



Global Traffic
Technologies

Installation Instructions

August 2012

Opticom™ Infrared System

Opticom™ GPS System

Model 794HM Multimode LED emitter

Model 794TM Multimode LED emitter

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Contents

1.1	Purpose of Manual.....	1
1.2	Technical Support.....	1
1.3	Safety Messages and Labels.....	1
1.4	Disposal of Device	1
2	Opticom system.....	1
2.1	Model 794HM and 794TM Emitters.....	2
3	Features.....	2
4	Description.....	3
5	Installation.....	4
5.1	Emitter Installation	5
5.2	Connecting the IR emitter to the Radio/GPS control unit.....	9
5.2.1	Power Connection Recommendations	10
5.3	Emitter Cable Connector Pin Index.....	11
5.4	Emitter programming.....	12
6	Installation Checkout (Infrared).....	14
7	Performance Tests	15
8	Maintenance	16
9	Separating the IR module from the Antenna Module.....	16
10	Troubleshooting (Infrared)	17

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1.1 Purpose of Manual

This manual provides step-by-step instructions for installing the Global Traffic Technologies Opticom™ System Model 794HM, 794TM multimode LED Emitters*. It is intended for use by installers, maintenance personnel, and others who are responsible for the installation and maintenance of the system.

1.2 Technical Support

If you have questions about the system, its use, or operation, please contact your dealer or call the GTT Technical Service department at 1-800-258-4610.

1.3 Safety Messages and Labels

We include safety messages and labels in this manual to help you protect your safety and the safety of others. **Please read all messages before proceeding with the installation.**

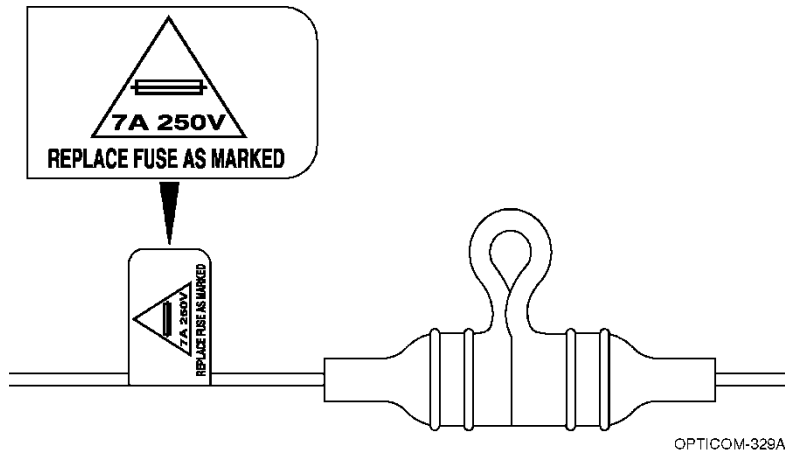


Figure 1-1 Fuse label location

1.4 Disposal of Device

Please dispose of the device in accordance with all local, state, and federal laws and regulations.

2 Opticom system

The system is intended to assist authorized priority vehicles through signalized intersections by providing temporary right-of-way through vehicle operator interface to the system and through the use of common traffic controller functions.

*The method of using the components of the Opticom™ Infrared system may be covered by US Patent Number 5172113. Other U.S. and foreign patents pending.

The method of using the components of the Opticom GPS system may be covered by one or more of US Patent Numbers 5539398, 5926113, 5986575, 6243026. Safety Information.

2.1 Model 794HM and 794TM Emitters

Opticom™ Infrared System emitters are compact, weather-resistant, devices with optional encoded-signal operation. These emitters are intended for use on priority vehicles. The emitter system consists of an LED module with a built-in power supply, radio and GPS antennas cables. The radio and GPS antennas are to be used with Opticom GPS vehicle equipment.

3 Features

Opticom™ Infrared System Model 794HM and 794TM Emitters have the following features:

- LED infrared light source
- Integrated GPS and 2.4 GHz antennas for use with Opticom GPS vehicle equipment
- Operates on 10-32 VDC
- Very low current consumption, less than 300mA
- Integrated power supply and LED array for small size
- Capable of remote programming via RC790 Remote Coding Unit
- Impact resistant design
- Fixed flash rate:
High Priority = 14 Hz
Low Priority = 10 Hz
- User-selectable disable mode; Latching or Non-Latching modes
- Disable circuitry (indicator flashes at 0.5 Hz)
- Self-diagnostic capability (failure indicator flashes at 2 Hz)
- User configurable visible LEDs
- 10,000 vehicle identification codes for each priority/frequency
- Wide operational temperature range: -30°F to +140°F
- 25-foot cables for installation flexibility
- J1708 compliant communication port
- Available Windows™¹ Configuration and Maintenance Software

¹ Windows is a trademark of Microsoft Corporation.

4 Description

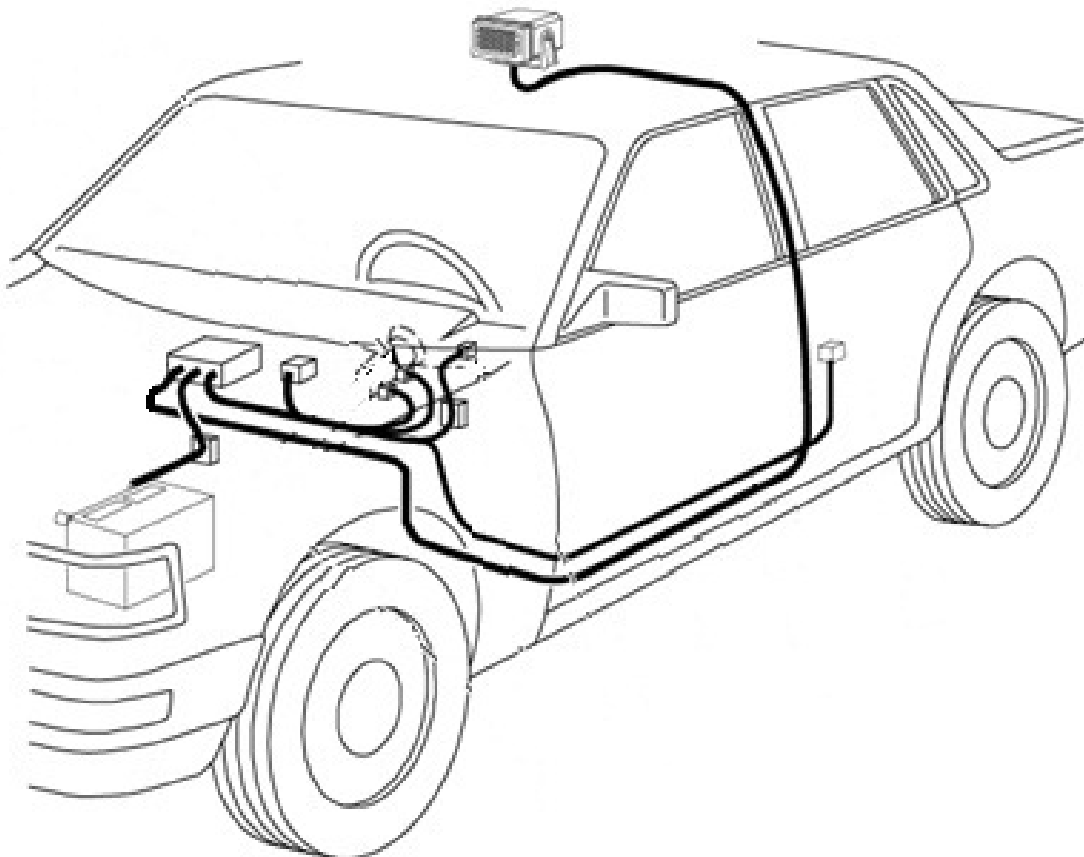
The Model 794HM is programmed to provide High-Priority operation. The Model 794TM is programmed to provide Low-Priority operation. Both versions contain a GPS antenna and a 2.4 GHz radio antenna to be connected to Opticom Model 2100 or 2101GPS vehicle radio/GPS control units.

Appropriate vehicle Class and ID numbers are determined at the time of installation and are programmed by the user via ITS Link/790-CS configuration software or the RC790 remote coding unit.

When connected to an Opticom Model 2100 or 2101 radio/GPS control unit the emitter is switched on and off with the 2100/2101. When the 2100/2101 is disabled the connected 794HM is shut off

This manual describes how to install Model 794HM and 794TM emitters and connect it to the 2100/2101. Refer to the Opticom GPS vehicle equipment manual for details on installing the rest of the Opticom GPS equipment.

Figure 4-1 shows a typical installation.



Opticom-560M

Figure 412 Typical emitter Installation for a vehicle in infrared/GPS operation

5 Installation

This section describes the installation of the emitters and connecting it to the Model 2100/2101. It also describes how to set the Vehicle ID code using 790-CS configuration software. See the Opticom GPS vehicle equipment manual for details on installing the 2100/2101.

Notes:

Please read and fully understand the following precautionary paragraphs before starting the installation.

- The emitter should point straight ahead, and should be mounted level (parallel with the road) and as high on the vehicle as possible.
- The emitter should not be obstructed by lights, lightbars speakers, grille work, antennas, or other devices.
- The emitter must be mounted so that it has a good view of as much of the sky as possible.
- The emitter should not be mounted inside the passenger compartment or behind the grille.
- The emitter should not be mounted inside of a light bar unless the location provides for a good view of the sky and has no obstructions in front of it.
- If mounted inside of a light bar, it should be behind a clear lens
- Always follow the vehicle manufacturer's recommendations concerning modification, alteration, and installation or connection of accessories or equipment to the vehicle.
- Installation on specialty vehicles (such as motorcycles, parking enforcement, utility and special maintenance vehicles) requires particular care and attention to details.
- Do not mount the emitter within 18 inches of other radio antennas.
- Follow the installation instructions to avoid possible radio frequency interference problems.
- Do not operate an emitter with a damaged lens or place colored lenses in front of the emitter. Use only a GTT replacement lens.
- Before cutting or drilling any openings in the vehicle or light bar, draw a diagram showing placement, measurements, and dimensions. Use the diagram to avoid drilling or cutting holes in undesirable locations.
- Wires that are routed under carpets or mats should be run between the pad and the carpet. This will minimize abrasion and heat damage from catalytic converters.
- Protect cables with armor or sheathing when they are routed around sharp corners and edges. Avoid routing cables through potential pinch points. Clamp or tie all cables in place. Route and secure cables well away from moving parts.

5.1 Emitter Installation

1. Remove interior panels and headliners, as necessary, to provide access for cable routing.
3. Using the emitter bracket as a template, mark where you want to drill holes at the mounting location. Be sure the emitter bracket is parallel with the front of the vehicle.
4. Drill two 1/4-inch holes at the mounting location.
5. Position the emitter bracket and gasket over the mounting holes and use two hex head bolts, flat washers, fender washers, lock washers, and nuts to secure the bracket to the vehicle. See Figure 5-1.
6. Check for proper forward alignment, and then tighten the nuts.

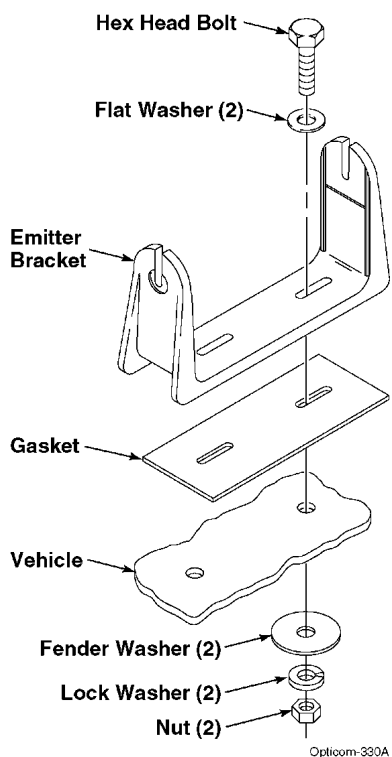



Figure 5-1. Emitter Bracket Installation

Model 794M Multimode Emitter Installation Manual

- Slide a carriage bolt into the slot on each side of the emitter. Next, slide the two plastic friction plates onto the bolts with the ridged surfaces together. See Figure 5-2.
- Insert the emitter into the mounting bracket. Make sure the friction plates are square and inside of the bracket arms. Then, place the flat washers, lock washers, and acorn nuts on the bolts. See Figure 5-2.

Note:

- All of the parts described in steps 7 and 8, and shown in Figure 5-2, are important and must be used to ensure that the emitter will remain mounted and aimed correctly.

 **NOTICE**

Mount the emitter right side up. **Failure to properly install the emitter may damage the unit and prevent proper operation as well as void the warranty.** The GTT Logo on the lens of the emitter must be right side up and the two small weep holes must be facing down. If the weep holes are facing up, the emitter may fill with water and cause it to fail. Also if the weep holes are facing up the antennas will not operate correctly.

- Align the emitter so it is facing forward and parallel with the ground, and with the GTT Logo upright. Then tighten the acorn nuts.

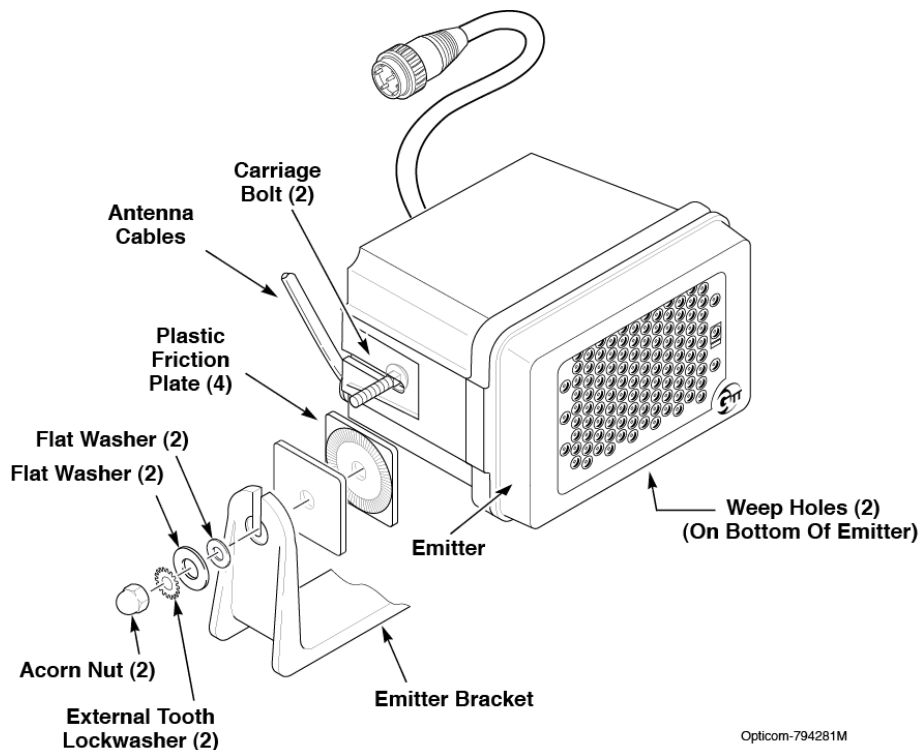
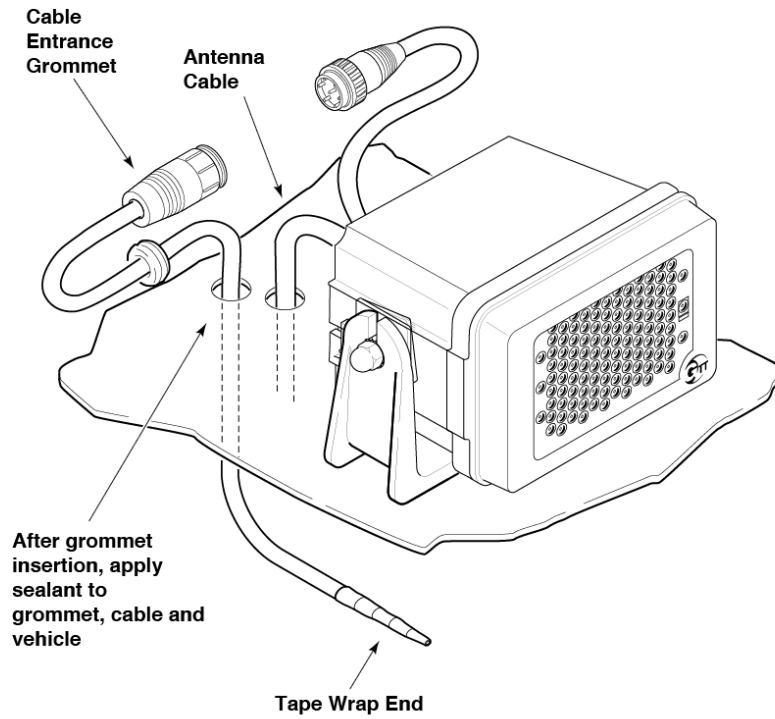


Figure 5-2. Emitter, Bracket, and Mounting Hardware

Model 794M Multimode Emitter Installation Manual

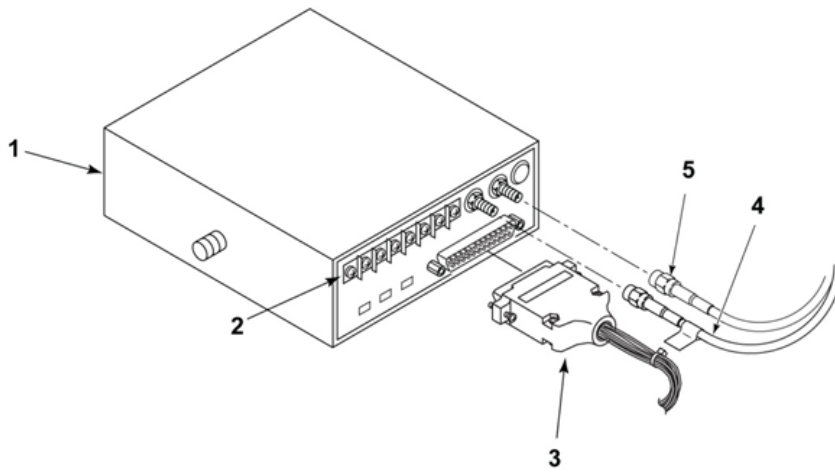
10. Mark the location of the entry holes for the cables. Check the hole location/s both inside and outside of the vehicle.
11. Drill hole/s for the emitter cables entrance grommet.
 - It is recommended that you drill separate holes for the emitter cable and for the antenna cables.
 - This is recommended in case it becomes necessary to replace either the IR module or the antenna module.
12. Tape wrap the end of the emitter cable (the cable without the connectors) to protect the wires and to ease cable routing. See Figure 5-3.
13. Select an appropriate size grommet from those supplied. The grommets are supplied in several sizes to allow for different thicknesses of vehicle sheet metal.
14. Place the grommet on the cables and slide it toward the emitter. Leave enough cable exposed to reach the emitter.
15. Apply lubricant to the grommet, and then insert it into the hole in the vehicle body or light bar. (Window cleaner works well as a lubricant.)
16. Route the emitter cable from the emitter mounting location to the emitter control switch location.
17. Route the two antenna cables (cables with connectors) to the location of the Opticom GPS radio/GPS control unit. See Figure 5-4. See the Opticom GPS vehicle equipment installation manual for more detail and for completing the installation of the rest of the Opticom GPS vehicle equipment.
18. Connect the emitter cable to the emitter (fully engage the locking ring) and pull the excess cable into the vehicle. Be careful not to unseat the grommet.
19. Dry the grommet and apply a sealant to the cable, grommet, and vehicle to seal the assembly against moisture penetration. (Silicone RTV is a good choice for a sealant.)
20. Finish routing and securing the emitter cables in the vehicle. Use cable ties to secure all wires away from heat sources and moving parts.
21. Remove the tape from the end of the emitter cable.

Model 794M Multimode Emitter Installation Manual



Opticom 794283M

Figure 5-3. Cable Installation



Opticom-502R

Figure 5-4 Opticom GPS antenna cable installation

1. Radio/GPS control Unit	3. Vehicle Interface Cable
2. Emitter terminal strip	4. GPS Antenna Cable
5. Radio antenna cable	

5.2 Connecting the IR emitter to the Radio/GPS control unit

The Model 2100-2101 radio/GPS control units contains a 6-pin terminal strip for connecting the Infrared emitter. When connected, the emitter will be able to be switched on and off by the radio/GPS control unit.

When the radio/GPS control unit is put into disable mode, the connected emitter will also be turned off (disabled). The emitter will not be put into disable mode but rather shut off. Therefore the LEDs will not flash at the disable flash rate.

Notes:

- **Additional power and ground connections must be made via the terminal strip BAT and GND connections.**
 - The emitter is not powered through the J2 power connections of the 2100/2101.
 - **On the Model 2100-2101, you must set the J1708/J1587 Serial port to the Emitter Master protocol using the On-site software for this feature to work.**
 - **The connected emitter will turn on and off with the Model 2100/2101. If you want to control the infrared emitter independently, either do not use the connections described in this section or install an additional switch in series with the red power wire.**
 - **The Model 2100-2101 controls the attached emitter by switching the ground.**
 - **Even though the emitter J1708 connections (Gray and Blue wires) have terminal strip connection points, they are not currently used. You may connect these wires or leave them disconnected.**
 - **If the IR emitter is to be controlled via J1708, do not connect the IR emitter to the 2100/2101. Connect the blue and gray wires directly to the controlling device. Connect power and ground wires directly to the vehicle's power source.**
 - **If the 2101 is set to Probe priority active at startup, the connected emitter will be shut off at start-up.**
 - When switched to low priority, the connected emitter will be turned on.
 - **When the 2100/2101 is set to disable mode the connected emitter will be turned off.**
 - **The connected emitter will be turned off when the 2100/2101 is switched to probe priority via the gray wire.**
 - **If both the 2100/2101 and the emitter are to be controlled via J1708, contact GTT technical support for more details.**
1. Connect a AWG 20 or larger red wire from a 12 VDC power source to the BAT terminal.
 - a. See section 5.2.1 for recommendations on the power source.
 2. Insert the supplied fuse holder, fuse and fuse label on the 12 VDC power source wire.
 - a. 7A, 250V, fast-acting 312 line fuse.
 3. Connect a AWG 20 or larger black wire from a vehicle ground point to the GND terminal.
 - a. See section 5.2.1 for recommendations on the power source.
 4. Crimp a spade lug on the red and blacks wires of the emitter cable.
 5. Connect the red wire to the red terminal.
 6. Connect the black wire to the black terminal
 7. Cut off, tape off, or insulate and secure the green, white and orange wires.
 8. Connect or cut off the blue and gray wires. (see note above)



Figure 5-5 Infrared emitter connections

5.2.1 Power Connection Recommendations

NOTICE

Connecting power to a power distribution system may not offer the current capacity or protection of direct connection to the battery, which may result in damage to the equipment or vehicle. **To avoid this problem, make the power connection directly to the battery or as close to the battery as possible.** An improper power connection may result in damage to the equipment or vehicle.

When installing emitters, GTT recommends connecting the emitter directly to the vehicle battery.

If you are not going to connect the emitter directly to the battery, please consider the following:

- **Always utilize a DC power distribution point as close to the battery as possible. The emitter must be connected to a point that will continuously supply a minimum of 10 VDC under all operating conditions.**
 - **Ensure the power source provides adequate current carrying capacity (1 amp minimum).**
- **Use insulated spade lug or butt-splice connectors to connect the emitter to the vehicle wiring.**
- **Always use the fuse supplied with the emitter.**
- **Connect the emitter's ground connection (black wire) directly to the vehicle chassis ground.**
- **Use conductive grease on the ground connection.**
- **Do not use insulation displacement connectors.**
- **Never connect the emitter power or ground circuit common to any life support or monitoring system.**
- **If you choose to use the light bar switch to activate the emitter, connect the emitter's power connection to the light bar relay output; not the relay coil switch.**

5.3 Emitter Cable Connector Pin Index

Table 5-1 lists the pin index for the Model 794HM, 794TM emitter cable connector. Figure 5-6 shows the pin view of the emitter cable connector and Figure 5-7 shows the socket view.

Pin	Wire Color	Function
1	Red	+ VDC input
2	Orange	Range setting enable (input)
3	White	Disable (input)
4	Gray	J-1708 COM (-) (B)
5	Green	DC return for indicator light
6	Black	DC negative/ground/chassis
7	Blue	J-1708 COM (+) (A)

Table 5-1. Emitter Cable Connector Pin Index

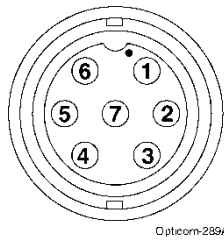


Figure 5-6. Emitter Cable Connector Pin View

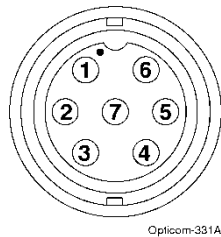


Figure 5-7. Emitter Cable Connector Socket View

Do not cut off any connectors. Cutting off connectors will void the warranty and prevent you from programming the emitter.

5.4 Emitter programming

Program the vehicle ID code into the emitter using ITS Link/790-CS configuration software.

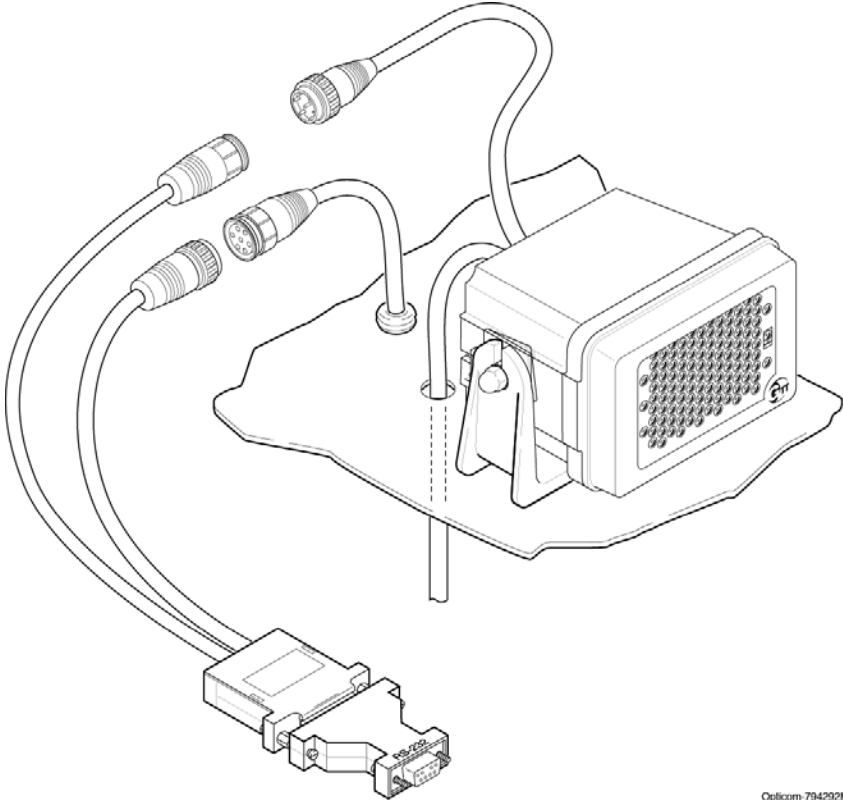
The emitters may also be programmed via the RC790 Remote Coding Unit. See the RC790 manual for more details.

1. Connect the interface cable assembly to the emitter cable. See Figure 5-8.
2. Connect the interface cable RS-232 end to the programming computer.
3. Turn the 2100 or 2101 on. The emitter should flash.
4. Turn on the computer and start the ITS Link software program.
5. Select Opticom 790-CS.
6. Press the **Read from Device** button.
7. To set the Vehicle ID code, click on **Class** in the Vehicle ID box. Then enter the predetermined vehicle class (**0 – 9**).

Click on **ID** in the Vehicle ID box. Then enter the predetermined vehicle ID (**000 – 999**). . Numbers out of range will not be accepted.

Note:

- **Factory defaults are Class 0 and ID 001.**
8. When connected to a Model 2100/2101 it is not necessary to set the **Disable Mode** since the emitter will be shut off when the 2100/2101 is disabled.
 9. Set the desired behavior of the visible LEDs.
 10. Click the **Apply** button.
 11. Exit from the configuration program.
 12. Turn off the emitter.
 13. Disconnect the interface cable assembly from the emitter cable and reconnect the emitter to the emitter cable (fully engage the locking ring).



Opticom 794292M

Figure 5-8. Interface Cable Assembly

6 Installation Checkout (Infrared)

1. See the Opticom GPS vehicle installation instructions for details on verifying the Opticom GPS equipment.
2. Turn the 2100 or 2101 on. The emitter should flash.

Notes:

- **Only the visible LEDs will be seen as flashing. The Infrared LEDs will be flashing but they are not visible. They may be viewed through a digital camera or a cell phone camera.**

7 Performance Tests

 **WARNING**

The system should ALWAYS be TESTED to verify the proper operation of the system. There are many variables in normal traffic operation and although it is not likely that the system can place an intersection into a dangerous configuration, the traffic signals should always be obeyed.

These installation instructions are the result of tests performed in our laboratory and we believe these tests to be accurate and complete. However, each installation involves variables that cannot be controlled or predicted. These variables may affect the operational characteristics of the system.

To ensure proper system operation, GTT strongly recommends that, when the system is turned on, the installer functionally tests the system using an Opticom equipped vehicle. To test the system, the installer drives the priority vehicle through the intersection to verify that the system is performing in accordance with customer requirements.

8 Maintenance

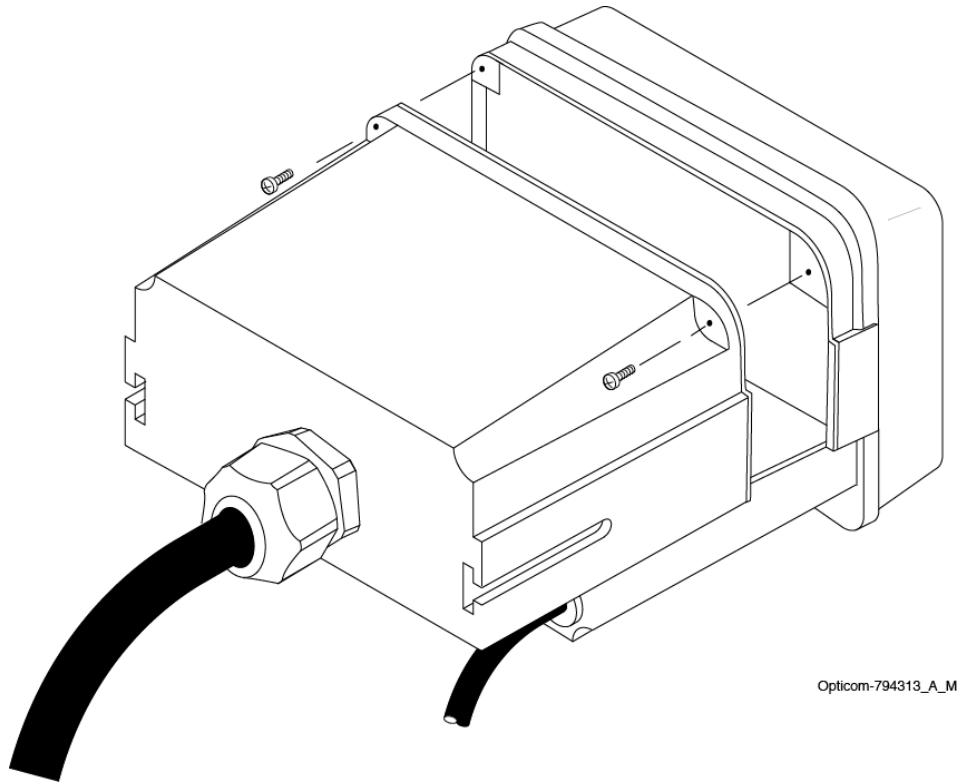
Opticom System components are designed for reliable operation. Inspect the components at regular intervals to ensure proper system operation.

GTT recommends the following:

- Each intersection and emitter system should be inspected and tested at least every 12 months to ensure it functions to your specifications and requirements.
- Intersection systems should be tested with known good Opticom vehicle systems.
- Opticom vehicle systems should be tested with known good intersection systems.
- You should develop a test plan that fits your department's operations and meets the needs of your system.
- You should keep accurate and up-to-date records of system performance and test results.

9 Separating the IR module from the Antenna Module.

The IR portion and the antenna module are each able to be replaced independently if necessary. Contact your GTT dealer to obtain replacement modules.



Opticom-794313_A_M

Figure 10-1 Separating the IR module from the Antenna module

Model 794M Multimode Emitter Installation Manual

10 Troubleshooting (Infrared)

See the Opticom GPS vehicle equipment installation instructions for troubleshooting the GPS system

Four Red LEDs are Flashing rapidly, no other LEDs flashing	Infrared LEDs are not visible	View through a digital or cell phone camera
Four Red LEDs are steadily lit or flashing two times per second	Emitter has failed	Send in for repair
Four red LEDs and switch indicator light are flashing once every two seconds	Emitter is in disable mode (White wire is grounded)	White wire should not be connected. Emitter is shut off when the 2100/2101 is disabled.
No LEDs are flashing	Visible (red) LEDs are set to be always off or off after 10 seconds	Normal operation if the visible LEDs are configured that way.
	No power	Check voltage between red and black wires s/b 10-32 VDC
	No power, fuse blown	Replace fuse
	2100/2101 not set to Emitter Master mode protocol	Set the J1708/J1587 Serial port to the Emitter Master protocol using the On-site software.
Emitter is flashing slowly or intermittently	Insufficient voltage/current	Voltage applied must be between 10-32 VDC under all conditions. Lowest voltage typically occurs while vehicle is operating and in full response mode.
	Poor ground	Connect black wire directly to battery or clean the area where black wire is connected to vehicle chassis.
	Unused wires touching each other.	Cut off or tape off all unused wires
	Model 2100/2101 is faulty	Replace the 2100/2101
LEDs flashing but not changing the signal lights	Code needed	Determine code needed for your area and program emitter accordingly
	Orange wire connected to + VDC	Orange wire should not be connected.
	Emitter is obstructed or misaligned	Emitter should be mounted as high as possible on the vehicle , aimed straight ahead/parallel with the road
	Detector is located poorly, misaligned, blocked or worn	Relocate, realign or replace detector, Trim trees that may be blocking detector
	Incorrect model/priority for your area	Verify model number using ITS Link/790-CS

Important Notice to Purchaser:

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GTT will, at its sole option, repair, replace or refund amounts paid for any Opticom™ System component found to be defective in materials or manufacture during the warranty period.

GTT warrants future system operability coverage as described herein. This warranty shall not apply to any Opticom™ system components which have been (1) repaired or modified by persons not authorized by GTT; (2) subjected to incorrect installation, misuse, neglect or accident; (3) damaged by extreme atmospheric or weather-related conditions, flood, fire, vandalism, crime or other events beyond the reasonable control of GTT; or (4) subjected to events or use outside the normal or anticipated course.

IN NO EVENT SHALL GTT BE LIABLE FOR ANY INJURY (INCLUDING, WITHOUT LIMITATION, PERSONAL INJURY), DEATH, LOSS, OR DAMAGE (INCLUDING, WITHOUT LIMITATION, PROPERTY DAMAGE), WHETHER DIRECT, INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL, OR OTHERWISE, ARISING OUT OF THE USE OR INABILITY TO USE, REPAIR OR FAILURE TO REPAIR, ANY GTT PRODUCT, REGARDLESS OF THE LEGAL THEORY ASSERTED. THE REMEDIES SET FORTH IN THIS DOCUMENT ARE EXCLUSIVE.

Sale and use of the Opticom™ System is expressly restricted to authorized agencies of government customers, within their specific jurisdictions. However, because the signal generated by the Opticom™ system may not be exclusive, GTT does not warrant exclusive activation by purchaser. Authorized users who desire to use or coordinate use of the Opticom™ system with that of other jurisdictions must first obtain the prior written approval of each authorized user in the jurisdiction where use is sought. Since the availability of a GPS signal is out of GTT's control and is required for Opticom™ GPS system operations, GTT does not warrant against Opticom™ GPS system failures due to the unavailability of the GPS signal for any reason.

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