

EVOLUTION[®] 4100 Thermal Imaging System

OPERATION AND INSTRUCTIONS

⚠ WARNING

THIS MANUAL MUST BE READ CAREFULLY BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, the unit will perform as designed only if it is used and maintained in accordance with the manufacturer's instructions. OTHERWISE IT COULD FAIL TO PERFORM AS DESIGNED AND RESULT IN SEVERE PERSONAL INJURY OR DEATH.

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repairs. During regular working hours, call 1-877-MSA-FIRE.

By order of the US Department of State, Office of Defense Trade Controls, this Thermal Imaging Camera may not be resold, re-exported, transferred, or otherwise disposed of outside of the country named as the location of foreign end use, either in its original form or after being incorporated into other end items, without the prior written approval of the Office of Defense Trade Controls, U.S. Department of State. Violation of this regulation may result in fine or imprisonment in accordance with 22 CFR, Parts 120-130.



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PITTSBURGH, PENNSYLVANIA, U.S.A. 15230

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BEFORE USE / DESCRIPTION

INTRODUCTION



Figure 1. The Evolution[®] 4100 TIC

Congratulations on the purchase of your new MSA Evolution 4100 Thermal Imaging System! This hand-held unit provides advanced thermal imaging technology backed by years of MSA quality, dedication, and service.

The Evolution 4100 Thermal Imaging Camera (TIC) is designed to assist firefighters to see in low visibility conditions of smoke and darkness. This high definition thermal imaging camera provides the latest in available thermal imaging technology for the fire service.

FEATURES AND BENEFITS

The Evolution 4100 Thermal Imaging Camera (TIC) can be used to aid firefighting in scenarios such as:

- Search and rescue missions
- Initial size-up/Scene assessment
- Locating the seat of the fire
- Locating fire extension
- Identifying potential flashover situations
- Determining entry and ventilation points
- Hazmat situations
- Incident command "eye-in-the-sky"
- Response vehicle navigation (darkness or heavy smoke)

- Preplanning/Fire code inspections
- Overhaul
- Assistance for law enforcement

BEFORE USE / DESCRIPTION

The Evolution 4100 TIC is a highly sophisticated piece of electronic equipment. The unit was designed to withstand the firefighting conditions of heat, driving spray, and frequent impact normally seen by a firefighter. Extension of these demands may damage the camera and render it inoperable. It is not recommended that the camera run for extended periods, particularly in high-heat conditions.

The Evolution 4100 TIC is intended as an aid to fire and rescue operations in conditions of poor visibility created by smoke and darkness. It is not a replacement for standard firefighting techniques and precautions. Users must ensure that the fire department's standard operating procedures are followed while using the camera.

ABOUT THE CAMERA

The Evolution 4100 TIC is:

- equipped with a state-of-the-art microbolometer thermal detector to provide the clearest high-definition images available in fire and non-fire environments
- equipped with a large-screen, high definition display to allow for all firefighters on the entry team to view the action
- designed with the most ergonomically correct balance, with the center of gravity located in the users hand



Figure 2. Entire Entry Team Can View Large, High-Definition Display



Figure 3. Ergonomic Balance and Easy Hand-Off

- completely usable with gloves, including battery changes
- durable to withstand a 4.5-foot drop from any plane onto a concrete surface up to three consecutive times
- dust and water-resistant to withstand short-term immersion in up to three feet of water per IP67 specifications
- equipped with the Heat-Seeker Indicator System which readily identifies the hottest point of the fire with red highlights on an otherwise black-and- white image
- available with an optional Quick-Temp™ Indicator that identifies the relative temperature of surrounding objects

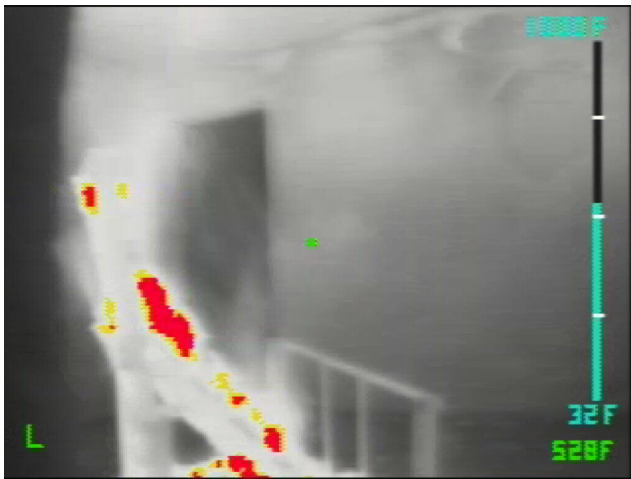


Figure 4. Heat-Seeker Indicator System

- available with an optional remote wireless video transmission system for seamless communication with incident command
- patent pending.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Specifications		
CASE	CONSTRUCTION	Flame retardant (material passes simulated NFPA direct flame exposure test). IP67 [withstands immersion to 3 feet (1 meter)]
APPROXIMATE DIMENSIONS	HEIGHT	8.5 inches (216 mm)
	WIDTH	7.5 inches (191 mm)
	LENGTH	15.0 inches (381 mm) (includes visor)
SENSOR		Uncooled microbolometer
ARRAY SIZE		160 X 120
WEIGHT		5.3 lbs. (base TIC without battery)
POWER SOURCE		One or two 7.2V rechargeable DR30 NiMH batteries
POWER USAGE	AT 72°F (22°C)	10.8 W nominal
OPERATING TIME	1 NiMH PACK	2.5 hours at nominal 72°F (22°C)
	2 NiMH PACKS	5.0 hours at nominal 72°F (22°C)
FIELD OF VIEW		54.4° diagonal
NETD		0.07°C Nominal
	HIGH SENSITIVITY	0.1° K maximum
	LOW SENSITIVITY	0.6° K maximum
VIDEO OUTPUT		RS-170A, 160 x 120 lines

Note: The Evolution 4100 TIC detects thermal energy radiated/generated from surrounding objects and converts this energy into a visual image.

- Hot objects appear white.
- Cold objects appear black.

TIC ACCESSORIES

TIC Configurations and Accessories

The Evolution 4100 TIC can be purchased as a complete kit with accessories or can be custom configured to your requirements under the Assemble to Order (ATO) System. There are several part-numbered kits to choose from. Please see the Evolution 4100 Brochure for complete ordering information.

Evolution 4100 TIC Standard Components

All Evolution TICs come standard with the following items:

- Thermal Imaging Camera
- Two Rechargeable NiMH Batteries
- Standard Universal Charger Kit with Cigarette Lighter Adapter or Truck Mounted Charger
- BNC Video Out Connector
- Instruction Manual.

The Evolution 4100 TIC can be ordered as standard kit part numbers or as Assemble to Order. See ordering information.

Other Options

Carrying Attachments

The Evolution 4100 TIC comes standard with a caribiner attachment. Additionally, users can choose to purchase any one of three optional carrying attachments:

- **Wrist Strap/Bunker Clip** - Attaches to the TIC and includes a clip for securing the TIC to bunker gear while not in use.

- **Shoulder Strap** - Attaches to the TIC to allow for easy carriage of the camera while not in use. FDNY strap available with seat belt style disconnect.
- **DC Cigarette Adapter** - Allows battery to be charged from a DC jack.

Display Sun Shroud

Display Shroud allows for crisp/clear viewing of the LCD screen while in bright sunlight.

Reflective Trim Kit

Reflective Trim allows the user to add additional visibility for the Evolution 4100 TIC.

Disposable Display Covers

A package of three Disposable Display Covers provides replaceable protection of the 3.5" LCD.

Custom Carrying Case

The durable Carrying Case allows for storage and transport of the TIC, batteries, charger, and carrying attachments.

Mounting Bracket

The non-charging Mounting Bracket enables convenient storage of the Evolution 4100 TIC.

Tripod

The Tripod allows for stationary viewing of the thermal imaging camera. The Tripod must be used with the Tripod Adapter.

Transmitter/Receiver

Two channel analog Transmitter and two Receiver options are available.

WARNINGS AND CAUTIONS

⚠ WARNING

1. The user must be trained and thoroughly familiar with the proper operation and limitations of the thermal imaging system prior to use. Use in controlled live-burn exercises is suggested before using the equipment in actual emergency situations. Improper use of the equipment in a hazardous atmosphere could result in serious personal injury or death.
2. Do not rely on the thermal imaging system as the sole means of navigation or deviate from standard fire-fighting navigational practices during use. Although the system provides an image in dark and smoky environments, the user may become disoriented or lost in such environments if the system becomes inoperative.

Most electronic devices will cease to operate at certain high temperature extremes. Tests on the Evolution 4100 TIC indicate that it will provide an acceptable image when subjected to an ambient temperature of approximately 120°C (248°F) for about ten minutes. Exposure to conditions exceeding these will result in deterioration and loss of image.
3. Thermal energy is **not** transmitted through glass or underwater and may be reflected off of smooth surfaces. Disorientation may occur if the user is unaware of these properties.
4. This thermal imaging system is not rated as "Intrinsically Safe." Do not use the system in environments or atmospheres where static or spark may cause an explosion.
5. Before entering a hostile environment, test the thermal imaging system as specified in the instructions to ensure that it is functional. After each use, inspect the system to determine if servicing is required.
6. Exposure to high temperature environments for an extended period of time may cause degradation or loss of thermal image. Avoid heat saturation or over exposure of the equipment. If degradation of the thermal image is observed, remove the equipment from the high heat environment and allow it to cool until the thermal image returns to normal; otherwise, the system may become inoperative.
7. Replacement batteries must exactly match the ratings and configuration of those supplied

with the equipment. Use of unapproved batteries may render the system inoperative.

8. Do not remove the thermal imaging camera cover or casing as the system operates on high voltage. Only authorized personnel may service the unit.

FAILURE TO FOLLOW THE ABOVE WARNINGS CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

⚠ CAUTION

1. Ensure battery is fully charged before use. If not fully charged, the system will not operate for the specified amount of time. Monitor battery level during use and exit the hazardous area when a low battery warning is observed.
2. Electromagnetic radiation (radio transmissions) may cause interference. Minimize nearby radio transmissions if excessive interference occurs.
3. To avoid lens fogging, the user may coat the lenses and view finder with anti-fog material (MSA P/N 13016).
4. Do not point the thermal imaging camera directly at the sun; otherwise, damage to the detector may occur.
5. Do not drop the thermal imaging camera. Although the camera is designed to withstand normal impacts that occur in fire service, such impacts may alter the focus or damage the unit.

FAILURE TO FOLLOW THE ABOVE CAUTIONS CAN RESULT IN PERSONAL INJURY OR EQUIPMENT DAMAGE.

LIMITATIONS

1. Although the Evolution 4100 TIC is IP67 waterproof, the system does not provide underwater thermal images.
2. The Evolution 4100 TIC does not provide images through glass, water, or shiny objects; these surfaces act like mirrors to the system.
3. The Evolution 4100 TIC does not improve impaired vision. Users with impaired vision should continue to use ophthalmic devices while using the system.

OPERATION

OPERATION

Getting Started

The rechargeable batteries supplied with the Evolution 4100 TIC must be fully charged before use. Also, periodically check and replace the battery in an actively-used imager.

- See "Battery Care and Installation" later in this manual.

TURNING THE CAMERA ON AND OFF

Normal Mode

1. To turn the camera ON, press the POWER (green) button directly under the view finder (see FIGURE 5) and hold for approximately one second.

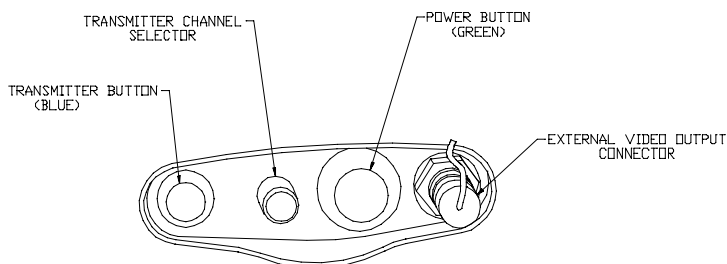
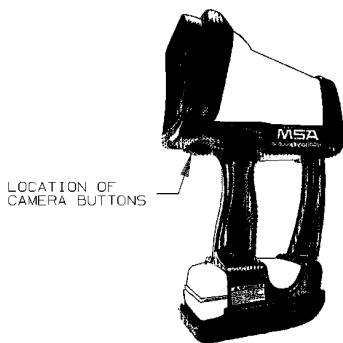


Figure 5. Camera Buttons

2. Verify the camera is functioning by aiming at an object or person until the thermal image appears in the camera viewer.
 - The thermal imaging camera is now ready for use.

NOTE: The Evolution 4100 POWER button has a momentary pushbutton switch that requires deliberate, one-second activation to operate. This is to prevent accidental shut-OFF. Rapid repeated depression of the POWER button may cause the TIC start-up software to lock, and a picture will not display (LEDs may still activate). If this condition occurs, simply turn the TIC OFF and back ON using slow, deliberate button presses.

Standby Mode

To conserve battery consumption, the camera is equipped with a Standby Mode feature.

3. To activate, press the POWER (green) button until:
 - The display shuts OFF.
 - The flashing GREEN POWER LED activates.
4. To return to Normal Mode from Standby Mode, press the POWER (green) button until:
 - The display immediately reactivates without warm-up time.
 - The flashing GREEN LED changes to solid GREEN.

Turning the Camera OFF

5. To turn the camera OFF, press and hold the green POWER button in for four seconds.
 - As a safety feature to avoid inadvertent power-offs, the green POWER button must be held for four seconds to turn OFF the camera.
 - The green POWER LED flashes during the power-off countdown to confirm effective button press.
 - When all LED indicators shut OFF, the user may release the green POWER button.
 - The camera is now OFF.

USER INTERFACE- INDICATORS AND WARNINGS

On-Screen Indicators

- A Low sensitivity firefighting mode indicator
- B Shutter indicator
- C Optional Quick - Temp Indicator/Digital Temperature.

Available Display LED Indicators (FIGURE 6)

LED Indicators

- D Over - Temperature Warning
- E System Status Indicator
- F Battery Status Indicators
- G Transmitter Indicator (optional).

On-Screen Indicators

A - Low Sensitivity Mode Indicator - An on-screen sensitivity indicator ("L") informs the user when the camera is in the low sensitivity (Firefighting) mode.

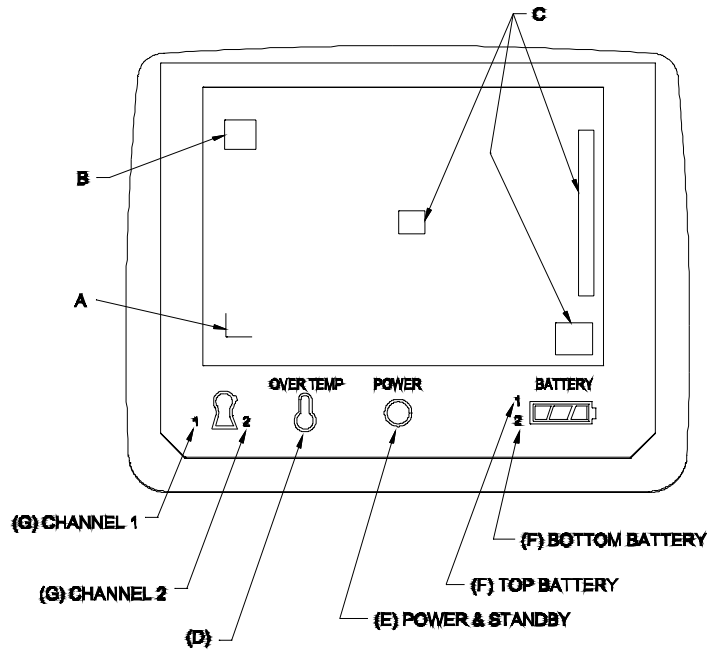


Figure 6. User Interface Display LED Indicators and Warnings

- This mode occurs when the thermal imager senses an environment above 150°C.
- Dynamic Range is extended while in this mode to provide greater image details of the surroundings.

In high-heat conditions, the TIC will automatically enter the Low Sensitivity (or Firefighting) mode. While in Low Sensitivity mode, the TIC's dynamic range is extended, thereby allowing the user to make better distinction of objects and people within a higher temperature range. When the Evolution 4100 TIC is in Low Sensitivity mode, the letter "L" appears in the lower left corner of the display.

B - Shutter Indicator - An on-screen indicator that tells the user when the TIC is shuttering appears as a green square in the upper left corner of the display.

While the TIC is in operation, it is periodically necessary for the TIC to refresh the focal plane in order to operate properly. This occurs via an internal shutter mechanism. When the TIC shutters, the image on the display temporarily freezes for about one second. Shuttering can occur more frequently in higher heat conditions. This is normal for all microbolometer - based TICs.

C - Optional Quick-Temp Indicator - On-screen operating Quick Temp spotter and vertical bar gauge spans temperatures from 32°F (0°C) to 300°F (150°C) in High Sensitivity mode and 32°F (0°C) to 1000°F (500°C) in Low Sensitivity mode for objects located in the spotter. The digital temperature feature displays the approximate number value of the temperature of objects located in the spotter.

LED Indicators

D - Over Temperature Warning - Warning activates when the system electronics approach maximum recommended operating temperature limits.

- **Not lit** indicates system is within operational thermal limits
- **Flashing Red** indicates the TIC has exceeded recommended operational thermal limits.

⚠ WARNING

Most electronic devices will cease to operate at certain high temperature extremes. Tests on the Evolution 4100 TIC indicate that it will provide an acceptable image when subjected to an ambient temperature of approximately 120°C (248°F) for about ten minutes. Exposure to conditions exceeding these will result in deterioration and loss of image.

E - System Status Indicator - A single LED shows the operational status of the TIC.

- **Green** indicates the TIC is ON and fully operational
- **Flashing Green** indicates the TIC is ON and in power-saving Standby mode.

F - Battery Status Indicator - Battery capacity is shown by a row of three LEDs: one green, one yellow, and one red. Only one of the three battery status indicators will be illuminated at any one time.

- **Green** indicates full or nearly full battery capacity
- **Yellow** indicates marginal battery capacity

- **Red** indicates battery warning and nominally 15 minutes of battery life remaining
- **Flashing Red** indicates battery shutdown is imminent (about one minute of warning time).

Additional Indicators

Optional Heat Seeker Indicator - The optional Heat Seeker indicator shows any portion of the screen in red:

- When in high sensitivity mode (low temperatures) any portion of the scene which is above 288°F (142°C)
- When in low sensitivity mode (firefighting mode) any portion of the scene which is above 887°F (475°C)

The Heat Seeker mode also indicates any portion of the scene in yellow:

- When in high sensitivity mode (low temperatures) any portion of the scene which is above 275°F (135°C)
- When in low sensitivity mode (firefighting mode) any portion of the scene which is above 842°F (450°C).
- **System Fault Indicator** - All five LEDs will flash if a system fault is detected. The TIC's internal computer runs a self-diagnostic program. If a problem with the internal component is detected, a Fault will be signaled and the LEDs will flash.

DIRECT VIDEO CONNECTION

- The Evolution 4100 TIC is equipped with a BNC connector fitting located next to the POWER button for direct cable feed of video signal to a remote television or display monitor (FIGURE 1).

FACTORY UPGRADEABLE FEATURES & ACCESSORIES

Remote Wireless Video Transmission

Introduction

The Optional Remote Wireless Video Transmission is completely integrated into the existing Evolution 4100 TIC and allows remote personnel to see and video tape actual thermal video scenes of the fire.

The Evolution 4100 Remote Wireless Video Transmission System accessory can be added to your thermal imaging camera. It is made up of:

- a transmitter unit
- a receiving unit.

The transmitter complies with the FCC Guidelines and is approved under Part 90, Class B.

The transmitter operates at one of two user-selectable frequencies:

- 2458 MHz or
- 2474 MHz.

Additional information on the optional Remote Wireless Video Transmission System can be found in the following documents:

- Deluxe Remote Wireless Video Transmission System Receiving Kit User's Manual (P/N 10048135)
- Remote Wireless Video Transmission System Mini-receiver User's Manual (P/N 10048134).

Remote Wireless Video Transmitter System Specifications

WEIGHT	3.9 ounces
CHANNELS	Two (user-selectable)
TRANSMITTING FREQUENCY	2458 MHz, 2474 MHz
POWER OUTPUT	40 mW

Operation and Use of the Remote Wireless Video Transmission System

1. To power ON the Remote Wireless Video Transmission System, press the blue TRANSMITTER button for one second (button is located next to the TRANSMITTER CHANNEL SELECT knob; see FIGURE 7).
 - When the transmitter is ON, the transmitter channel is identified by the

Remote Wireless Video Transmission Indicator at the lower left-hand corner of the display screen.

2. TRANSMITTER CHANNEL SELECTION

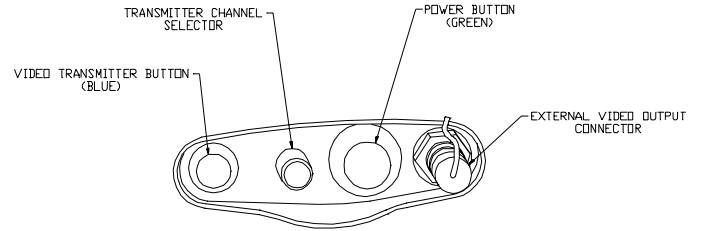


Figure 7. Blue Transmitter Button Location

- The transmitter's FREQUENCY SELECTION knob is designed to prevent accidental frequency change during normal operation.
 - To change the channel, turn the knob in the direction of least resistance (or until the switch points to the other channel) until the knob "clicks" into place, and the Remote Wireless Video Transmission Indicator changes to a different channel.
 - Verify that the transmitter and receiver are on the same channel.
 - Verify that the receiver display image reflects the camera display image without significant interference artifacts.
3. To power OFF the Remote Wireless Video Transmitter, press the blue TRANSMITTER button for one second.
 - The Remote Wireless Video Transmission Indicator also shuts OFF.

⚠ WARNING

The Video Transmission System is not rated as "Intrinsically Safe." Do not use the system in environments or atmospheres where static or spark may cause explosion. Failure to follow this warning can result in serious personal injury or death.

FCC REGISTRATION FORMS

To ensure proper licensing with the FCC for units equipped with Remote Wireless Video Transmission, complete and forward the FCC registration form to the appropriate agencies.

FCC REGISTRATION REQUIREMENTS

Contact your local frequency coordinator and/or the FCC web site for complete information in completing proper licensing. The FCC web site address is:

- www.fcc.gov/formpage/html

The following information will assist with completion of the documents.

FREQUENCY	(Mhz) 2458 2474 single (Simplex) frequencies require wide band video transmission
OUTPUT	40 MW
EMISSION	JRR2YTA-10C
ACTIVITY	Public Safety - thermal imaging for monitoring fire fighting and other emergency activity
RULE SECTIONS	90.20
NATURE OF SERVICE	Private mobile, internal users, not for profit
RADIO SERVICE CODE	PW
OPERATION CODE	N

BATTERY CARE AND INSTALLATION

RECHARGEABLE NIMH BATTERIES

The Evolution 4100 TIC is shipped with two Nickel Metal Hydride (7.2-volt, 3.6 AH or greater) batteries.

THEORY OF OPERATION

The Evolution 4100 TIC utilizes a unique battery management system. The Evolution 4100 TIC can run from either one or two batteries. With one battery, the TIC will run for 2.5 hours at 72°F (22°C) while saving the weight expense of a second battery. The battery can be placed in either battery slot.

For applications requiring a longer run time, two batteries can be installed, enabling the TIC to run for five hours at 72°F (22°C). On power up, the TIC will analyze the batteries and determine which one has more capacity. The electronics will then use that one first. When that battery is completely discharged, the electronics will automatically switch over to the second battery. Uninterrupted TIC operation will continue until the second battery is drained. The discharged battery's corresponding green LED will be dimmed to allow for quick identification and replacement. Because the TIC only drains one battery at a time, the discharged battery can be removed without affecting camera operation.

BATTERY INSTALLATION AND CARE

1. Place the unit on a clean, non-abrasive surface.
2. Unhook the battery latch and open the battery compartment.
3. Place the battery inside either battery compartment with the battery logo and arrow facing upward and the contacts facing in toward the front of the camera.
4. Close and latch the battery compartment.

BATTERY MAINTENANCE

After each use, inspect:

- battery contacts for damage
- batteries and battery adapters for damage or leakage
- charger switches for proper indication that systems are running correctly
- contact points for corrosion or damage to ensure battery charger is charging by:
 - placing a battery into the charger
 - checking that the battery charger LCD display reacts accordingly.

Note: Batteries not meeting this inspection must be removed from service until the proper repairs are made.

Note: For optimal performance, the battery charger should be operated at temperatures between 50 to 70°F (10 to 25°C). Charging batteries outside this temperature range may result in a charging error and/or premature battery degradation.

Note: Some Charger models have a calibrate button on the top surface. The "calibrate" function does not apply to the DR30 NiMH batteries used by the Evolution 4100 TIC and should not be used during the charging cycle.

Note: All TIC NiMH batteries should be periodically cycled and recharged to help maintain good performance. It is a good practice to fully discharge the batteries in the thermal imager and then fully recharge them twice a month to help ensure better capacity performance.

EVOLUTION 4000 SERIES TRUCK MOUNTED CHARGER



Figure 8. The Evolution[®] 4000 Series TIC Vehicle-Mounted Charging System

ABOUT THE CHARGER

The Evolution 4000 Series TIC Vehicle-Mounted Charging System is:

designed for use with the Evolution 4100 Thermal Imaging Camera ("TIC"). The unit must have a charging connector installed in the front handle of the unit

low profile and streamlined to fit in tight quarters and/or side cabinets

equipped with an advanced trickle charge system for optimum charging performance and conditioning

designed to pass simulated NFPA rollover requirements when installed correctly

designed for installation flexibility with three different mounting positions

manufactured from high quality aluminum for unsurpassed durability

equipped with fabricated, anti-theft anchor points for increased TIC security.

Specifications		
HOUSING	CONSTRUCTION	Powder-coated aluminum
STRAPS	MATERIAL	Polypropylene webbing
APPROXIMATE DIMENSIONS	HEIGHT	5.25 inches (133 mm)
	WIDTH	7.75 inches (197 mm)
	LENGTH	18.50 inches (470 mm)
WEIGHT	LESS TIC	5 lbs.
POWER SOURCE	VEHICLE SOURCE	12.5 to 26.0 VDC
POWER USAGE	AT 72°F (22°C)	12 W
CHARGE TIME	1 NiMH PACK	4.5 hours at nominal 72°F (23°C)
	2 NiMH PACKS	9 hours at nominal 72°F (23°C)

TIC VEHICLE-MOUNTED CHARGING SYSTEM COMPONENTS

- Charger with rollover strap
- Installation hardware
- Instruction manual

OPTIONAL COMPONENTS

- Spare battery case
- Locking cable
- Rechargeable NiMH batteries

INSTALLATION

OPERATION

Getting Started

The Evolution 4000 TIC Vehicle-Mounted Charging System must be correctly installed before use. Read all installation instructions thoroughly before starting actual installation.

⚠ WARNING

Carefully follow all instructions provided with this charger. This charger will perform as designed only if installed, used, and maintained properly; otherwise, it may fail to operate properly and result in serious personal injury or death.

Wear eye or face protection to avoid eye injury during installation; failure to do so may result in serious personal injury.

What You will Need:

- Electric drill
- #7 (.201) drill bit
- 1/4-20 tap
- #2 Phillips head screwdriver with at least 7 inches shaft length
- Stainless steel 1/4-20 bolts (4)
- 5-amp in-line fuse
- master ON/OFF switch
- Strain relief bushing for power hookup cable
- Installation hardware kit (provided, FIGURE 9).

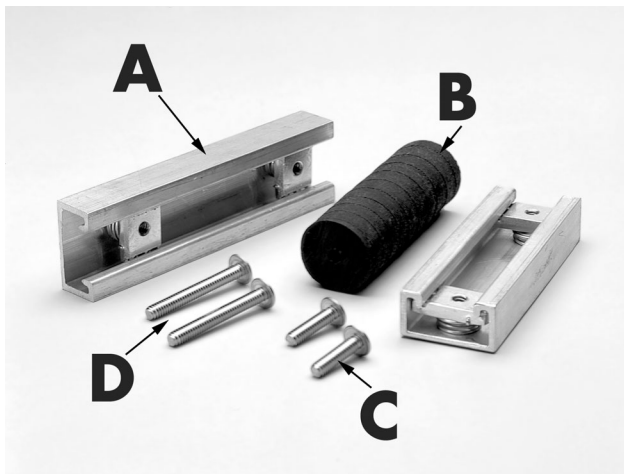


Figure 9. Installation Hardware Kit (provided)

INSTALLATION GUIDELINES

The charger has the flexibility to mount on the back surface and both left or right sides. Select a large flat surface area for mounting that will allow

easy access of Evolution 4100 TIC for storage and adequate cable length for electrical connection(s). **Take care to install charger in an area protected from water spray and extreme temperature conditions (see "Limitations").**

Mounting Hanging Channels

1. Drill two holes in both Unistrut channels (A), using a 9/32 (.281) drill.
 - Drill mounting holes one inch in from the edge of Unistrut channels.
2. Position top Unistrut channel on the cab wall at least four inches away from overhead obstructions.
3. Using a Unistrut channel as a template, drill two holes into cab wall with a #7 (.201) drill (FIGURE 10).

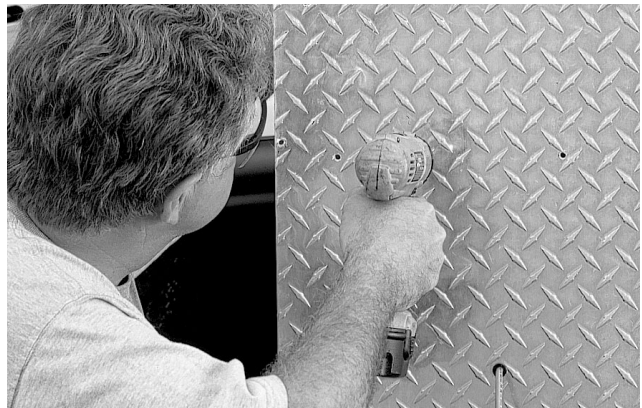


Figure 10. Drill Holes in Cab Wall

4. Tap both holes for 1/4-20 mounting bolts.
5. Position bottom Unistrut channel on the cab wall 14-1/4 inches away from center of top Unistrut channel.
6. Using a Unistrut channel as a template, drill two holes into the cab wall with #7 (.201) drill.
7. Tap both holes for 1/4-20 mounting bolts.
8. Bolt the Unistrut channels in-place with stainless steel 1/4-20 bolts (FIGURE 11).

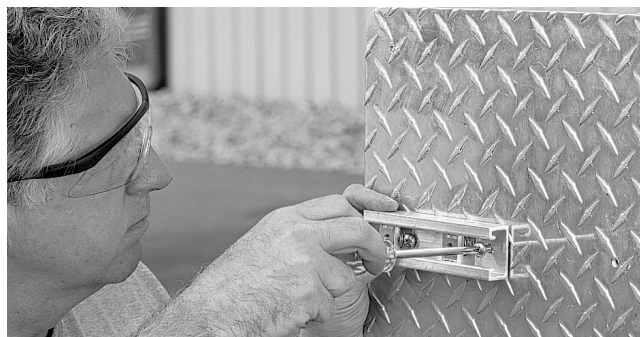


Figure 11. Bolt Unistrut Channels in

Mounting Evolution 4000 Series TIC Charger to Channel Using Rear Panel

1. Cut neoprene bumper rod (B) to appropriate lengths.
 - The bumpers should all be the same thickness (approximately 3/8-inch thick).
2. Slide Unistrut spring nut into channels, two per channel. Rotate nut 90° to seat nut in V-groove on channel.
3. Place one-inch stainless steel bolt (C) with washer through hole in rear panel (FIGURE 14).



Figure 12. Correct Hardware Placement for Rear Panel Mounting

4. Place rubber bumper over bolt, align bolt with Unistrut spring nut, and tighten.

Mounting Evolution 4000 Series TIC Charger to Channel Using Side Panel

1. Cut neoprene bumper rod to appropriate lengths.
 - Cut two pieces 3/8-inch thick and two pieces 1-5/8 inches thick.
2. Slide Unistrut spring nut into channels, two per channel. Rotate nut 90° to seat nut in V-groove on channel
3. Place one-inch stainless steel bolt (C) with washer through top hole in side panel.
4. Place 3/8-inch thick rubber bumper over bolt, align bolt with Unistrut spring nut, and tighten.
 - Access to tighten bolts through the holes is on opposite side of charger.
5. Place two-inch stainless steel bolt (D) with washer through bottom hole in side panel.
6. Place 1-5/8 inch thick rubber bumper over bolt, align bolt with Unistrut spring nut, and tighten.

Electrical Connections

Note: A non-charging Evolution 4100 TIC Mounting Bracket is also available. Electrical connections do not apply to this unit.

Power Requirements

After a complete discharge, the vehicle-mounted charging system will consume enough current to eventually fully drain the battery if the vehicle

stands unused for longer than a 12-hour period without supplemental battery charging.

Therefore, it is recommended that the charger be installed using any master ON/OFF switch where power comes directly from the battery or installed in a vehicle with a supplemental charger, which is connected to AC power via a shoreline when the vehicle is stored.

Electrical Specifications	
INPUT VOLTAGE RANGE	12.5 to 26.0 VDC (Fused at the Source)
INPUT CURRENT	0.900 Amps DC
NOMINAL CHARGE TIME PER BATTERY	4.5 hours

Installation

1. Connect the positive lead #1 (FIGURE 14) of the prepared wires end of the power hookup cable to a fused, in-line connection with a master switch, to the switched side of ignition, or power source of choice (see "Power Requirements").
2. Connect the negative lead #2 (FIGURE 16) of the power hookup cable to a confirmed ground.

Note: The vehicle-mounted charging system is protected from reverse polarity. If connected backwards, the unit will not function.

3. Connect the green charger's connector of the power hookup cable to the plug-in receptacle located (recessed) on the right side of the LED panel cover (if unit is standing upright). (See FIGURE 13.)
4. With power source ON, confirm that the center power status LED lights in green. If any other result occurs, see "Troubleshooting Guidelines" in the "Maintenance, Troubleshooting and Service," section of this manual.
5. Place the Evolution 4100 TIC in the charger and connect it to the charger by inserting the interface cable male receptacle through the top strap grommet and into the female

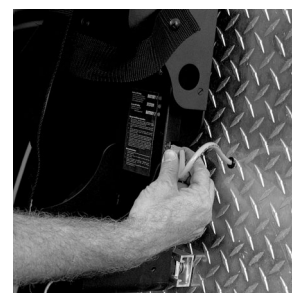


Figure 13. Connection of the Power Hookup Cable

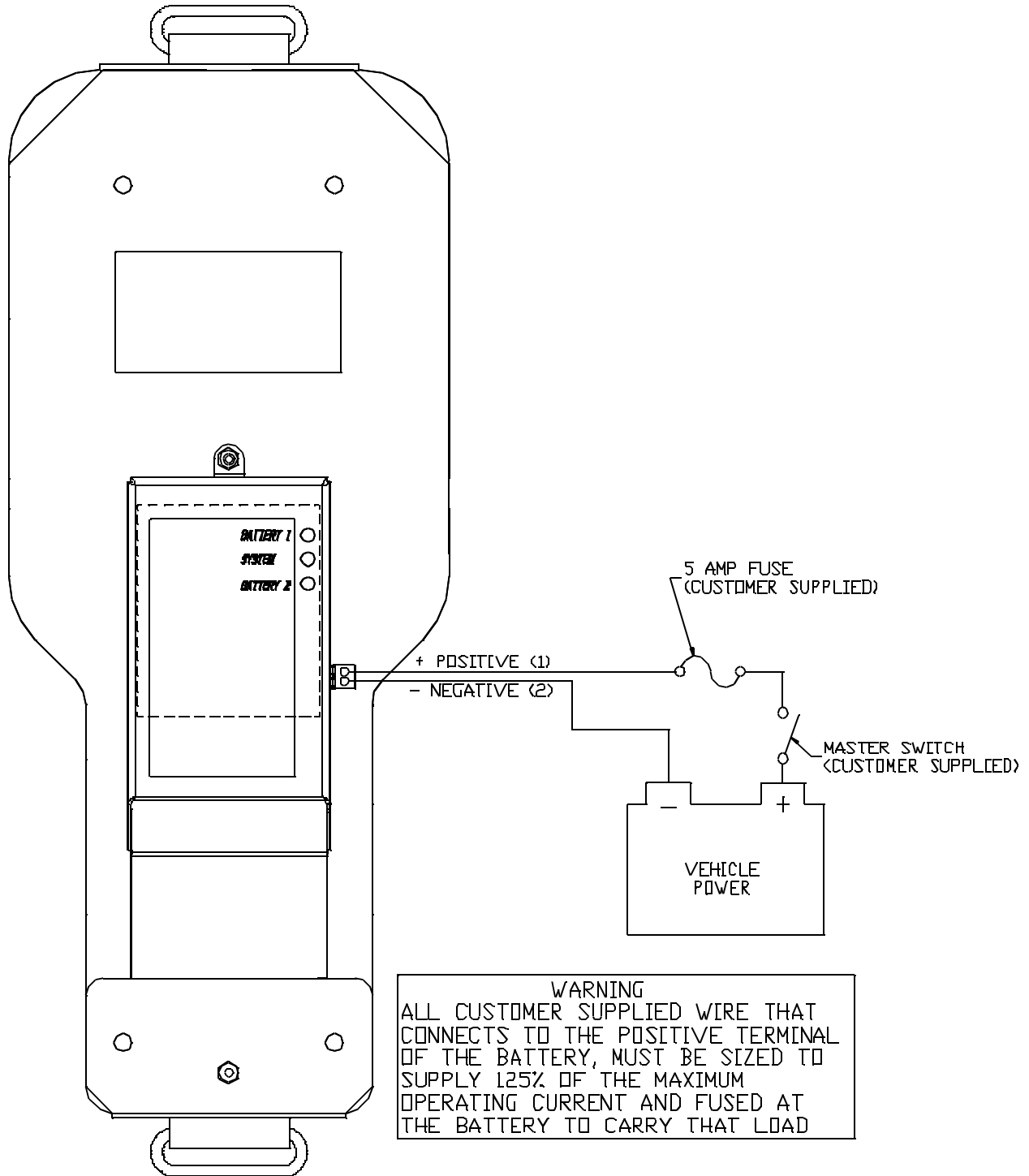


Figure 14. Wiring Diagram

charging connector at the base of the Evolution 4100 TIC's front handle.

⚠ CAUTION

All customer-supplied wire that connects to the positive battery terminal, must be sized to supply at least 125% of the maximum operating current, and fused AT THE BATTERY to carry that load.

⚠ WARNING

This charger system is not rated as "Intrinsically Safe." Do not use the system in environments or atmospheres where static or spark may cause an explosion.

The Charger must only be used for charging Evolution rechargeable NiMH DR30 Battery Packs.

Do not use damaged chargers.

Do not attempt to charge damaged packs.

FAILURE TO FOLLOW THE ABOVE WARNINGS CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

Operation

Once the Evolution 4100 TIC VMCS is correctly installed, the charger is ready for operation.

The VMCS is an automatic, sequential charger (one battery charges at a time). Battery #2 (on the bottom of the unit), if present and chargeable, will be charged first, followed by Battery #1.

The power status LED indicator should always remain green when the power source is on and properly connected. If correctly installed and connected to the Evolution 4100 TIC, the charger's status indicators will light as follows:

Battery LED Indicators	
OFF	No battery present
RED	Charging
GREEN	Finished charging
BLINKING RED	Charge mode pending
*Any LED indication other than that listed indicates faulty operation and the unit must be returned for service.	

Power Status LED Indicator	
OFF	Power not ON; system not ready
GREEN	Power ON; system operational
RED	Error circuit fault
*Any LED indication other than that listed indicates faulty operation and the unit must be returned for service.	

Note: For optimal performance, the battery charger should be operated at temperatures between 50 to 78°F (10 to 25°C). Charging batteries outside this temperature range may result in a charging error and/or premature battery degradation. Charging batteries in environments greater than 100°F may result in premature termination of charging function.

If new batteries are being used, it is recommended that the Evolution 4100 TIC be completely charged, discharged, and charged again prior to use.

The charging cycle takes approximately 4.5 hours to completely charge a single battery, or approximately nine hours for two batteries. Each charging cycle begins with a diagnostic period; therefore, charged batteries may show a charging indication if the interface connector is removed and reconnected, or the power source is momentarily lost.

Note: If the same batteries are used consistently in the Evolution 4100 TIC, it is recommended that they be rotated monthly (battery 1 and battery 2 switched).

MAINTENANCE, TROUBLESHOOTING, AND SERVICE

Cleaning

Should the VMCS become dirty, clean all surfaces with a soft, lint-free cloth. Under no circumstances should water or liquid cleaners be used on the device. Failure to comply may result in permanent electrical damage to the unit.

Cleaning the Charging Connector

Occasionally, the remote charging connector on the Evolution 4100 TIC may become impacted with dirt and debris. To clean the connector:

1. Gently dislodge and break up debris in the connector using a small blunt tool, such as an O-ring removal tool (P/N 636060) or plastic stick (P/N 633411).
 - Take care not to bend or break the connector pins.

⚠ WARNING

Wear eye or face protection when cleaning connector to avoid eye injury. Failure to observe this precaution may result in serious personal injury.

2. Using a maximum 100 psi compressed air source, blow debris pieces from the connector.
3. Repeat steps 1 and 2 until the majority of debris is removed.
4. Stubborn particles or debris may be further loosened by spraying a small amount of contact cleaner, such as WD-40, into the connector. Allow a 30-second penetration period; then, repeat steps 1 through 4 until the debris is completely removed.

Note: Users may prevent dirt and debris build-up in the Evolution 4100 TIC's charging connector by properly sealing the rubber connector plug.

⚠ CAUTION

Do not use solvents or paint thinners to clean the TIC or VMCS; otherwise, the protective case may become damaged.

TROUBLESHOOTING

Troubleshooting Guidelines	
SYMPTOM	PROBLEM/SOLUTION
NO LEDS LIT	Check power connections. Is power available?
	Is the positive power lead connected to the positive terminal?
	External in-line fuse blown. Replace fuse. Internal fuse #1 blown. Replace fuse #1.
BATTERY LED ALWAYS FLASHES RED; NEVER SWITCHES TO SOLID RED	Battery temperature is outside the chargeable temperature range. Allow battery to cool or warm.
	Battery pack is bad or damaged. Replace pack.
POWER STATUS LED (CENTER LED) IS RED	Internal PCB fuse #2 blown. Replace fuse #2.
POWER LED STATUS IS GREEN AND NO BATTERY LED LIGHTS WHEN CHARGER CONNECTED TO CAMERA	No batteries installed in the camera. Verify that there are good batteries in the camera.
	Bad connection to the camera. Verify that there are no broken pins on the camera connector. Reseat the connector firmly to insure connection. Check interface cable for wear/damage. Replace as necessary.
BATTERIES DO NOT FULLY CHARGE	Out of operating temperature range. Check that temperature of environment and /or batteries is within recommended operating range.
	Power source is noisy. Ensure power hookup cable is connected to a clean source without voltage spikes.

⚠ WARNING

It is possible that charge can be terminated abnormally. While this condition is rare, it can occur because of external in-band noise that may reach the charger electronics. In the unlikely event that charge is falsely terminated because of noise, the battery may not fully charge. Always use the camera battery gauge as an indicator of battery condition.

Field Repairs and Maintenance

Note: Only remove the VMCS's LED panel cover in an ESD-protected area with personal grounding system (e.g., grounded wrist strap).

Internal PCB Fuse Replacement

A. Power LED will not light and other troubleshooting guidelines do not resolve the problem.

1. Disconnect power hookup cable by disconnecting Phoenix connector from plug-in receptacle on the right side of the LED panel.
2. Remove the screw from the top of the LED panel cover and remove cover.
3. Internal PCB fuse #1 is located next to the Phoenix connector on the circuit board.

Remove the fuse using plastic/nonconductive tweezers and replace with a new fuse (P/N 10036109).

Note: One spare fuse is provided with each truck charger unit and is stored mid-center on the bottom of the circuit board.

4. Replace the LED cover panel, tighten the retaining screw at top, and reconnect the power hookup cable to confirm correct LED function.

B. Power Stats LED is red.

1. Disconnect power hookup cable by disconnecting Phoenix connector from plug-in receptacle on the right side of the LED panel.
2. Remove the screw from the top of the LED panel cover and remove cover.

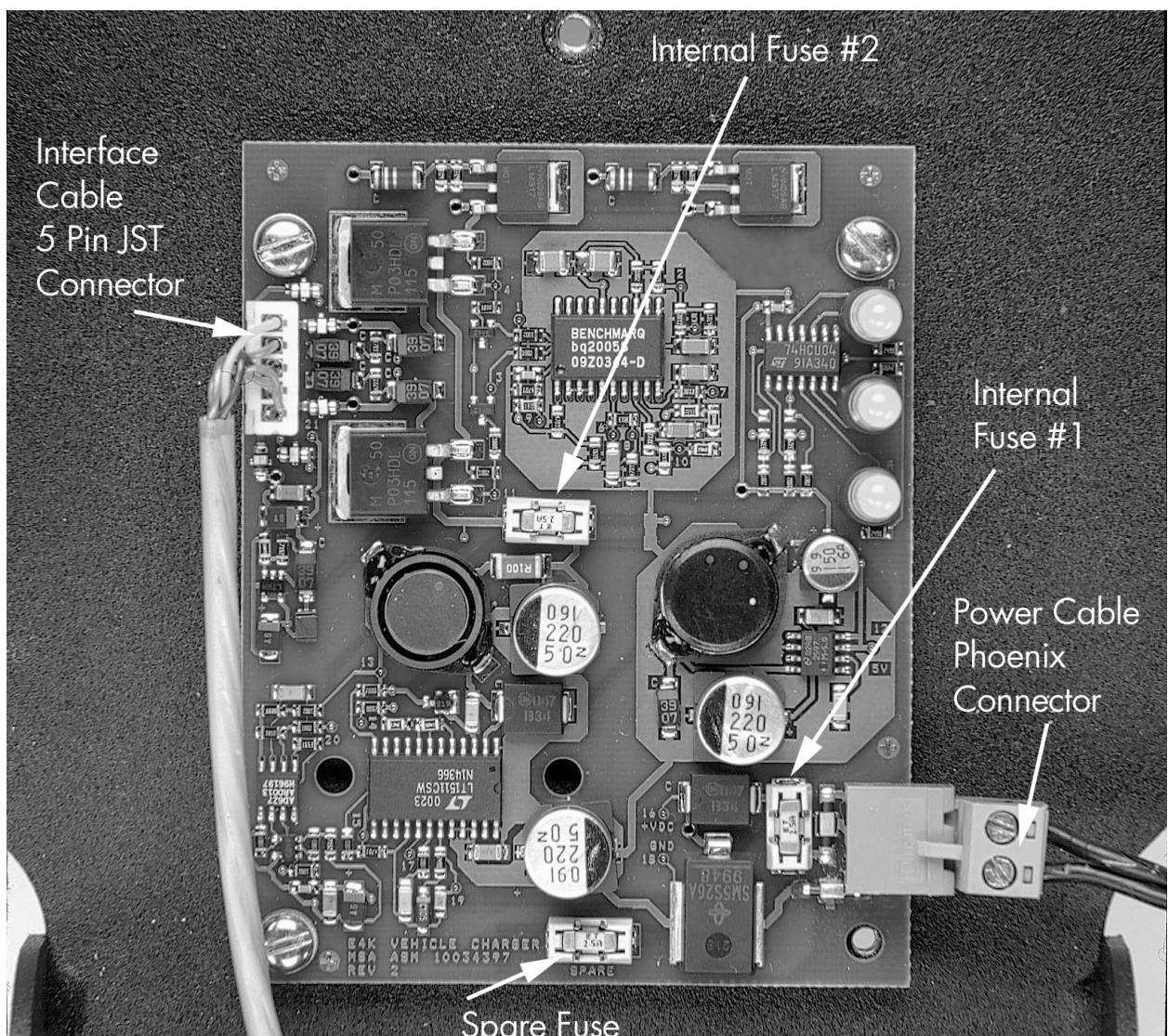


Figure 15. Location of Internal Fuse, Fuse Interface Cable Connector and Main Power Phoenix Connector

3. Internal PCB fuse #2 is located in the center of the PCB. Remove the fuse using plastic, nonconductive tweezers and replace with a new fuse (P/N 10036109).

Note: One spare fuse is provided with each truck charger unit and is stored mid-center on the bottom of the circuit board.

Interface Cable Replacement

1. Disconnect power hookup cable by disconnecting Phoenix connector from plug-in receptacle on the right side of the LED panel.
2. Remove the screw from the top of the LED panel cover and remove cover.
3. Disconnect the interface cable by disconnecting the five-pin JST connector from the top left of the circuit board.
4. Remove the interface cable clamp screws along the interface cable at the base of the unit.

5. Remove the inoperative interface cable from the unit.
6. Feed the new interface cable (JST connector end) through top, center cut-out at back of the shoulder strap compartment and connect it to the open connector at the top left of the circuit board.
7. Remove the cable clamps from the old interface cable and position them along the new interface cable.
8. Screw the interface cable clamps securely to the housing, allowing approximately 14 inches of free wire between the last cable clamp and the male camera interface connector.
9. Replace the LED cover panel, tighten the retaining screw at top, and reconnect the power hookup cable to confirm correct power status LED function.
10. Insert the Evolution 4100 TIC and connect it to the charger interface cable to confirm correct battery status LED function.

WARRANTY AND SERVICE

MSA EVOLUTION 4000 SERIES TIC AND VEHICLE-MOUNTED CHARGING SYSTEM WARRANTY

1. Warranty - Seller warrants that this product and its accessories will be free from mechanical defect or faulty workmanship for a period of one (1) year from date of purchase, not to exceed eighteen (18) months from date of manufacture, which ever occurs first, provided it is maintained and used in accordance with Seller's instructions and/or recommendations. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning the goods sold under this contract. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.
2. Exclusive Remedy - It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and/or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and/or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any nonconforming product shall not cause the remedy established hereby to fail of its essential purpose.
3. Exclusion of Consequential Damage - Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of non-operation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

MAINTENANCE AND ADJUSTMENTS

General Maintenance

After each use, inspect:

- the Evolution 4100 TIC for structural, heat and/or chemical damage
- the mechanical hardware to ensure no screws are loose and no O-rings or gaskets are loose or misplaced
- all lenses for heat damage, chemical damage, cracks and breaks
- to ensure that all warning labels are intact
- battery - see "Battery Care and Installation".

Note: Thermal Imaging Cameras not meeting the above inspection must be removed from service until the proper repairs are made.

Cleaning

After each use, clean all external surfaces (case, base, visor, lens, window and straps) by wiping with a solution of mild detergent and warm water. Dry with a soft, lint-free cloth, to avoid scratching the optical surfaces.

Periodically check connector terminals, video socket, ON/OFF switch, locking latch and hinge for contamination. Clean with a soft, lint-free cloth.

⚠ WARNING

Do not remove the thermal imaging camera cover or casing as the system operates on high voltage. Only authorized personnel may service the unit.

FAILURE TO FOLLOW THE ABOVE WARNING CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

⚠ CAUTION

Do not use solvents or paint thinners to clean the Thermal Imager; otherwise, the protective case may become degraded.

SERVICE

If your Evolution 4100 Thermal Imaging Camera (TIC) is in need of service or repair, please contact the MSA Service Center at 1-877-MSA-FIRE.

Describe the problem to the Representative as completely as possible.

1. Verify with your Representative that the product should be returned to MSA.
 2. Before returning the product, decontaminate and clean your Thermal Imaging Camera to remove any hazardous materials that may have settled on the product during use.
- Laws and/or shipping regulations prohibit the shipment of hazardous or contaminated materials.
 - Products suspected of contamination will be professionally decontaminated at the customer's expense before servicing.
 - Ship returned products (including those under warranty) with pre-paid transportation charges; MSA cannot accept returned goods on a freight-collect basis.

MSA FACTORY REPAIR & SERVICE POLICY CARD

To help process your repair requests, please provide the following information:

Please complete this form in full. Thank you.

Customer's Billing Address:		Customer's Shipping Address:	
Company Name:		Company Name:	
Street/P.O. Box:		Street Address:	
City/State/Zip:		City/State/Zip:	
Contact Name:		Phone Number:	
Product Name:		Fax Number:	
Model Number:		Your PO Number	
To save time - please check ONE of these alternatives:		Description of problem/special instructions:	
<input type="checkbox"/>	Repair and return (PO Number must be provided)		
<input type="checkbox"/>	Estimate required before repair		
<input type="checkbox"/>	Warranty Claim (Orig. MSA Invoice No. _____)		
<input type="checkbox"/>	Medical RA No. _____		
Authorized by:		Title:	
		Date:	- -

FOR CALIBRATION OR REPAIR, PLEASE PROVIDE THE INFORMATION REQUESTED ABOVE. PLEASE USE A SEPARATE SHEET FOR EACH INSTRUMENT.

EVOLUTION 4000 TIC VEHICLE-MOUNTED CHARGER SPARE PARTS LIST

PART NUMBER	SPARE PART
10036107	Interface Cable
10034906	Bottom Strap
10034907	Top Strap
10034910	Mounting Kit
10035819	15-foot Hook Up Cable Assembly With Phoenix Connector
10036106	6-inch Aluminum Channel and Nuts
10035088	Spacer Rod
10036105	Internal Fuse (bag of 10)
636060	O-ring Removal Tool
633411	Plastic Stick

EVOLUTION 4100 SPARE PARTS LIST

PART NUMBER	SPARE PART
10054951	Instruction Manual
10022538	Carrying Case
10016001	1.5 hour NiMH Battery Pack
10016300	2.5A 1-slot NiMH Battery Charger
10016301	2.5A 2-slot NiMH Battery Charger
10016302	110 VAC NiMH Battery Charger Power Cord
10016304	12VDC NiMH Battery Charger Cigarette Lighter Adapter
10022532	Shoulder Strap w/strap anchor
10028850	FDNY Shoulder Strap
10022505	Wrist Lanyard / Bunker Clip w/strap anchor
10018996	Tripod Kit
10020290	10 foot Auxiliary BNC video cable
10012458	Deluxe Remote Wireless Video Receiving Kit w/Display Module
10022129	Front Bumper
10022130	Bottom Bumper
10022131	LCD Surround Bumper
10022133	Battery Door
10022125	Battery Door Strap
13016	4 oz. Anti-Fog Spray
10032953	Disposable display Cover Protectors (Pkg. of 3)