracket in a location visible to the operator, using the supplied hardware.

Snap the rocker switch into the EMIT3-SWITCH bracket.

Following Tomar drawing 14656, included with this document, connect the EMIT3-CONTCBL to the EMIT3-SWITCH as shown.

Disconnect the vehicle battery and make the final power connections from the EMIT3-CONTCBL, the included 10-amp fuse, and the vehicles door

or parking brake switch (customer supplied), to the vehicles electrical system.

Reconnect the battery and operate the EMIT3-SWITCH to the ON position.

Observe the emitter lamp for flashing, and verify that the indicator LED on the EMIT3-SWITCH is ON steady.

Activate the vehicle door or parking brake, and verify that the emitter stops flashing. The LED in the EMIT3-SWITCH should blink at a slow .5 Hz rate to indicate the T792HL-R has been disabled.

Return the EMIT3-SWITCH to the OFF position. Installation is complete.

If the LED in the EMIT3-SWITCH flashes at a fast 2 Hz rate during testing, refer to Section 5 - Emitter System Troubleshooting for assistance.

2.3 Model 2090/2091 Detector

ENSURE THAT ALL POWER SOURCES ARE DISCONNECTED FROM THE CABINET END OF THE M913 CABLE BEFORE INSTALLATION OF THE DETECTORS.

REFER TO TOMAR DRAWING #IS0178A-03 FOR DETECTOR INSTALLATION DETAILS.

Mount the 2090/2091 detector using the 1/2" female NPT hub molded in the unit's base. If mounted inverted, care must be taken to prevent water from entering the detector and dripping dirt and corrosion onto the detectors terminal block.

Various mounting adapters are available from Tomar for mast arm or span wire mounting. All Tomar manufactured mounts hold the detector in an upright orientation for maximum resistance to moisture.

Remove the three screws holding the cover of the detector to the base.

Feed the M913 detector cable through the mounting hub in the base of the unit.

Strip and terminate the orange (+24VDC), blue (GND), and yellow (SIGNAL) wires from the M913 detector cable to the proper locations on the terminal block as indicated on the detector labeling.

Position the detector cover on the base and reinstall the three screws. Do not over tighten the screws or the base may be damaged.

Using the mechanisms provided on the specific mount used, adjust the horizontal alignment of the detector sight tube in the direction of vehicle approach. Adjust the vertical alignment of the sight tube so that it is parallel to the approaching roadway for maximum range.

This completes the installation process for the 2090/2091 detector.

Remove the 4 screws securing the top of the 4090 series to gain access to the internal terminal block. Connect the orange, blue, yellow, and drain wires of the M913 detector cable per the label inside the detector. To insure proper operation, the bare drain wire must be connected to the proper connector inside the unit. The terminal block is equipped with wire clamping screws and no lugs or other connectors are necessary. The 4090 series are fully protected from damage due to mis-wiring, however, system startup problems due to mis-wired heads can be difficult and expensive to troubleshoot. Double check the wiring and secure the top of the 4090 to the base using the 4 screws removed earlier. DO NOT over tighten the screws as the base may be damaged.

Installation is now complete.

2.4 Model 4090 Series Detectors

ENSURE THAT ALL POWER SOURCES ARE DISCONNECTED FROM THE CABINET END OF THE M913 CABLE BEFORE INSTALLATION OF THE DETECTORS.

4090 SERIES DETECTORS ARE NOT COMPATIBLE WITH OSPOC OSPS.

The 4090 series is equipped with a 3/4" female NPT threaded base for mounting and an internal terminal block for wiring termination. Any mounting that is stable and allows the M913 detector cable to enter through base can be used.

The Strobecom II system and the 4090 series use electronic methods for range control. For maximum range setting flexibility the 4090 series should be mounted so its sight tube is parallel to the slope of the roadway approach. Final tilt/swivel adjustments in each detector head alignment may be done via an adjustable ball joint. Loosen the ring holding the ball joint to adjust the direction of the detector. When the desired position is obtained, finger tighten the ring holding the ball joint. DO NOT over tighten or use a tool to tighten as this may damage the holding mechanism.

2.5 Model DETOC Series Detectors

ENSURE THAT ALL POWER SOURCES ARE DISCONNECTED FROM THE CABINET END OF THE M913 CABLE BEFORE INSTALLATION OF THE DETECTORS.

DETOC SERIES DETECTORS ARE COMPATIBLE ONLY WITH THE TOMAR OSPOC OSP OR GTT 200, 500, AND 700 SERIES IR PHASE SELECTORS.

DETOC detectors are equipped with a 3/4" female NPT threaded base for mounting and an internal terminal block for wiring termination. Any mounting that is stable and allows the M913 detector cable to enter through base can be used.

The OSPOC/DETOC system uses electronic methods for range control. For maximum range setting flexibility DETOC detectors should be mounted so its sight tube(s) is parallel to the slope of the roadway. Final tilt/swivel adjustments of the alignment of each detector head may be done via an adjustable ball joint. Loosen the ring holding the ball joint to adjust the direction of the detector. When the desired position is obtained, finger tighten the ring holding the ball joint. DO NOT

over tighten or use a tool to tighten as this may damage the holding mechanism.

Remove the 4 screws securing the top of the DETOC to gain access to the internal terminal block. Connect the orange, blue, yellow, and drain wires of the M913 detector cable per the label inside the DETOC. To insure proper operation, the bare drain wire must be connected to the proper connector inside the unit. The terminal block is equipped with wire clamping screws and no lugs or other connectors are necessary. DETOC detectors are fully protected from damage due to mis-wiring, however, system startup problems due to mis-wired heads can be difficult and expensive to troubleshoot. Double check the wiring and secure the top of the DETOC to the base using the 4 screws removed earlier. DO NOT over tighten the screws as the base may be damaged.

Installation is now complete.

2.6 Model 1881 Card Cage and Harness

REFER TO TOMAR DRAWING NUMBER 11229-07 FOR INSTALLATION DETAILS.

The 1881 card cage assembly is used in NEMA controllers that do not have preinstalled card files to provide a method of interfacing the 2070, 2080, 2140, 3080, 3140, 4140, or OSPOC OSP card to the detector cables, AC power, and the traffic controller preempt call inputs.

To install the 1881 set the card cage on a shelf in the traffic cabinet.

Referring to your cabinet prints, and Tomar drawing number 11229-07, connect the wires coming from the 1881 harness to AC power and the controller preempt call inputs. Connect the cables from the detectors to the terminal block provided with the 1881.

2.7 Model 2070/2080/3080/2140/3140 Optical Signal Processor

If using a model 1881 card cage to provide interface between the 2070, 2080/3080, or 2140/3140 OSP and the controller, simply slide the OSP into the card guides of the 1881. Push firmly until seated fully in the card edge connector.

If installing the 2070, 2080/3080, or 2140/3140 into a type 170 controller, locate the right-hand-most card slot (when viewed from the front of the controller) reserved for preemption usage and slide the OSP into place.

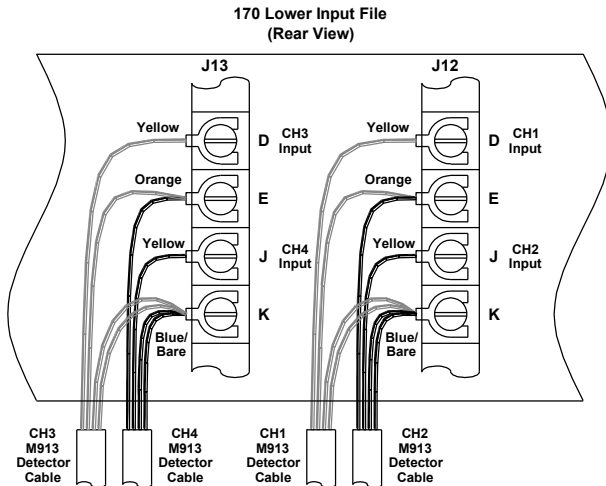


Figure 1: Detector to 170 Input File Wiring

NOTE

THE 2070/2080/3080/2140/3140 IS A FOUR CHANNEL DEVICE AND AS SUCH NO OTHER CARD OF ANY TYPE SHOULD BE PLUGGED INTO THE LEFT-HAND PREEMPTION SLOT.

Terminate the cables from the detectors on the proper terminal blocks for the 170 slot occupied by the 2070, 2080/3080, or 2140/3140 OSP card. Inputs to channels 1 and 2 will be connected to the terminal block for the slot the OSP is inserted into and the inputs for channels 3 and 4 will be connected to the terminal block for the slot immediately to the left of the OSP position. For example, if the OSP is plugged into slot 13 of a 170 input file, detectors for channels 1 and 2 will hook to the terminal block for slot 13. Detectors for channels 3 and 4 will be connected to the terminal block for slot 12. Refer to your input file wiring diagram specific to your equipment for internal wiring details.

NOTE

YOU MUST REMOVE ANY EXTERNAL SURGE SUPPRESSION DEVICES (SURRESTORS) THAT MAY HAVE BEEN PREINSTALLED ON THE DETECTOR INPUTS IN THE 170. THE STROBECOM II EQUIPMENT COMES FULLY EQUIPPED WITH SURGE SUPPRESSORS INSTALLED AND ADDITIONAL THIRD PART SURGE SUPPRESSORS ON THE DETECTOR INPUTS CAN CAUSE DETERIORATION OF THE SIGNAL FROM THE DETECTOR.

If you are installing a model 2140 or 3140 OSP you may wish to use the OSPsoft configuration software package and a laptop computer to configure the way the 2140/3140 handles various types of emitters, and other functions.

See the OSPsoft user's manual for details.

2.8 Model 4140/OSPOC/4080/OSPOC8X Optical Signal Processor

For 4140 and OSPOC:

REFER TO STROBECOM II 4140/OSPOC: GETTING STARTED (IS0592-03) FOR ANY NETWORK CONFIGURATION THAT MAY BE NEEDED ON THE 4140 OR OSPOC OSPs

If using a model 1881 card cage to provide interface between the 4140, OSPOC, 4080, or OSPOC8x OSP and the controller, simply slide the OSP into the card guides of the 1881. Push firmly until seated fully in the card edge connector.

If installing the 4140, OSPOC, 4080, or OSPOC8x into a type 170 controller, locate the right-hand-most card slot (when viewed from the front of the controller) reserved for preemption usage and slide the OSP into place.

170 input file, detectors for channels 1 and 2 will hook to the terminal block for slot 13. Detectors for channels 3 and 4 will be connected to the terminal block for slot 12. Refer to your input file wiring diagram specific to your equipment for internal wiring details.

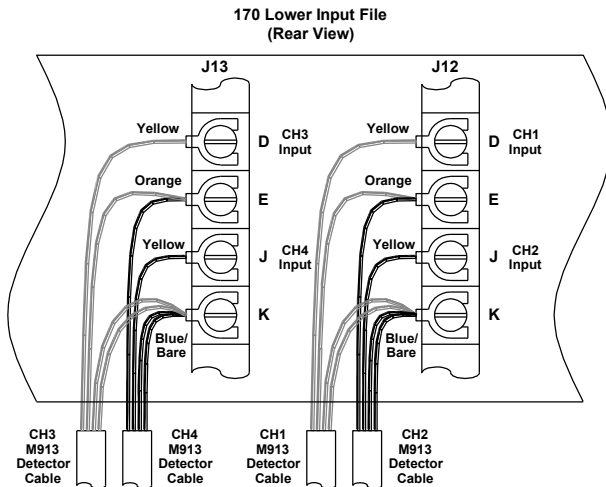


Figure 2: Detector to 170 Input File Wiring

NOTE

YOU MUST REMOVE ANY EXTERNAL SURGE SUPPRESSION DEVICES (SURRESTORS) THAT MAY HAVE BEEN PREINSTALLED ON THE DETECTOR INPUTS IN THE 170. THE STROBECOM II EQUIPMENT COMES FULLY EQUIPPED WITH SURGE SUPPRESSORS INSTALLED AND ADDITIONAL THIRD PART SURGE SUPPRESSORS ON THE DETECTOR INPUTS CAN CAUSE DETERIORATION OF THE SIGNAL FROM THE DETECTOR.

For 4140 and OSPOC:

You may wish to use the OSPsoft configuration software package and a laptop computer to configure the way the 4140 or OSPOC handles various types of emitters, and other functions.

See the OSPsoft user's manual for details.

NOTE

THE 4140/OSPOC/4080/OSPOC8x IS A FOUR CHANNEL DEVICE AND AS SUCH NO OTHER CARD OF ANY TYPE SHOULD BE PLUGGED INTO THE LEFT-HAND PREEMPTION SLOT.

Terminate the cables from the detectors on the proper terminal blocks for the 170 slot occupied by the 4140, OSPOC, 4080, or OSPOC8x OSP card. Inputs to channels 1 and 2 will be connected to the terminal block for the slot the OSP is inserted into and the inputs for channels 3 and 4 will be connected to the terminal block for the slot immediately to the left of the OSP position. For example, if the OSP is plugged into slot 13 of a

2.9 Model 2140-GPMON 8-phase Green Signal Monitor

Refer to Tomar drawing number 13225-01, attached to this document, for detailed wiring and installation information for the model 2140-GPMON.

3 Equipment Operation

ATTENTION

THE STROBECOM II SYSTEM IS DESIGNED TO AID IN THE TRANSIT OF DESIGNATED VEHICLES THROUGH THE TRAFFIC CONTROL SYSTEM TO THEIR DESTINATIONS.

IT IS IMPERATIVE THAT THE DRIVERS OF EACH TYPE OF VEHICLE THAT USES THE STROBECOM II SYSTEM BE MADE AWARE OF THE RESPONSE HE CAN EXPECT FROM THE TRAFFIC CONTROL SYSTEM.

IT IS THE RESPONSIBILITY OF THE CUSTOMER TO CONFIGURE THE SYSTEM'S RESPONSE TO EACH VEHICLE TYPE AND TO EDUCATE EACH DRIVER TO EXPECT THE APPROPRIATE RESPONSE FROM THE SYSTEM.

AT NO TIME SHOULD A DRIVER OF A VEHICLE EXPECT THAT HE IS GUARANTEED TO RECEIVE PROTECTED RIGHT-OF-WAY THROUGH TRAFFIC INTERSECTIONS. DRIVERS OF VEHICLES THAT WILL OPERATE OUTSIDE OF THE NORMAL TRAFFIC LAWS AND CONVENTIONS MUST ALWAYS TAKE RESPONSIBILITY FOR ENSURING THE SAFE PASSAGE OF HIS VEHICLE THROUGH AN INTERSECTION REGARDLESS OF THE OPERATION OR NON-OPERATIONS OF THE STROBECOM II SYSTEM.

3.1 Emitter Operation

Activate the 3065/3065-R or T792HL/T792HL-R emitter by operating the EMIT3-SWITCH to the ON position. The LED on the EMIT3-SWITCH should display a steady condition indicating the emitter is operating properly.

If the EMIT3-SWITCH is in the ON position but the LED on the EMIT3-SWITCH blinks slowly at a .5 Hz rate, the emitter may be in disable mode

because the vehicle door is open or the parking brake is set. Once the door is closed or brake released, the 3065/3065-R should operate.

If the LED on the EMIT3-SWITCH begins to flash rapidly at a 2 Hz rate, the emitter lamp is getting old and is missing flashes. In this condition, the transmission of vehicle identification and preemption request is unreliable. The emitter may be left on, but the driver should understand that the intersection may not be able to decode the vehicle's emitter, and may not give the vehicle the expected response. The emitter should be serviced as soon as possible.

After activation of the emitter and verification of a steady burning indicator, no further operator intervention is required. The emitter will continuously emit the vehicle's programmed code during the vehicle's travel.

3.2 Model 2070/2080/3080/2140/3140 OSP Operation

3.2.1 Normal Optical Signal Processor Operation

Normal operation of the 2070, 2080/3080, and 2140/3140 optical signal processors requires no operator intervention at the intersection. The OSP will respond automatically to approaching vehicles equipped with emitters per its configuration. The model 2140/3140 will log events in non-volatile memory if configured to do so.

3.2.2 Testing a Channel

For the 2070 and 2080/3080:

Individual channels may be tested by actuating the front panel test switch for that channel and signal band.

Upon activation of test mode for a channel, a test signal is internally applied to the input of the selected channel and its output is monitored for

proper operation. If the appropriate response is not given by the selected channel, the LED for that channel and band will turn RED. If the test is successful, the LED will glow GREEN.

For the 2140/3140:

Individual channels may be tested by actuating the front panel test switch for that channel and signal band.

Upon activation of test mode for a channel, a simulated test event is set up for processing. This event is processed in the same way as a normal vehicle event, but at the lowest possible priority. If no other event is in progress, the LED for that band/channel will turn green while the event is processed and preemption occurs. The LED will be amber if any other event is in progress, or if the channel is disabled. The event will continue as long as the test switch is held in the actuated position. When the switch is released, the event is terminated and the LED turned off. For the 2140/3140, toggling the switch simulates the acquisition and subsequent loss of an emitter signal.

3.2.3 Disabling OSP Outputs

To enhance troubleshooting, each channel on the 2080/3080/2140/3140 can be disconnected from the controller call input via a front panel disable switch. Operation of a channel disable switch physically disconnects the output of the 2080/3080/2140/3140 from the controller input preventing any calls from being placed to the controller. However, the channel continues to operate normally internally logging the passage of vehicles and sending RS-232 data in real-time if so configured (2140/3140 only).

Disabling a channel is useful for initial installation testing and for isolation and monitoring of suspected unreliable detectors or wiring.

The operation of any channel disable switch on the 2080/3080/2140/3140 will light the red disabled LED on the front panel for the channel. This indicates to the technician that a channel will

not place a call to the controller. In addition, the operation of a disable switch will be logged as an event in non-volatile EEPROM on the model 2140/3140.

3.2.4 Setting OSP Range

To set vehicle detection range from the front panel of the 2070, 2080/3080, OR 2140/3140 OSP, simply press and hold the RANGE ARM push button and momentarily actuate the test mode switch for the desired channel and signal band.

The annunciator LED for that channel will blink YELLOW when the channel is successfully armed for range setting.

After arming the desired signal band of the desired channel, position a vehicle with an emitter set to operate in the band being adjusted at the desired point of pick-up. Activate the emitter for a minimum of 10 seconds.

When the emitter is detected, the LED for the selected channel will turn solid GREEN and remain on until the emitter is shut off.

3.2.5 Disabling OSP Transit Band Response

For 2070, 2080, and 3080 OSPs, Transit band OSP response can be disabled from the front panel by turning the OSP power off, pushing and holding the range arm switch, pushing and holding the channel 1 test switch to the T position, and turning OSP power back on.

The transit band annunciator LED's will turn red indicating the transit band has been disabled. To re-active transit band, simply perform the same procedure again.

Use OSPsoft configuration software to disable transit band response in 2140 and 3140 OSPs.

3.2.6 Resetting the OSP to Default Settings

If, for any reason, it is necessary to reset the OSP to the factory default settings, this can be accomplished by simultaneously depressing the Range Arm button, actuating (and holding) the Emergency Band test switch for channel 1, then cycling unit power, releasing the test switch and Range Arm button after power comes on.

3.2.7 Red LEDs/Preemption Disabling

If the red LEDs are on for all installed channels, then preempts are currently disabled for the 2140/3140. This condition will be seen during normal power-up and when the 2140/3140 is in Configuration Mode.

The 2140/3140 will be in Configuration Mode if control parameter or vehicle code table changes are currently in progress via RS232 messaging.

In addition, following power-up, the red LEDs will remain on if a checksum error was detected in the control parameters or the vehicle code table. The user's options at this point are to cycle the power switch to cause the checksums to be tested again, or to perform a default reset of the 2140/3140 (see section 3.2.6). The default reset sequence will reset the control parameter values, reinitialize the vehicle code table, and clear the log. New checksums will be calculated for all, and normal operation can resume. NOTE: Any time the default reset is executed, the user may need to update control parameter values or vehicle code table entries according to configuration requirements for his/her installation. Alternatively, if the OSPsoft software package is available, the required configuration may be re-established by downloading a previously defined clone file containing the required settings.

3.2.8 Flashing Power LED on Power-up and Default Reset

During normal power-up, the red power LED will flash at a 1 HZ rate. During the default reset operation, it will flash at a lower frequency during parameter re-initialization and then switch to the 1 HZ rate as normal startup continues (following re-initialization).

3.2.9 Amber LEDs Representing Non-Preemption Events

Emitters that aren't presently causing preemption, but are in range, will have the amber LED lit for their direction/band. The amber led will remain lit until the emitter is out of range (LED off), or the event causes preemption (LED changes to green). A preempting event, which is overridden by one at a higher priority, will have its LED switched from green to amber.

3.3 Model 4140/OSPOC/4080/OSPOC8x OSP Operation

For the 4140 and OSPOC:

**SEE DOCUMENT IS0591-05 – STROBECOM II
4140 AND OSPOC: FRONT PANEL USER
GUIDE FOR FULL DETAILED FRONT PANEL
OPERATION INSTRUCTIONS**

For the 4080 and OSPOC8x:

**SEE DOCUMENT IS0612-00 – STROBECOM II
4080 AND OSPOC8x: CONFIGURATION AND
FRONT PANEL USER GUIDE FOR FULL
DETAILED FRONT PANEL OPERATION AND
JUMPER CONFIGURATION INSTRUCTIONS**

The 4140/OSPOC/4080/OSPOC8x provides a pushbutton that is used to access various operations that may be needed during installation and troubleshooting procedures.

THE HEARTBEAT LED IS LOCATED ON THE FRONT PANEL NEXT TO THE POWER SWITCH AND IS LABELED 'ON'. IT IS USED TO INDICATE WHETHER THE SYSTEM IS BOOTING, SETTING DEFAULTS VALUES, OPERATING NORMAL, OR AN ERROR CONDITION HAS OCCURRED

3.3.1 Normal Optical Signal Processor Operation

NOTE

DURING NORMAL OPERATIONS, THE LED POSITIONED BY THE POWER SWITCH, LABELED 'ON', WILL PULSE GREEN WITH A RATE AROUND ONE SECOND.

Normal operation of the 4140/OSPOC/4080/OSPOC8x optical signal processors requires no operator intervention at the intersection. The OSP will respond automatically to approaching vehicles equipped with emitters per its configuration. The model 4140/OSPOC will log events in non-volatile memory if configured to do so.

3.3.2 Testing the Optical Signal Processor

Individual channels may be tested by utilizing the front panel menu system.

To test emergency band signals, select the emergency band menu item and the channel via the front panel menu operations. The LED for the selected channel will turn green, indicating an emergency call has been placed.

To test transit band signals, select the emergency band menu item and the channel via the front panel menu operations. The LED for the selected channel will blink green at a one second rate, indicating a transit call has been placed.

3.3.3 Disabling OSP Outputs

To enhance troubleshooting, each channel on the 4140/OSPOC/4080/OSPOC8x can be disabled from making a call to the controller via the front panel menu. Operation of a channel disable command does not physically disconnect the output of the 4140/OSPOC/4080/OSPOC8x from the controller input, it only blocks any calls from being placed to the controller. However, the channel continues to operate normally.

For 4140 and OSPOC:

In addition, the model 4140 and OSPOC will internally log the passage of vehicles and send Ethernet data in real-time if so configured.

Disabling a channel is useful for initial installation testing. To disable a channel, select the channel disable command from the front panel menu and select the channel to disable.

The operation of any channel disable command on the 4140/OSPOC/4080/OSPOC8x will light the red disabled LED on the front panel for the channel. This indicates to the technician that a channel will not place a call to the controller. In addition, the operation of a disable command will be logged as an event in non-volatile flash on the model 4140/OSPOC.

To re-enable a channel, the same process can be performed.

3.3.4 Setting OSP Range

To set vehicle detection range from the front panel of the 4140/OSPOC/4080/OSPOC8x OSP, the front panel menu shall be used to select the desired channel and signal band.

The LED for that channel will blink AMBER when the channel is successfully armed for range setting.

After arming the desired signal band of the desired channel, position a vehicle with an emitter

set to operate in the band being adjusted at the desired point of pick-up. Activate the emitter for a minimum of 10 seconds.

When the emitter is detected, the LED for the selected channel will turn solid GREEN for emergency band or blinking GREEN for transit band and remain on until the emitter is shut off.

If no emitter is detected within 10 minutes, the ranging operations will be automatically disabled. The user also has the option to abort the ranging process via front panel menu operations.

3.3.5 Disabling Transit Band Response

Transit band OSP response for a channel can be disabled from the front panel via the front panel menu operations.

The transit band annunciator LED's for the channel will briefly turn red indicating the transit band has been disabled. To re-active transit band, simply perform the same procedure again.

NOTE

DISABLED TRANSIT BANDS DO NOT DISPLAY ON THE FRONT PANEL DURING NORMAL OPERATIONS. HOWEVER, VIA THE FRONT PANEL MENU, THE TRANSIT BAND DISABLE COMMANDS CAN BE USED TO OBSERVE THE CURRENT ENABLED OR DISABLED STATE OF EACH CHANNEL DURING THE CHANNEL SELECTION PROCESS.

3.3.6 Resetting the OSP to Default Settings

NOTE

DURING RESET TO DEFAULT OPERATIONS, THE LED POSITIONED BY THE POWER SWITCH, LABELED 'ON', WILL PULSE AMBER WITH A RATE AROUND ONE SECOND.

THE 4140/OSPOC/4080/OSPOC8x CAN ONLY BE RESET TO DEFAULT CONDITIONS FROM THE FRONT PANEL MENU SYSTEM.

If, for any reason, it is necessary to reset the OSP to the factory default settings, this can be accomplished via the front panel pushbutton.

After entering the front panel full menu system, simply press and hold the pushbutton for more than 12 seconds. A flashing pattern will be observed on the front panel indicating that the system is being reset to defaults. The heartbeat LED will also pulse AMBER during this process. Once the heartbeat LED turns GREEN, the reset to default operations have completed and the system has returned to normal operations

3.3.7 Red LEDs/Preemption Disabling

If the LEDs are solid RED on all channels, then preempts are currently disabled for the 4140/OSPOC/4080/OSPOC8x.

If the LEDs are flashing RED on all channels, then the 4140/OSPOC is in Configuration Mode.

The 4140/OSPOC will be in Configuration Mode if control parameter or vehicle code table changes are currently in progress via Ethernet messaging.

In addition, following power-up, the LEDs will remain solid RED if a checksum error was detected in the control parameters or the vehicle code table. The user's options at this point are to cycle the power switch to cause the checksums to be tested again or to perform a default reset of the 4140/OSPOC/4080/OSPOC8x (see section 3.2.6). The default reset sequence will reset the control parameter values, reinitialize the vehicle code table, and clear the log (logs available only on 4140/OSPOC). New checksums will be calculated for all, and normal operation can resume. NOTE: Any time the default reset is executed, the user may need to update control parameter values or vehicle code table entries according to configuration requirements for his/her installation.

For 4140 and OSPOC:

Alternatively, if the OSPsoft software package is available, the required configuration may be re-established by downloading a previously defined clone file containing the required settings.

3.3.8 Heartbeat LED on Power-up and Default Reset

The heartbeat LED is located on the front panel next to the power switch and is labeled 'on'. It is used to indicate whether the system is booting, setting default values, operating normal, or an error condition has occurred.

During normal power-up, the heartbeat LED will pulse RED at a 1 HZ rate. During the default reset operation, it will pulse AMBER at a 1 HZ rate during parameter re-initialization and then switch to pulsing GREEN at a 1 HZ rate (following re-initialization).

3.3.9 LED Representation of Event Band and Preemption Status

NOTE

EACH CHANNEL HAS A SINGLE ANNUNCIATOR LED. TO DIFFERENTIATE BETWEEN EMERGENCY BAND AND TRANSIT BAND, A SOLID LED INDICATES EMERGENCY BAND WHILE A BLINKING LED INDICATES TRANSIT BAND.

IF MULTIPLE EMITTER EVENTS OCCUR ON THE SAME CHANNEL, THE LED WILL DISPLAY THE STATE OF THAT EVENT WHICH HAS THE HIGHEST PRIORITY.

For emergency band, emitters that aren't presently causing preemption, but are in range, will have the amber LED lit solid for their direction. The amber led will remain lit solid until the emitter is out of range (LED off), or the event causes preemption (LED changes to solid green). A

preempting event, which is overridden by one at a higher priority, will have its LED switched from solid green to solid amber.

For transit band, emitters that aren't presently causing preemption, but are in range, will have the amber LED flashing at a 1 HZ rate for their direction. The amber led will remain flashing at a 1 HZ rate until the emitter is out of range (LED off), or the event causes preemption (LED changes to green flashing at a 1 HZ rate). A preempting event, which is overridden by one at a higher priority, will have its LED switched from green flashing at a 1 HZ rate to amber flashing at a 1 HZ rate.

4 Routine Equipment Maintenance

4.1 Emitter Maintenance

The 3065/3065-R or T792HL/T792HL-R emitter should be inspected for proper operation at the beginning of every vehicle shift.

Visually confirm the solid illumination of the LED on the EMIT3-SWITCH and if possible the flashing of the emitter lamp.

Monthly, the emitter lamp should be visually inspected. Any arc lamp that is blackened over more than 30% of its length should be replaced.

If the LED on the EMIT3-SWITCH flashes quickly at a 2Hz rate, indicating a lamp that is beginning to misfire due to age, the emitter system should be taken out of service and the emitter lamp replaced immediately.

4.2 Detector Maintenance

The only maintenance required on the 2090/2091, 4090, or DETOC detectors is possible periodic cleaning of the sight tube.

AS YOU REMOVE THE SITE TUBE, THE LENS IS LOOSE AND SHOULD COME OUT WITH THE SITE TUBE. BE CAREFUL NOT TO DROP OR LOSE THE LENS. DON'T ALLOW DIRT OR WATER INTO THE DETECTOR AS THE PHOTODIODE IS EXPOSED.

The 2090/2091 detector sight tube is removable by unscrewing from the detector case. The sight tube lens can then be cleaned using any glass-cleaning product then replaced and the site tube screwed back into place.

For the 4090 or DETOC detectors remove the 2 screws holding the site tube to the detector head.

THE LENS ON THE 4090 AND DETOC DETECTORS IS PLASTIC. USE MILD CLEANING PRODUCTS SUCH AS SOAP AND WATER.

When re-inserting, the lens has a flat spot that keys it to the site tube.

The frequency of required cleaning will vary greatly upon the environment the detector operates in. In clean environments, the sight tubes may not need cleaning for many years. In more dirty environments, the sight tubes may require cleaning once or twice a year. A dirty sight tube will have the effect of a slow reduction in emitter reception range.

New installations should be monitored closely during the first year of operation to determine the need for sight tube maintenance.

4.3 OSP Card Maintenance

The 2070 and 2080/3080 optical signal processors require no periodic maintenance.

The 4080 and OSPOC8x optical signal processors require no periodic maintenance.

Routine maintenance of a 2140/3140/4140/OSPOC OSP not connected to a central system consists of period downloading of the event logs gathered during the normal operations of the system at the intersection using a portable computer and OSPsoft configuration software.

For Strobecom II systems employing 2140/4140/OSPOC OSP cards, routine maintenance would also be required should new vehicle codes be enabled or sub-group/class organization or priorities changed. These changes can be implemented locally using the OSPsoft configuration software on a portable computer, or via the 2140's RS-232 port via modem or the traffic control system's communication system. For the 4140/OSPOC, an Ethernet connection must be used for OSPsoft configurations.

If the 2140/3140/4140/OSPOC OSP card is interfaced to the traffic control system for remote

downloading of the system's event logs, then no on-site routine maintenance is required for the 2140/3140/4140/OSPOC.

5 Equipment Troubleshooting

When a report of system failure is received from the field, the Strobecom II system must be analyzed and the source of the failure repaired. The major components of the Strobecom II system have self-diagnostic functions that aid in troubleshooting.

5.1 Emitter System Troubleshooting

When a report of system failure is received from the field, the Strobecom II system must be analyzed and the source of the failure repaired. The major components of the Strobecom II system have self-diagnostic functions that aid in troubleshooting.

The 3065/3065-R and T792HL/T792HL-R emitter is equipped with a monitoring system that continuously checks for the proper operation of the emitter lamp.

Troubleshooting the emitter is required when the status indicator located on the emitter control switch is flashing.

An indicator flashing quickly at a 2Hz rate indicates that the emitter lamp is reaching end of life and is beginning to miss flashes. Immediately replace the emitter lamp.

THE EMITTER LAMP IS UNRELIABLE AND MAY NOT INITIATE PREEMPTION IN THIS CONDITION AND SHOULD BE SERVICED IMMEDIATELY.

If the EMIT3-SWITCH is activated but the LED indicator does not illuminate, or the emitter does not generate a signal, check the following items.

Check the 10-amp fuse.

If the 10-amp fuse is OK, measure the voltage to the RED wire of the EMIT3-CONT CBL. With the EMIT3-SWITCH in the ON position, vehicle battery voltage should be applied.

Check all wiring for damage.

If all above fail replace the 3065-HOUSING or 3065-R-PS power supply with a known good unit. Return the defective power supply to Tomar Electronics, Inc. for service.

If the EMIT3-SWITCH is activated and the LED on the EMIT3-SWITCH flashes slowly at a .5 Hz rate, check the following items:

Check the door or parking brake cut-out switch for proper operation.

Check the wiring to the door or Parking brake switch.

5.2 Receiver System Troubleshooting

5.2.1 Model 2070/2080/3080/2140/3140 OSP

Begin troubleshooting the intersection equipment by turning the power off on the OSP card, waiting 15 seconds, and turning power back on.

Cycling the power will cause the OSP to initiate self-diagnostic tests.

If the power on indicator fails to light at all, then check the input power fuse (F1). If it is blown replace it and reapply power. If it blows again, the OSP has a power supply failure and must be sent to the factory for repair.

If fuse F1 is intact but the power on LED still fails to light then replace the communication or control module (MOD7) and retest.

Operate each test switch and note the receipt of the solid GREEN indication on each channel and signal band tested and the appropriate action from the controller.

If the LED for a particular channel and signal band test respond with a RED indication, replace the signal processor module for that channel and repeat the test.

If the LED indicates that the channel is operating properly but the controller does not indicate a call

placed on its input, examine and repair the wiring between the card edge of the OSP and the controller inputs.

If the intersection fails to operate properly after all test switch operations respond properly, use a volt meter to measure the voltage being supplied to the detectors on the terminal block where their connections are made. If the voltage from the Orange (+24) to the Blue (GND) connection is not in the range from 10 to 30VDC, then the detector heads are not receiving the proper power.

If the voltage reading is 0, then check the condition of output fuse F2. If it is blown then replace it and reapply power. Recheck the voltage and verify it is in the proper range. If the voltage is proper then recheck the intersection for proper operation.

If F2 blows again then a detector head has failed or a short has developed in the cable to a detector. Disconnect all the detector orange leads at the terminal block and replace F2. Reconnect each detector one at a time until the shorted detector run is discovered. To determine if the short is caused by the cable or the detector, disconnect the suspect detector at the mast arm end of the cable, and reapply power. If F2 holds then the detector is shorted and must be replaced. If F2 still opens then the detector cable run has become damaged and needs to be replaced.

After the OSP operation has been tested and the detector power and cabling has been verified, the intersection should respond to optical signals. If a channel still fails to receive a known good emitter signal then the detector connected that channel may be defective.

Disconnect the suspect detector at the terminal block where it terminates in the traffic cabinet. Connect a known good detector in its place and temporarily aim the detector at the known good emitter signal. If the channel now responds, then replace the detector for that channel.

After performing the above testing procedure the intersection equipment should be in working order. If the above tests and corrective actions have not solved the difficulty, return the

intersection equipment to the factory for more in depth analysis and repair.

5.2.2 Model 4140/OSPOC/4080/OSPOC8X OSP

NOTE

DURING NORMAL SYSTEM OPERATIONS, THE HEARTBEAT LED WILL BE PULSING GREEN. HOWEVER, IT IS STILL POSSIBLE THAT THE SIGNAL INPUTS OR OUTPUTS NEED REPAIR.

Begin troubleshooting the intersection equipment by turning the power off on the OSP card, waiting 15 seconds, and turning power back on.

Cycling the power will cause the OSP to initiate self-diagnostic tests.

When cycling power, note the front panel LEDs. They should display a pattern on each channel using GREEN, AMBER, and RED. If this pattern is seen but the heartbeat LED does not display, then the heartbeat LED has a fault. While this does not affect system performance, a faulty heartbeat LED will not allow visual indications of system health.

If the heartbeat LED fails to light at all, then check the input power fuse. If it is blown replace it and reapply power. If it blows again, the OSP has a power supply failure and must be sent to the factory for repair.

If fuse is intact but the heartbeat LED still fails to light and no front panel LEDs patterns were observed, the OSP must be sent to the factory for repair.

If the front panel LED display shows a RED LED pattern traversing the channels one at a time, this indicates that an SPM module has not been detected. If an SPM module is inserted, remove and re-insert the SPM module. If the LED display does not change, then the OSP must be sent to the factory for repair

If the front panel LED display shows channels alternating between AMBER and RED, then a power failure to the detectors has occurred. Since the 4140/OSPOC/4080/OSPOC8x supplies power to all detectors simultaneously, systematically remove power and signal to each detector from the 4140/OSPOC/4080/OSPOC8x until this condition clears. Allow at least 5 seconds for the system to detect that the fault has been cleared for any given detector. If the front panel LED display turns off, then the fault has been cleared.

Operate each test command via the front panel menu system and note the receipt of the solid GREEN indication for emergency (or flashing GREEN for transit) on each channel and signal band tested and the appropriate action from the controller.

If the LED indicates that the channel is operating properly but the controller does not indicate a call placed on its input, examine and repair the wiring between the card edge of the OSP and the controller inputs.

If the intersection fails to operate properly after all test command operations respond properly, use a volt meter to measure the voltage being supplied to the detectors on the terminal block where their connections are made. If the voltage from the Orange (+24) to the Blue (GND) connection is not in the range from 10 to 30VDC, then the detector heads are not receiving the proper power.

After the OSP operation has been tested and the detector power and cabling has been verified, the intersection should respond to optical signals. If a channel still fails to receive a known good emitter signal then the detector connected that channel may be defective.

Disconnect the suspect detector at the terminal block where it terminates in the traffic cabinet. Connect a known good detector in its place and temporarily aim the detector at the known good emitter signal. If the channel now responds, then replace the detector for that channel.

After performing the above testing procedure the intersection equipment should be in working order. If the above tests and corrective actions

have not solved the difficulty, return the intersection equipment to the factory for more in depth analysis and repair.

MODEL 209X-SD Strobecom II Optical Preemption Detector and MODEL 209X-ST Strobecom II Optical Preemption Detector w/ Self Test INSTALLATION INSTRUCTIONS

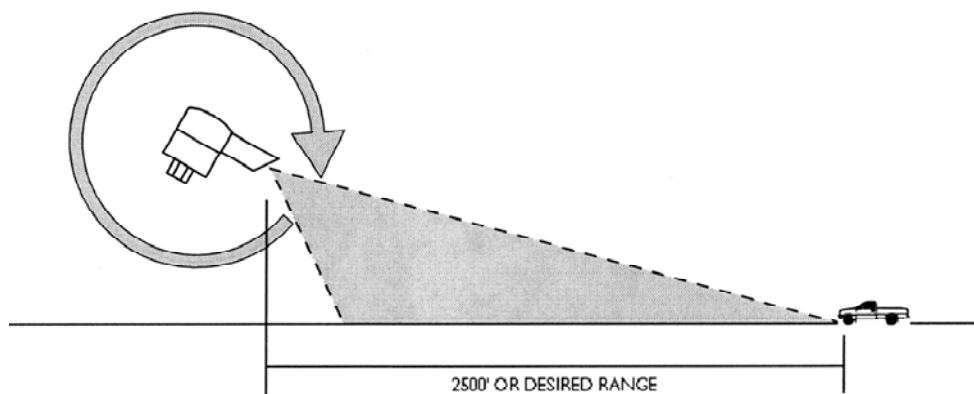


MOUNTING

The 2090-SD, 2091-SD, 2090-ST & 2091-ST are equipped with a 1/2" female NPT threaded base for mounting and an internal terminal block for wiring termination. Any mounting that is stable and allows the M913 detector cable to enter through base can be used.

The 2090-SD or 2090-ST is recommended for mast arm mounting where a narrow field of view is required. The 2091-SD or 2091-ST is recommended for span wire mounting and on most mast arms where a wider field of view makes aiming easier. Many styles of mounts are available for the 209x-SD & 209x-ST for mast arm and span wire mounting. Contact your TOMAR distributor for more information.

The Strobecom II system and the 209x-SD & 209x-ST use electronic methods for range control. For maximum range setting flexibility the 209x-SD & 209x-ST should be mounted so its sight tube is parallel to the slope of the roadway. For extremely short approaches (under approximately 200 feet), it may be desirable to leave the electronic range adjustment at maximum and limit the 209x-SD & 209x-ST's field of view by tipping it downward as shown below.



WIRING—CAUTION: MAKE SURE POWER IS OFF BEFORE INSTALLING

Remove the 3 screws securing the top of the 209x-SD / 209x-ST to gain access to the internal terminal block. Connect the orange, blue, yellow, and drain wires of the M913 detector cable per the label inside the 209x-SD / 209x-ST. **To insure proper operation, insulate the bare drain wire to prevent contact with the connections inside the unit and any other metal.** The terminal block is equipped with wire clamping screws and no lugs or other connectors are necessary. The 209x-SD & 209x-ST are fully protected from damage due to miswiring, however, system startup problems due to miswired heads can be difficult and expensive to troubleshoot. Double check the wiring and secure the top of the 209x-SD / 209x-ST to the base using the 3 screws removed earlier. **DO NOT overtighten the screws as the base may be damaged.** Installation is now complete.

TOMAR Electronics, Inc.

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TECHNICAL BULLETIN

12/17/1998

TB0002 – SPAN WIRE MOUNTING OF STROBECOM DETECTORS

Tomar Electronics, Inc., model 2090-SD and 2091-SD optical detectors are suitable for mounting either on a mast arm or from a span wire.

While the electronics inside the 2090-SD and 2091-SD detectors is encapsulated, the terminal block where cable connections are made is exposed. The mechanical design of the 2090-SD and 2091-SD includes weep holes which allow for water or condensation that does enter to escape from the detector wiring compartment.

When mounting the 2090-SD or 2091-SD upside down from a span wire, special care must be taken to prevent water from entering a mount made from a material that can corrode. If mounted improperly, oxide or rust laden water may flow from the mount into the wiring compartment of the detector, follow the detector cable, and drip directly onto the detector terminal block. The corrosion can deposit on the terminals seizing the screws and eventually leading to detector failure.

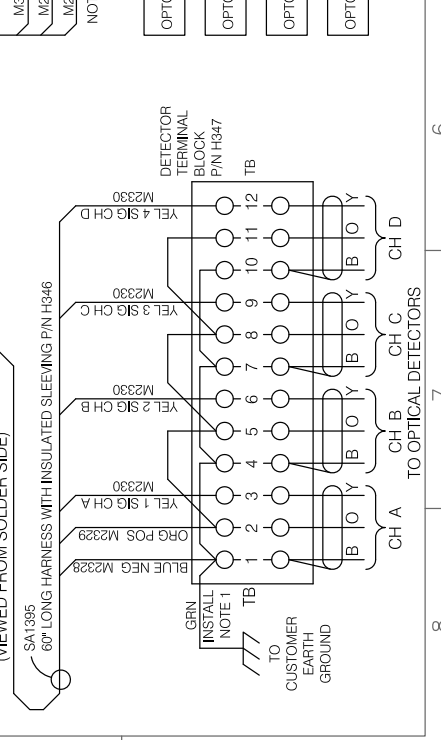
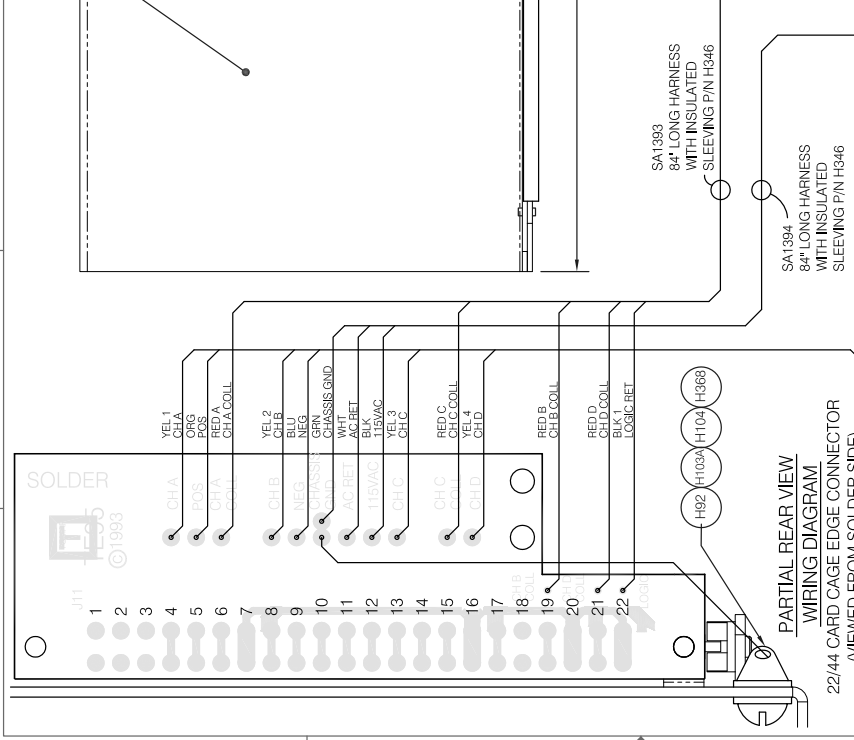
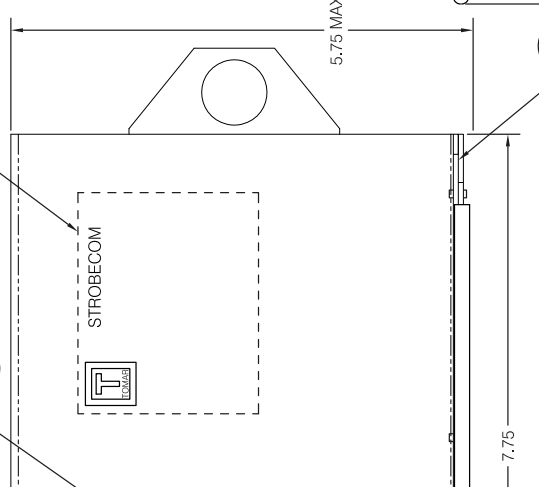
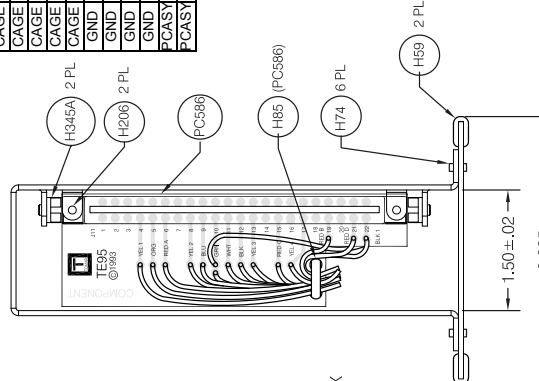
The recommended Tomar model 2091-S span wire mount will orient the detector upright preventing water from entering the detector wiring compartment eliminating the possibility of damage.

Third party supplied mounts for span wire use should be constructed to mount the detector upright or to positively prevent water entry by some other means.

The Tomar Electronics, Inc., warranty for the 2090-SD and 2091-SD does not cover damage to the detector due to improper mounting that allows rust laden water to drip directly into the detector wiring compartment.

Contact the Tomar Electronics, Inc. engineering department for more information.

BILL OF MATERIAL		
NAME (QTY)	DESCRIPTION	PART NO.
1	NAMEPLATE 1881 CARD CAGE	MT103A
CAGE	RUBBER U-CHANNEL, 2 PCS @ 6 IN	H0059
CAGE	POP RVLET .094" DIA X .03-.125	H0074
CAGE	CARD GUIDE 4.5" LONG SNAP-IN	H0345A
CAGE	ENCLOSURE CARD CAGE ANODIZED	M4044-A
CAGE	BASE PLATE CARD CAGE ANODIZED	M4044-BASE-A
GND	4-40 HEX NUT ZP 1/4" ACROSS FLATS	H0092
GND	#4 SOLDER LUG BENT	H0103A
GND	#4 INTERNAL LOCKWASHER ZP	H0388
PCAS1	POP RVLET .094" DIA X .25-.375	H0206
PCAS3	1 1881 BACKPLANE PCB	PC0686



SPECIFICATIONS

- PHYSICAL SIZE**
 HEIGHT.....5.75" MAX (146mm)
 DEPTH.....7.75" (197mm)
 WIDTH.....3.325" (84mm)
- MOUNTING**
 UNIT CAN STAND OR LIE ON SHELF
- ENVIRONMENTAL**
 TEMPERATURE (OPERATING).....-30°F TO + 165°F
-34°C TO + 74°C
- INTERFACE CONNECTIONS**
 4 CHANNEL
1. OUTPUTS ARE SOLID GROUND TRUE ~8.9VDC> DURING HI PRIORITY OPTICAL INPUT (PREFMPT)
 2. OUTPUTS ARE PULSING AT 55% DUTY CYCLE 24-16VDC HIGH TO 8-0VDC LOW - FOR LOW PRIORITY OPERATION
 3. ALL GROUND AND POWER WIRING IS #18 AWG UL 1015.
 4. ALL LOGIC AND SIGNAL WIRING IS #20 AWG UL 1007.

INSTALLATION NOTES

1. **CAUTION** ALL STROBECOM SYSTEM GROUND CONNECTIONS MUST BE CONNECTED TO A GOOD EARTH GROUND. FAILURE TO PROPERLY GROUND EQUIPMENT RESULT IN IMPROPER OPERATION AND/OR CREATE AN ELECTRICAL HAZARD.
 2. **CAUTION** DETERMINE THAT YOUR CONTROLLER IS EQUIPPED WITH THE NECESSARY SOFTWARE PACKAGE BEFORE BEGINNING OPERATION.

INTERFACE CONNECTIONS TO CUSTOMERS TRAFFIC CONTROLLER

TYPE	DESCRIPTION
AC	CH A OUTPUT (COLLECTOR)
AC	CH B OUTPUT (COLLECTOR)
AC	CH C OUTPUT (COLLECTOR)
AC	CH D OUTPUT (COLLECTOR)
AC	LOGIC RETURN (EMITTERS)
AC	LOGIC GND
AC	AC +
AC	AC RETURN (NEUTRAL)
AC	SAFETY GROUND (NOTE 1)
AC	GND

AC POWER CONNECTIONS

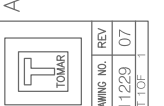
AC	CH A OUTPUT (COLLECTOR)
AC	CHANNEL B OUTPUT (COLLECTOR)
AC	CHANNEL C OUTPUT (COLLECTOR)
AC	CHANNEL D OUTPUT (COLLECTOR)
AC	LOGIC SUPPLY RETURN (EMITTERS)

NOTE: GROUND AND AC POWER WIRING IS #18 AWG LOGIC SUPPLY RETURN AND OUTPUTS ARE #20 AWG

REV	DATE	DESCRIPTION
02	01/17/03	Assemble and test reference
03	01/17/03	Assemble baseplate PCB TEST
04	2/10/04	Assemble M2330 & H346 for final assembly
05	4/12/04	Connector P4 to P1C
06	10/23/01	SBK: M4044-A2:Output Harness: Initial mass
07	01/03/08	Rev Card Cage Design

REV	DATE	DESCRIPTION
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 2100 WEST OBERSON
 GILBERT, ARIZONA 85233

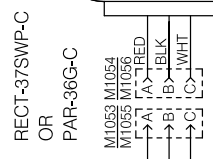
STROBECOM
 1881 CARD CAGE AND HARNESS
 ASSEMBLY AND
 WIRING DIAGRAM

TOMAR PART NO.: FP636B-1

REV	DATE	DESCRIPTION
02	01/17/03	Assemble and test reference
03	01/17/03	Assemble baseplate PCB TEST
04	2/10/04	Assemble M2330 & H346 for final assembly
05	4/12/04	Connector P4 to P1C
06	10/23/01	SBK: M4044-A2:Output Harness: Initial mass
07	01/03/08	Rev Card Cage Design

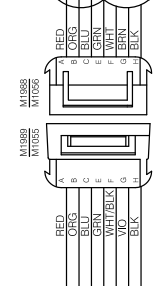
REV	DATE	DESCRIPTION
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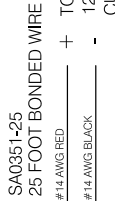


EMIT2-1228
POWER SUPPLY

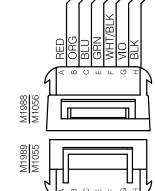
**CAUTION
HIGH
VOLTAGE**



SA1069
15' CONTROL CABLE

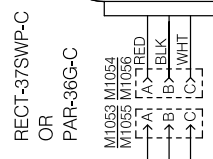


SA0351-25
25 FOOT BONDED WIRE
+ TO VEHICLE FUSE PANEL
- 12 VDC INPUT
CURRENT DRAW APPROXIMATELY 3 AMPS MAX

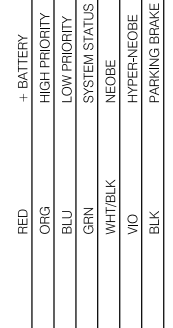


SA0697
15' LAMP CABLE

PC0161-15C-WP2



SYSTEM STATUS INDICATOR
STEADYBURN = SYSTEM OPERATING PROPERLY
TWO FLASHES PER SECOND = LAMP FAILED



+ 12 VDC CONTROL ACTIVATION



M2060A
SWITCH SPST
ILLUMINATED ROCKER
SYSTEM STATUS INDICATOR



M2062A
SWITCH SPST
ILLUMINATED 3-WAY ROCKER
SYSTEM STATUS INDICATOR

WARNING

THE EMIT2-1228 WEIGHS APPROXIMATELY 2.5 LBS. IT IS VITAL THAT IT BE MOUNTED SO THAT IN THE EVENT OF AN ACCIDENT, IT CANNOT COME LOOSE AND IMPACT A VEHICLE PASSENGER.

INSTALLATION

- UNPACKING**
AFTER UNPACKING THE EQUIPMENT, EXAMINE IT FOR DAMAGE THAT MAY HAVE OCCURRED IN TRANSIT. IF THE EQUIPMENT HAS BEEN DAMAGED, DO NOT ATTEMPT TO INSTALL OR OPERATE IT. FILE A CLAIM IMMEDIATELY WITH THE CARRIER STATING THE EXTENT OF THE DAMAGE. CHECK ALL CHECK-ALL ENVELOPES, SHIPPING LABELS AND TAGS BEFORE RETURNING TO THE MANUFACTURER.
- MOUNTING AND WIRING**
 - MOUNT THE EMITTER LIGHTHEAD ON THE VEHICLE. AIM THE LIGHTHEAD SO THAT IT IS DIRECTED AT THE CONTROL PANEL. THE LIGHTHEAD SHOULD BE SECURED TO THE CONTROL PANEL WITH A CONTROL PANEL FUSE WILL BE GREATLY REDUCED, AND/OR INEFFECTIVE.
 - ROUTE THE CABLE FROM THE LIGHTHEAD TO THE INTENDED POWER SUPPLY LOCATION. MAKE SURE THE CABLE IS PROTECTED AND SECURED TO PREVENT ABRASION OF THE INSULATION WHERE THE CABLE PASSES THROUGH THE VEHICLE.
- CONTROL SWITCH & SYSTEM STATUS INDICATOR**
 - ROUTE THE 16 FOOT CONTROL CABLE FROM THE POWER SUPPLY TO THE SWITCH AND SYSTEM STATUS INDICATOR AND CONNECT AS SHOWN.
- POWER WIRING**
 - LOCATE A SUITABLE 16 AMP FUSED BATTERY CIRCUIT AT THE VEHICLES FUSE BLOCK OR WIRE A NEW CIRCUIT DIRECTLY TO THE VEHICLE BATTERY AS SHOWN IN THE WIRING DIAGRAM. CONNECT THE RED POWER WIRE TO THE POSITIVE BATTERY SUPPLY AND CONNECT THE BLACK LEAD TO A NEGATIVE BATTERY TERMINAL.
 - CONNECT THE POWER CABLE CONNECTOR INTO THE POWER CONNECTOR ON THE EMIT2-1228 POWER SUPPLY AFTER CONNECTING THE LAMP AND CONTROL WIRING.

OPERATION

- TO ACTIVATE THE EMITTER SYSTEM, SIMPLY TURN ON THE SWITCH. THE EMITTER WILL ACTIVATE AND AUTOMATICALLY TEST ALL COMPONENTS. VERIFY SYSTEM STATUS INDICATOR ON ILLUMINATED SWITCH.

INSTALLATION IS COMPLETE

- TROUBLE SHOOTING**
IF THE EMITTER SYSTEM FAILS TO OPERATE AS IN SECTION 3 ABOVE, TRY THE FOLLOWING STEPS.
 - CHECK THE SYSTEM STATUS INDICATOR. A STEADY GREEN INDICATION SHOWS THAT THE LAMP, THE POWER SUPPLY AND ALL CONTROL WIRING ARE OPERATING PROPERLY.
 - CHECK ALL CONNECTORS TO MAKE SURE THAT THEY ARE FIRMLY CONNECTED.
 - CHECK ALL FUSES.
 - CHECK SUPPLY VOLTAGE AT THE EMIT2-1228 POWER SUPPLY TO INSURE PROPER INPUT VOLTAGE IS BEING APPLIED TO THE POWER SUPPLY.
 - FUSE F1 - 20 AMP WILL OPEN IF INCORRECT BATTERY POLARITY IS APPLIED.
 - FUSE F2 - 1 AMP PROTECTS ALL CONTROL WIRING CIRCUITY.

EMIT2-1228 EMITTER SYSTEM INSTALLATION INSTRUCTIONS
SAFETY NOTICES

WARNING
FAILURE TO FOLLOW ALL SAFETY PRECAUTIONS AND INSTRUCTIONS MAY RESULT IN PROPERTY DAMAGE, SERIOUS INJURY OR DEATH TO YOU OR OTHERS.

DANGER HIGH VOLTAGE
SAFETY MESSAGE TO INSTALLERS, USERS, AND MAINTENANCE PERSONNEL

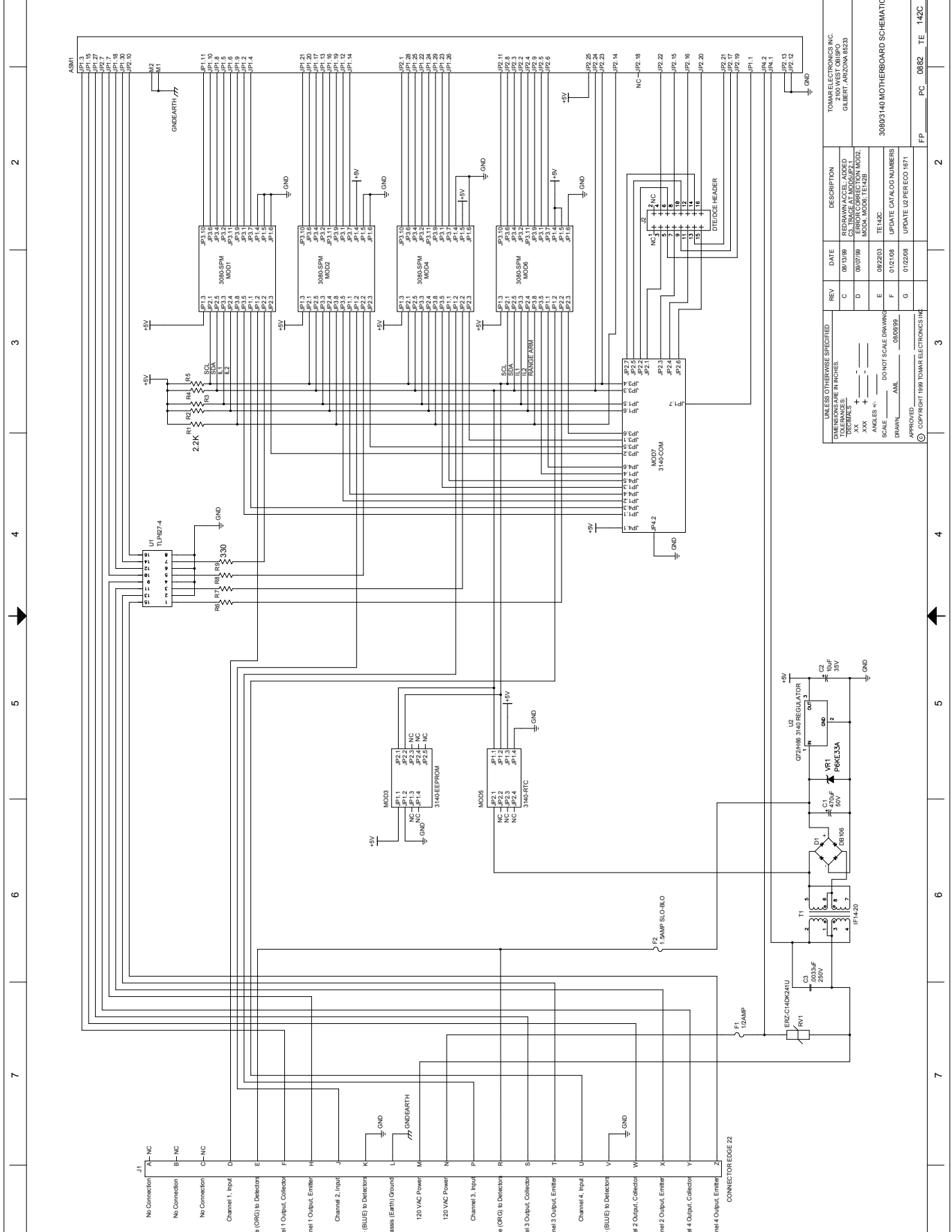
IT IS THE RESPONSIBILITY OF THE INSTALLER, TO INSTALL THIS PRODUCT, IN COMPLIANCE WITH ALL GOVERNMENT, STATE, TOWN OR ANY LOCAL CODES THAT HAVE JURISDICTION OVER THIS INSTALLATION.

IT IS IMPORTANT TO FOLLOW ALL INSTRUCTIONS SHIPPED WITH THIS PRODUCT. THIS DEVICE IS TO BE INSTALLED BY A TRAINED INSTALLER WHO IS THOROUGHLY FAMILIAR WITH THE NATIONAL AND LOCAL ELECTRIC CODES.

- THE SELECTION FOR THE MOUNTING LOCATION FOR THE DEVICE, ITS CONTROLS AND THE ROUTING OF THE WIRING IS TO BE ACCOMPLISHED BY THE DIRECTION OF THE INSTALLER. THE FOLLOWING ARE THE SAFETY PRECAUTIONS AND PRECAUTION YOU SHOULD FOLLOW:
- BEAD AND UNDERSTAND ALL INSTRUCTIONS BEFORE INSTALLING OR OPERATING THIS EQUIPMENT.
 - DO NOT CONNECT THIS DEVICE TO THE SYSTEM WHEN THE POWER IS TURNED ON.
 - AFTER INSTALLATION, ENSURE THAT ALL SCREWS AND THREADED JOINTS ARE PROPERLY TIGHTENED.
 - AFTER INSTALLATION, TEST THE SYSTEM REGULARLY TO ENSURE THAT IT IS OPERATING PROPERLY.
 - AFTER INSTALLATION AND TESTING IS COMPLETE, PROVIDE A COPY OF THIS INSTRUCTION SHEET TO ALL OPERATING PERSONNEL.

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.		TOMAR ELECTRONICS INC.	
REV	DATE	DESCRIPTION	QUANTITY
01	12/06/06	DRAW IN AUTOCAD	1
02	02/09/07	CORRECT M2060A	1
03	01/21/08	PROGRAM MODULE	1
04	01/29/08	EMIT2	1
05	07/07/09	SYSTEM STATUS UPDATE	1
06	03/29/10	3-WAY SWITCH OPTION	1

TOMAR ELECTRONICS INC.	
2100 W. GIBSON AVENUE	12024 06
GILBERT, ARIZONA, 85233	
800-536-3133	
EMIT2-1228 EMITTER	
SYSTEM INSTALLATION WIRING	
IS02229A	
TOMAR PART NO.: SA1060A	



REV	DATE	DESCRIPTION
C	08/15/98	DESIGN CORRECTION MOD.
D	09/07/98	CS TRACE AT MOD/02.1
E	09/22/03	ERROR CORRECTION MOD.
F	01/21/08	WASH MODS 1424S
G	01/22/08	WASH MODS 1424S

SCALE	DO NOT SCALE DRAWING	TE142C
AWL	08/09/99	UPDATE CATALOG NUMBERS
		UPDATE I2 PER ECO 1671

APPROVED	DATE	BY

UNLESS OTHERWISE SPECIFIED	DIMENSIONS ARE IN INCHES
XX TECHNICALS	
ANGLES °	
SCALE	DO NOT SCALE DRAWING
DRAWN	AWL
APPROVED	

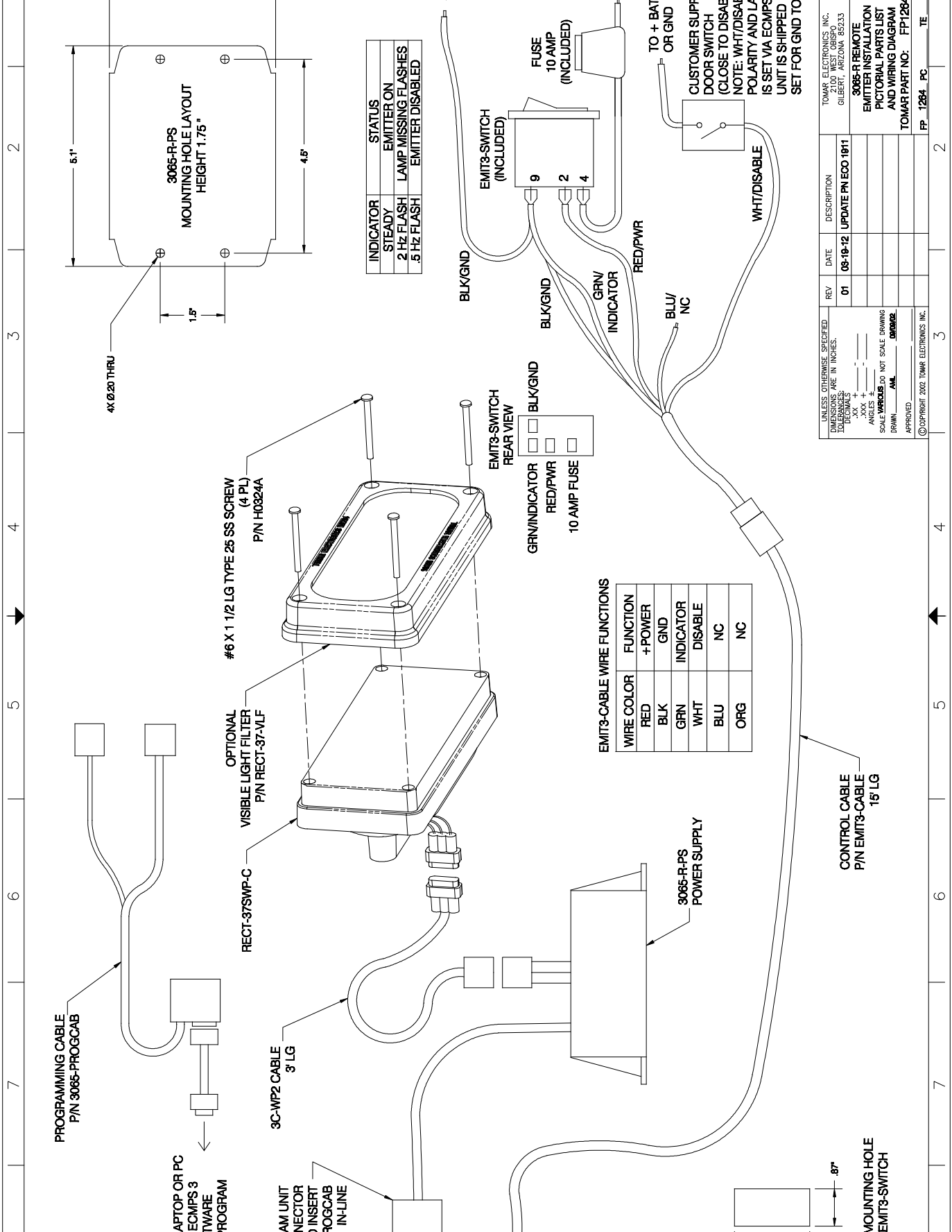
3080G 140 MOTHERBOARD SCHEMATIC

TOMAR ELECTRONICS INC.
2100 WEST OMBIPO
GILBERT, ARIZONA 85233

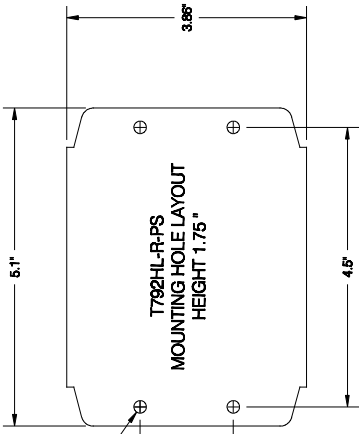
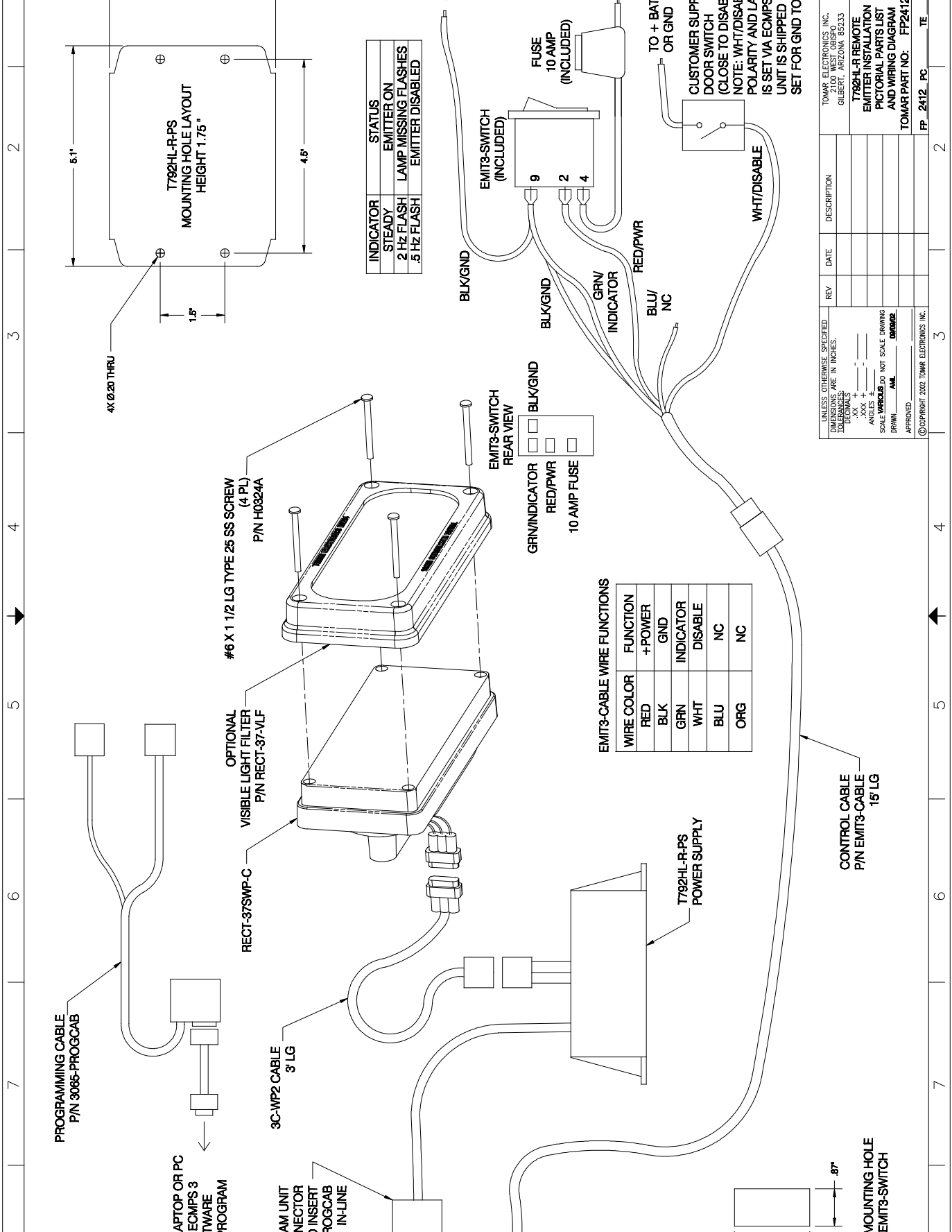
DRAWING NO. 60000
REV. G

PC 0882 TE 142C
PP

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Plateform 60000-G.sch



TOMAR ELECTRONICS INC. 1000 N. GILBERT AVENUE GILBERT, ARIZONA 85233	
REV	DESCRIPTION
01	09-19-12 UPDATE PN ECO-1811
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DECIMALS .XXX + .XXX - ANGLES ± SCALE VARIOUS DO NOT SCALE DRAWING DRAWN: <u>AWL</u> CHECKED: <u>DP/MLZ</u> APPROVED: _____ © COPYRIGHT 2002 TOMAR ELECTRONICS INC.	
3065-R REMOTE EMITTER INSTALLATION PICTORIAL PARTS LIST AND WIRING DIAGRAM TOMAR PART NO: FP1284	
DRAWING NO.	REV
12184	01
12184	01
FP-1284	PC
TE	1



INDICATOR	STATUS
STEADY	EMITTER ON
2 HZ FLASH	LAMP MISSING FLASHES
.5 HZ FLASH	EMITTER DISABLED

WIRE COLOR	FUNCTION
RED	+POWER
BLK	GND
GRN	INDICATOR
WHT	DISABLE
BLU	NC
ORG	NC

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
DIMENSIONS IN PARENTHESES ARE DECIMALS
ANGLES ± .XXX °
SCALE VARIOUS DO NOT SCALE DRAWING
DRAWN: AWL CHECKED: DP/MSZ
APPROVED: _____
© COPYRIGHT 2002 TOMAR ELECTRONICS INC.

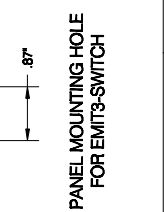
REV	DATE	DESCRIPTION

TOMAR ELECTRONICS INC.
1000 W. GILBERT AVENUE
GILBERT, ARIZONA 85233

T792HL-R REMOTE
EMITTER INSTALLATION
PICTORIAL PARTS LIST
AND WIRING DIAGRAM
TOMAR PART NO: FP2412

DRAWING NO. REV
14656 00

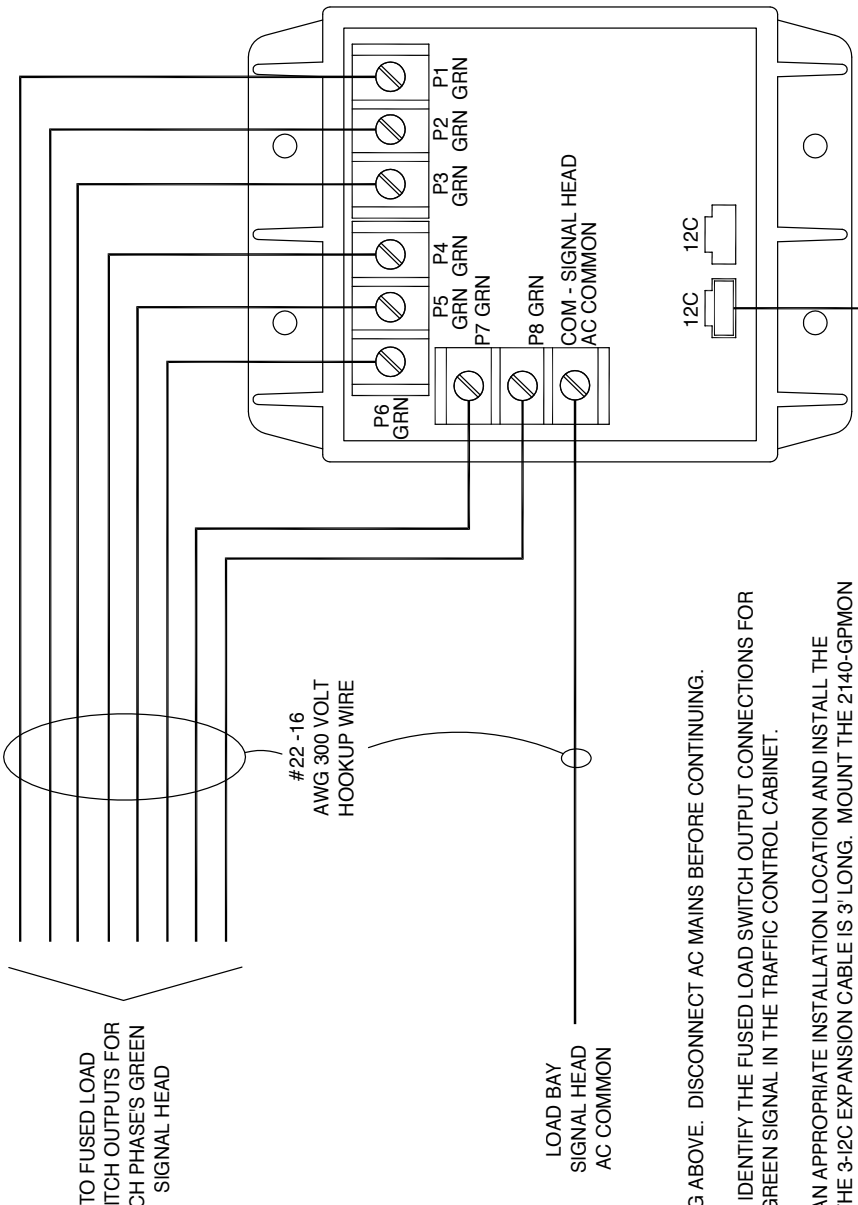
FR: 2412 PC TE



PANEL MOUNTING HOLE
FOR EMIT3-SWITCH

WARNING

INSTALLATION OF THIS DEVICE MAY EXPOSE YOU TO AC VOLTAGE AND THE RISK OF ELECTRIC SHOCK OR ELECTROCUTION. TURN OFF THE AC MAINS AND USE ACCEPTED AND RECOGNIZED SAFETY PRECAUTIONS TO AVOID EXPOSURE TO RISK OF ELECTRIC SHOCK OR ELECTROCUTION. ELECTRIC SHOCK MAY CAUSE SEVERE INJURY OR DEATH.



MODEL 2140-GP8MON
8 PHASE OPTICALLY ISOLATED GREEN SIGNAL MONITOR

TOP VIEW

INSTALLATION

1. SEE WARNING ABOVE. DISCONNECT AC MAINS BEFORE CONTINUING.
2. LOCATE AND IDENTIFY THE FUSED LOAD SWITCH OUTPUT CONNECTIONS FOR EACH PHASE'S GREEN SIGNAL IN THE TRAFFIC CONTROL CABINET.
3. DETERMINE AN APPROPRIATE INSTALLATION LOCATION AND INSTALL THE 2140-GP8MON. THE 3-12C EXPANSION CABLE IS 3' LONG. MOUNT THE 2140-GP8MON WITHIN 3' OF THE 2140 OPTICAL SIGNAL PROCESSOR.
4. USING 22-16 AWG WIRE, CONNECT THE LOAD SWITCH GREEN SIGNAL OUTPUTS TO THE MATCHING GRNØ INPUT OF THE 2140-GP8MON.
5. USING 22-16 AWG WIRE, CONNECT THE SIGNAL HEAD AC COMMON FROM THE LOAD BAY TO THE 2140-GP8MON SIGNAL HEAD AC COMMON INPUT.
6. CONNECT ONE END OF THE 3-12C EXPANSION CABLE TO EITHER EXPANSION PORT OF THE 2140-GP8MON, AND THE OTHER END OF THE 3-12C CABLE TO THE EXPANSION PORT ON THE FRONT PANEL OF THE 2140 OPTICAL SIGNAL PROCESSOR.
7. VERIFY YOUR WIRING AND MAKE SURE THAT ALL CONNECTIONS ARE TIGHT.

REV	DATE	DESCRIPTION
01	03/25/05	LABEL NOTATION

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES. DIMENSIONS .XX ANGLES ± SCALE: NONE, DO NOT SCALE DRAWING DRAWN: AML 05/28/00 APPROVED: _____	TOMAR ELECTRONICS INC. 2100 WEST OBERLO GILBERT, ARIZONA 85233
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MODEL 2140-GP8MON SCI PHASE MONITOR INSTALLATION AND WIRING DIAGRAM	TOMAR PART NO: FP-1200
--	------------------------

DRAWING NO: 13225	REV: 01
ISSUE: 1	DATE: 05-11-05

TOMAR STROBECOM™ WARRANTY

TOMAR Electronics, Inc. warrants that the STROBECOM™ Traffic Preemption System will be delivered in merchantable quality. TOMAR further warrants that, provided the system has been properly installed, operated, and maintained by the purchaser, TOMAR will, at its option, either repair or replace any system component or components except xenon strobe lamps or flash-tubes found to be defective in materials and/or workmanship within (10) ten years from the date of shipment from TOMAR. Xenon strobe lamps or flash-tubes are warranted for (2) two full years from the date of shipment from TOMAR.

TOMAR has designed, developed, and tested each STROBECOM™ Traffic Preemption System component as part of a matched component priority control system which can function by itself or be used in mixed systems side by side with the 3M Opticom™ System on a system wide basis. TOMAR will assume the warranty liability for 3M's Opticom™ components that have had their warranties reduced in duration by 3M due to the customer using TOMAR STROBECOM™ emitters or traffic control components. TOMAR further warrants that its STROBECOM™ System is compatible with 3M's Opticom™ System, except for vehicle ID information, and assumes overall system performance responsibility.

Sale and use of the STROBECOM™ Traffic Preemption System is expressly restricted to authorized agencies of the federal, state, and local governments within their respective jurisdictions. However, because the optical signal generated by STROBECOM™ or OPTICOM™ is not exclusive, TOMAR cannot ensure exclusive activation by the purchaser. It is recommended that authorized users who desire to use their STROBECOM™ emitters with other jurisdictions first obtain prior written approval of each jurisdiction where use is sought.

This warranty does not cover damage to any component due to ordinary wear and tear, misuse, neglect, or accident, or any damage done by extreme atmospheric or weather-related conditions, including chemical corrosion, hail, windstorm, lightning, or flooding, or any system component which has been repaired or modified by persons not authorized by TOMAR so that in TOMAR's sole judgement, the stability or reliability of such component is adversely affected.

THIS WARRANTY IS MADE IN LIEU OF ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION HEREIN. THERE ARE NO WARRANTIES EXPRESSED OR IMPLIED OR ANY AFFIRMATION OF FACT OR REPRESENTATION EXCEPT AS SET FORTH HEREIN.

REMEDY

TOMAR Electronics, Inc.'s sole responsibility and liability, and purchaser's exclusive remedy shall be limited to the repair or replacement at TOMAR's option, of a part or parts not so conforming to the warranty. All products requiring warranty service shall be returned to TOMAR shipping prepaid. TOMAR will return repaired or replaced products to the purchaser via prepaid ground transportation. In no event shall TOMAR Electronics, Inc. be liable for damages of any nature, including incidental or consequential damages, including but not limited to any damages of any nature, including but not limited to any damages resulting from non-conformity, defect in material or workmanship. THE REMEDIES SET FORTH HEREIN ARE EXCLUSIVE.

TOMAR Electronics, Inc.

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sales@tomar.com