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A-GAGE[®] MINI-ARRAY[®] Two-Piece Measuring Light Screen

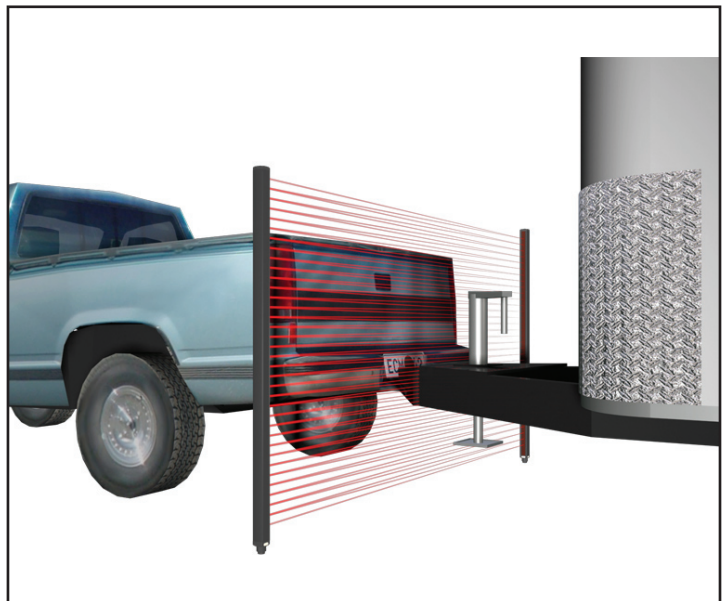
Configured for Vehicle Separation

2 Discrete Outputs with EIA-485 Communication

Instruction Manual

Features

- Simple two-piece measuring light screen for inspection, profiling, and object detection, tailored for vehicle separation applications.
- Detects single-fault emitter, receiver and dirty lens conditions; continues to function in single-fault conditions.
- Diagnostic LEDs provide a simple means of monitoring sensor performance.
- The sensor algorithm ignores objects up to 125 mm (5") while detecting automobile trailer hitch profiles as small as 25 mm (1").
- Models available with array lengths from 150 to 1220 mm in 150 mm increments (6" to 4' in 6" increments) plus 1520 mm (5') and 1830 mm (6') models.
- Beam spacing 19.1 mm (3/4").
- Two discrete outputs plus EIA-485 serial communication.
- System is configurable via the EIA-485 serial interface.
- Alarm output signals dirty lens and system fault conditions.
- EIA-485 serial communication enables a computer to process scan data and system status.



WARNING . . . Not To Be Used for Personnel Protection

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.

These sensors do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition. Consult your current Banner Safety Products which meet OSHA, ANSI and IEC standards for personnel protection.

1.0 System Overview

The Banner A-GAGE MINI-ARRAY Two-Piece Measuring Light Screen was customized for vehicle separation applications. It incorporates the popular MINI-ARRAY emitter and receiver design and ease of use, while simplifying installation. This two-piece system does not require a separate controller.

A typical system consists of four components:

- Emitter
- Receiver
- Two interconnecting cables

Models are available in array lengths from 150 to 1220 mm in 150 mm increments (6" to 4' in 6" increments), plus 1520 mm (5') and 1830 mm (6') lengths. Models are listed in Section 2.1. Beam spacing is 19.1 mm ($\frac{3}{4}$ "). Sensing range is 0.9 to 15 m (3' to 50').

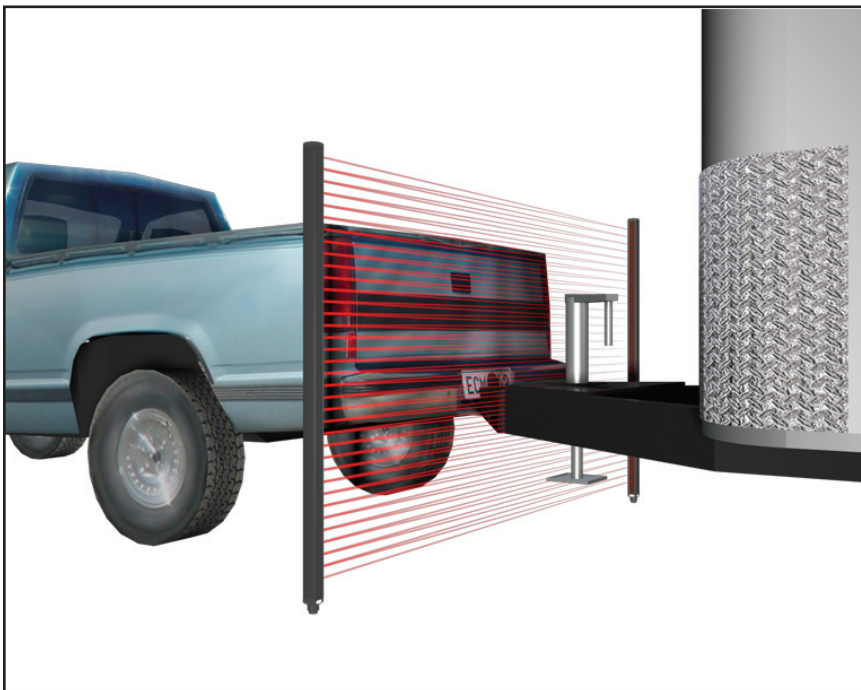


Figure 1-1. Typical vehicle separation application

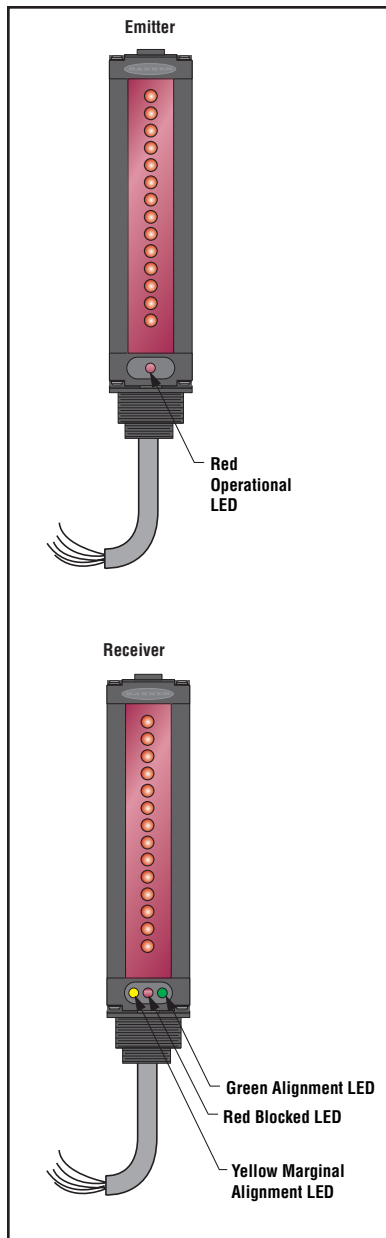


Figure 1-2. System features

1.1 System Features

Built-in features simplify the operation of the MINI-ARRAY Two-Piece Light Screen system, which is customized to specifically address the demanding requirements needed to reliably detect vehicle separation. Large optical lenses provide strong optical excess gain (needed for demanding outdoor environments).

The system is pre-configured for an interlaced optical pattern, which provides the minimum object detection necessary to detect a trailer hitch. A sensor scan involves individually enabling each emitter channel twice. In effect, each emitter channel fires at both its opposing receiver element, and at the one beneath it. The result is an interlaced optical detection pattern, as shown in Figure 1-3. This pattern can better detect objects within the middle third of the sensing area.

Along with using the interlaced pattern, the sensor processes the scan data in a method that is tailored for Vehicle Separation applications: both for initial car detection and trailer detection (see Sections 1.2 and 1.3). Several important features have been built into the MINI-ARRAY Two-Piece system:

- Easy-to-understand diagnostic LEDs
- 2 discrete outputs
- EIA-485 serial communication
- Self-diagnostics to detect dirty lens, faulty or degraded sensor operation conditions

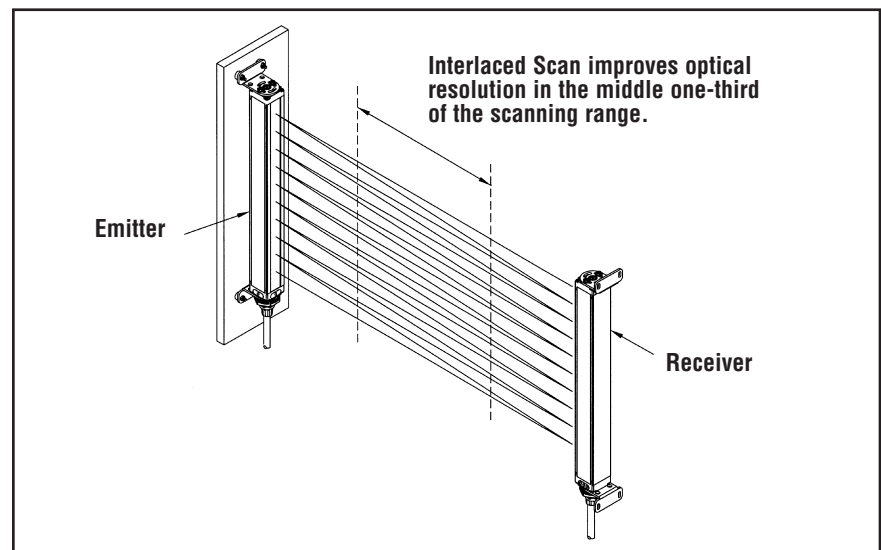


Figure 1-3. Interlaced scan

1.1.2 Easy-to-Understand Diagnostic LEDs

The system provides simple, straightforward indications of sensor performance (see Figure 1-2). See Section 3.3 for a more detailed guide to troubleshooting system status using the diagnostic LEDs.

Emitter: 1 Red Diagnostic LED

LED Condition	ON Solid	OFF	Flashing (5x per second)	Flashing (1x per second)
Emitter Condition	Sensor is functioning normally	No power to emitter	Receiver is removed from the system	One or more emitter optical channel(s) not working properly

Receiver: 3 Diagnostic LEDs (Green, Red, and Yellow)

The combined status of the Green and Red LEDs provides a simple sensor alignment process. The Yellow LED signals a dirty lens or degraded sensor condition (see Section 1.4).

LED Condition	ON Solid	OFF	Flashing (2 Hz)
Green	Light screen is unobstructed	Light screen is obstructed	Non-functioning emitter
Red	Light screen is obstructed	Light screen is unobstructed	Non-functioning emitter
Yellow	Dirty lens (whether light screen is blocked or clear); will remain ON until receiver detects proper light signal strength		Light signal of one or more beam(s) is degraded

1.1.3 Two Solid-State Outputs

The receiver has two discrete outputs (Output #1 and Output #2). Each output is independent and can be configured for either NPN or PNP operation. The sensor is factory-configured for NPN outputs, with Output #1 designated for vehicle separation detection and Output #2 for sensor “health” status output. These outputs are rated to 150 mA and are short circuit protected.

1.1.4 EIA-485 Interface

To provide sensor profiling and system status information, the receiver has a serial EIA-485 interface. Please see Appendix A for further information.

1.1.5 Sensing Scan Time

Sensing scan time is a function of the sensor length and number of beams interrogated (i.e. steps) per scan of the array. The models table in Section 2.1 provides scan times for the Vehicle Separation scanning application (labeled as interlaced scanning) for each light screen size. The worst-case response time is twice the scan time.

1.1.6 Supplied System Software

The system provides other scanning modes and operation features, which are not optimized for vehicle separation but are useful for other applications.

These features are easily accessed via a simple-to-use Banner-supplied PC software program and an appropriate EIA-485 interface (consult a Banner Engineering representative for more information). The PC software can be run on any computer running Windows® 98, NT, ME, XP or 2000. The menu-driven program walks the user through the many scanning and output options. After the desired options are selected, download the settings to the receiver; the receiver will store the configuration settings in non-volatile memory.

This software also enables the user to check sensor alignment, obtain sensor readings, and verify sensor status. The built-in system diagnostics can be used to assess emitter and receiver hardware errors or dirty lens locations.

1.2 Vehicle Detection Applications (Output #1)

The MINI-ARRAY Two-Piece Light Screen features a superior interlaced (cross-hatched) beam pattern. When the light screen is clear (no object is obstructing the receiver's view of the emitted beam pattern), the sensor will ignore small objects while waiting to detect the beginning of a vehicle. Up to 125 mm (5") of consecutive light channels must be blocked before a valid object is detected; once the sensor detects 125 mm or more of consecutive blocked light, Output # 1 will become active (output ON).

1.3 Trailer Hitch Detection Applications (Output #1)

Once an object is detected (see Section 1.1.1), Output #1 will remain active until the receiver again detects the entire emitter beam pattern (sensor is clear). The interlaced scan pattern will detect smaller objects after initially detecting a vehicle, even if only one beam is obstructed. Once the receiver detects a fully unobstructed light screen, Output #1 again will become inactive (output OFF).

1.4 System Self-Diagnostics (Output #2)

Advanced electronic and data processing allows the receiver to continually monitor and evaluate light signal quality and alert the user to light signal degradation or sensor faults. The sensor can detect marginal alignment, permanently blocked channels, a faulty emitter element, or a non-functioning emitter.

This receiver was designed to detect system failures and remain operational. Potential problems include a dirty lens that totally blocks (occludes) the optical light signal or a light signal failure (caused by either the emitter or receiver). Although sensor failures are rare, the Two-Piece MINI-ARRAY has been designed to continue to function while warning the user of fault conditions, minimizing system down time and providing advance notice that system maintenance or repairs are required.

Whenever the receiver detects proper operation, Output #2 is active (ON). When the sensor detects a system problem (either a sensor fault or a degraded signal), Output #2 is disabled (goes OFF, an alarm condition).

A system problem is acknowledged in three ways:

1. The condition of the diagnostic LEDs,
2. Output #2 will be inactive (OFF), and
3. The condition can be transmitted to the monitoring system, via the EIA-485 interface (see Appendix A, System Status Information: command 0x66).

1.4.1 Marginal Alignment/Dirty Lens Detection (Output #2)

When the received light signal drops below a predetermined threshold, the receiver will recognize a “marginal alignment” or “dirty lens” condition. (The dirty lens threshold is equivalent to three times the minimum light signal necessary for detection.)

Once this condition is detected, the receiver will signal the user that the lens surface should be cleaned or re-aligned. The Yellow diagnostic LED will turn ON until the condition is no longer detected (whether the light screen is blocked or clear). This advance recognition can be used to initiate a proper maintenance process.

1.4.2 Fault Detection and Sensor Degradation Operation (Output #2)

The receiver detects an occluded light channel detected when one or two consecutive light channels remain blocked after eight or more vehicles are detected. Once a blocked channel is detected (the Yellow diagnostic LED will flash at 2 hertz), the receiver will note the fault and begin to operate in sensor degradation mode.

Once the receiver detects a permanently blocked optical channel, it will effectively ignore the degraded optical channel while continuing to operate. This allows the sensor to continue working and for many instances, provide reliable service.

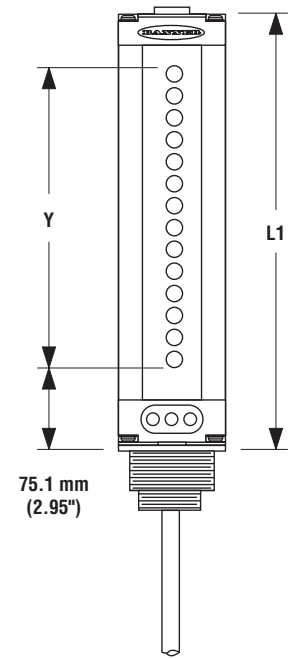
Along with ignoring permanently blocked channels, the sensor continuously monitors sensor performance. Should an optical channel become inoperable (due to a faulty light channel), the sensor will detect the problem and begin to operate in the sensor degradation mode. Sensor degradation mode provides the user with advance notice of a fault while continuing to maintain a functional traffic lane.

Emitter faults: In addition to sensing a permanently blocked channel and a faulty light channel, the receiver can detect a non-functioning emitter (possibly caused by a disconnected cable). The receiver’s Green and Red diagnostic LEDs will flash at 2 hertz to signal this emitter condition.

2.0 Specifications

2.1 Emitter and Receiver Models

Emitter/Receiver Models*	Sensor Scan Time**		Array Length (Y)	Housing Length (L1)	Total Beams
	Interlaced Scant†	Straight Scan			
MAE616 Emitter MAR616NX485 Receiver	1.4 ms	0.91 ms	143 mm (5.62")	231 mm (9.1")	8
MAE1216 Emitter MAR1216NX485 Receiver	2.5 ms	1.5 ms	295 mm (11.62")	384 mm (15.1")	16
MAE1816 Emitter MAR1816NX485 Receiver	3.6 ms	2.0 ms	448 mm (17.62")	536 mm (21.1")	24
MAE2416Q Emitter MAR2416NX485 Receiver	4.8 ms	2.6 ms	600 mm (23.62")	689 mm (27.1")	32
MAE3016 Emitter MAR3016NX485 Receiver	5.9 ms	3.2 ms	752 mm (29.62")	841 mm (33.1")	40
MAE3616 Emitter MAR3616NX485 Receiver	7.0 ms	3.7 ms	905 mm (35.62")	993 mm (39.1")	48
MAE4216 Emitter MAR4216NX485 Receiver	8.1 ms	4.3 ms	1057 mm (41.62")	1146 mm (45.1")	56
MAE4816 Emitter MAR4816NX485 Receiver	9.2 ms	4.8 ms	1210 mm (47.62")	1298 mm (51.1")	64
MAE6016 Emitter MAR6016NX485 Receiver	11.5 ms	6.0 ms	1514 mm (59.62")	1603 mm (63.1")	80
MAE7216 Emitter MAR7216NX485 Receiver	13.7 ms	7.1 ms	1819 mm (71.62")	1908 mm (75.1")	96



* Standard cabled models (2 m/6.5' long) only are listed. For 150 mm (6.5") Euro-style pigtail QD model, add suffix "Q" to any model (e.g., MAE616Q).

** Worst-case response time is twice the scan time.

† Scan time for Vehicle Separation scanning configuration.

2.2 Euro-Style Quick-Disconnect Cables

Cable: PVC jacket, polyurethane connector body, chrome-plated brass coupling nut
Conductors: 24 AWG high-flex stranded, PVC insulation, gold-plated

Model	Length	Style	Connector	Pin Out (female view)
MAQDC-806	2 m (6.5')	8-pin Euro-style straight with shield		
MAQDC-815	5 m (15')			
MAQDC-830	9 m (30')			
MAQDC-850	15 m (50')			
MAQDC-875	22 m (75')			
MAQDC-8100	30 m (100')			
MAQDC-8125	38 m (125')			
MAQDC-8150	46 m (150')			

2.3 Specifications

Supply Voltage and Power	16 to 30V dc. Maximum power 12 watts.	
Supply Protection Circuitry	Protected against transient voltages and reverse polarity	
Discrete Output Configuration	2 Discrete Outputs: Output 1 and Output 2. Outputs can be configured as either open collector NPN or PNP transistors. For the vehicle separation application, the outputs are factory configured as NPN outputs. Discrete Output (either NPN or PNP) ratings: Rated at 30V dc max, 150 mA max load, short circuit protected OFF-State Leakage Current: <10 µA @ 30V dc ON-State Saturation Voltage: <1V @ 10 mA, <1.5V @ 150 mA	
Serial Data Outputs	EIA-485 interface Baud rate 9600, 19.2 K, 38.4 K 8 data bits, 1 start bit, 1 stop bit, no parity	
Controller Programming	Via EIA-485 to PC-compatible computer running Windows® 98, NT, ME, XP, 2000 Operating System	
Emitter/Receiver Range	Sensors < 1220 mm (4') long: 0.9 to 16.5 m (3' to 55') Sensors ≥ 1220 mm (4') long: 0.9 to 13.5 m (3' to 45') NOTE: Maximum range is specified at the point where 3x excess gain remains.	
Minimum Object Sensitivity	Interlaced Mode: 25.4 mm (1.0")* Other scanning modes: 38.1 mm (1.5") *NOTE: Assumes sensing is in middle one-third of scanning range.	
Sensor Scan Time	See Section 2.1. NOTE: Worst-case response time is twice the scan time.	
Cable Connections	Emitter and receiver connections: See Figure 3-6. For QD versions, use cable listed in Section 2.2. Emitter and receiver cables may not exceed 80 m (250') each.	
Status Indicators (see Section 3.3 for more information)	Emitter Red LED lights for proper operation	Receiver Green: sensors aligned (> 3x excess gain) Yellow: marginal alignment (1x-3x excess gain) Red: sensors misaligned or beam(s) blocked
Environmental Rating	NEMA 4, 13 (IEC IP65)	
Construction	Aluminum housing with black anodized finish; acrylic lens cover	
Operating Conditions	Temperature: -40° to +70° C (-40° to +158° F) Max. rel. humidity: 95% (non-condensing)	
Application Notes	<ul style="list-style-type: none"> • The emitter and receiver sync lines (pink and white wires) will be damaged if connected to the power supply. • The receiver EIA-485 interface (red and green wires) will be damaged if connected to the power supply. 	

2.4 Emitter and Receiver Mounting Dimensions

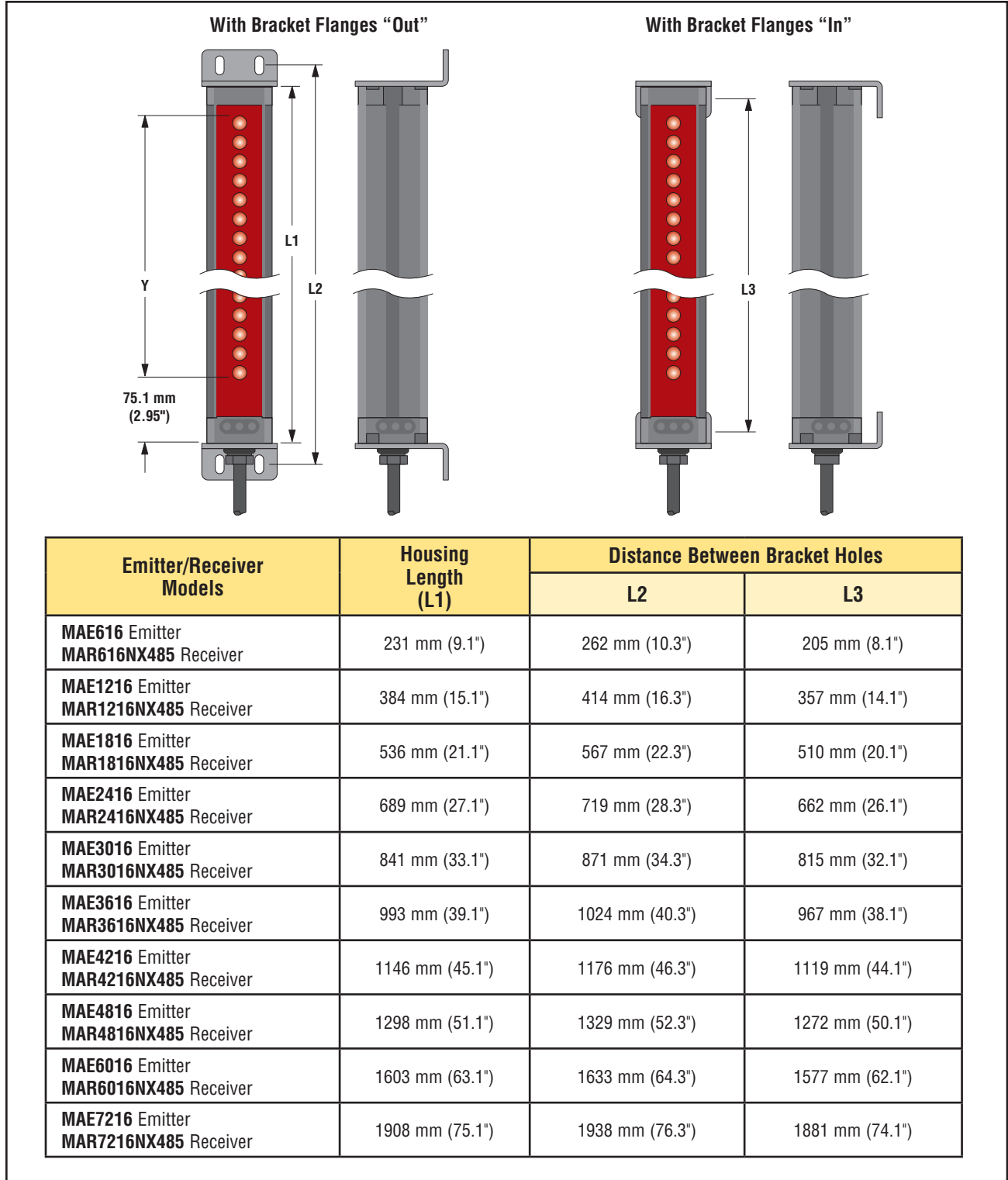


Figure 2-1. Emitter and receiver mounting dimensions and defined area location

3.0 Installation and Alignment

3.1 Emitter and Receiver Mounting

Banner MINI-ARRAY emitters and receivers are small, lightweight, and easy to mount; the mounting brackets (supplied) allow ± 30 degrees rotation.

From a common point of reference, make measurements to position the emitter and receiver in the same plane with their midpoints directly opposite each other. Mount the emitter and receiver brackets using the M4 x 0.7 x 14 mm bolts and associated mounting hardware (all supplied). See Figure 3-1.

Although the internal circuitry of the emitter and receiver can withstand heavy impulse forces, vibration isolators can be used instead of the M4 bolts to dampen impulse forces and prevent possible damage from resonant vibration of the emitter or receiver assembly. Two different Anti-Vibration Mounting Kits are available from Banner as accessories.

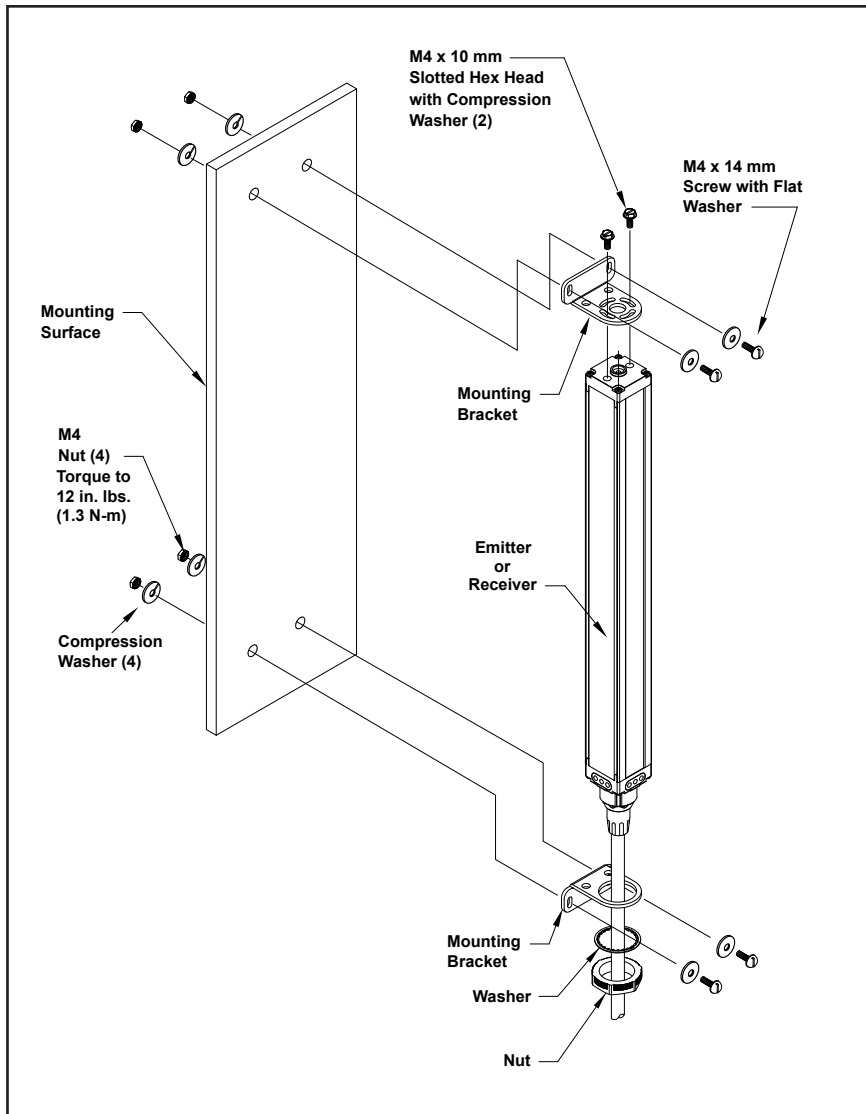


Figure 3-1. MINI-ARRAY emitter and receiver mounting hardware

P/N 48955 consists of 4 anti-vibration mounts (M4 x 0.7 x 9.5 mm) and 8 M4 Keps nuts. These mounts are made from BUNA-N rubber and are more resistant to chemicals and oils.

P/N 12847 consists of 4 anti-vibration mounts (M4 x 0.7 x 9.5 mm) and 8 M4 Keps nuts. These mounts are made from natural rubber, which are less chemically resistant than the 48955 mounts, but have a greater sheer force spec at higher temperature.

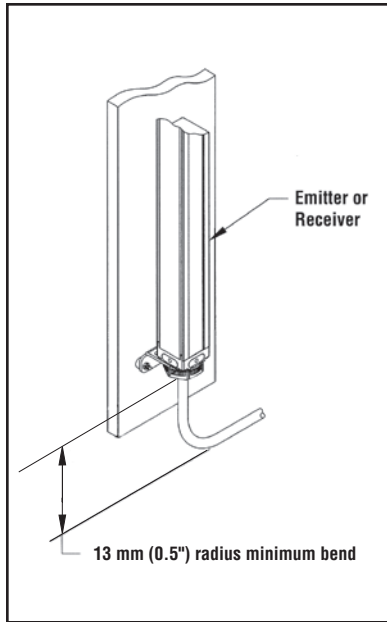


Figure 3-2. Cable clearances

Mount the emitter and receiver in their mounting brackets (see Figure 3-1), and position the red lenses of the two units directly facing each other. The connector ends of both sensors must point in the same direction. Measure from one or more reference planes (i.e., the floor) to the same points on the emitter and receiver to verify their mechanical alignment. If the sensors are positioned exactly vertical or exactly horizontal, a carpenter's level may be useful for checking alignment. Extending a straight-edge or a string between the sensors may help with positioning. Also check by eye for line-of-sight alignment. Make any necessary final mechanical adjustments, and hand-tighten the bracket hardware.

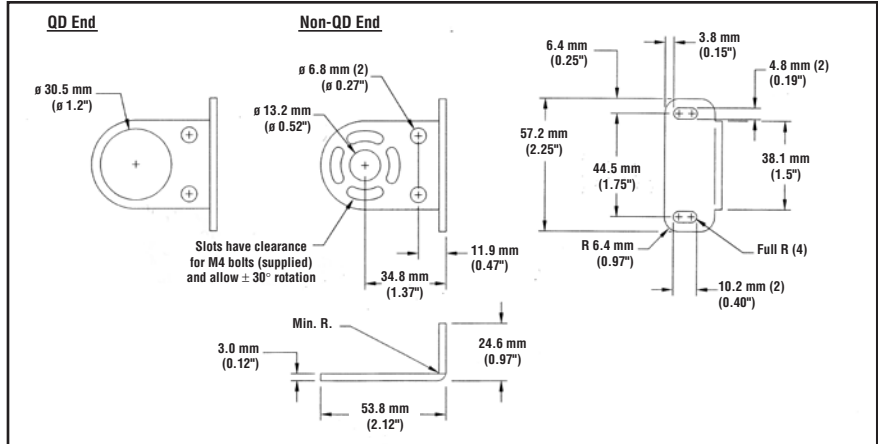


Figure 3-4. MINI-ARRAY emitter and receiver mounting bracket dimensions

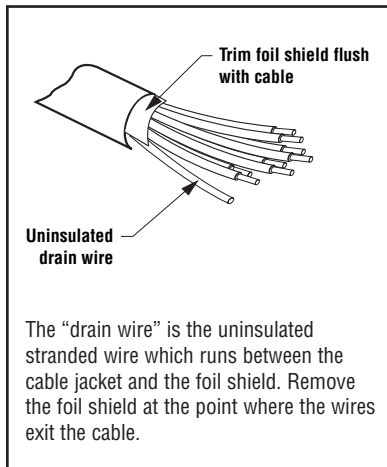


Figure 3-3. Emitter/receiver cable preparation

Connect the shielded cables to the emitter and receiver, and route them to the terminal location. Follow the local wiring code for low-voltage dc control cables. The same cable type is used for both emitter and receiver (two cables required per system). Cut the cables to length after making sure they are routed properly.

3.2 Emitter and Receiver Hookups

Connect the emitter and receiver cables as shown in Figure 3-6.

Receiver Output 1: (OUT1) is an open-collector NPN transistor switch rated at 30V dc max., 150 mA max. It is protected against overload and short circuits.

Receiver Alarm: (ALARM) is an open-collector NPN transistor switch rated at 30V dc max., 150 mA max. It is protected against overload and short circuits.

Both outputs are current sinking.

3.3 Diagnostic LED Indicators

The emitter has a single Red status LED. The receiver's three LEDs (Green, Yellow, and Red) are used in combination to diagnose system status.

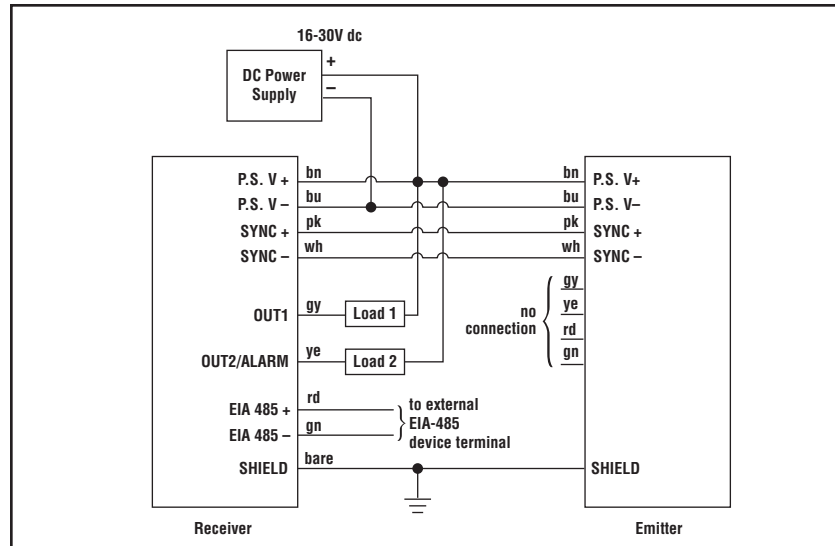


Figure 3-5. A-GAGE MINI-ARRAY Two-Piece Measuring Light Screen hookup diagram

Receiver LED Condition			System Status	Possible Action
Green	Yellow	Red		
ON	OFF	OFF	Emitter/receiver pair aligned	• None
ON	ON	OFF	Emitter/receiver pair aligned with dirty lens	• Clean lenses • Align emitter and receiver
OFF	OFF	ON	Emitter/receiver pair blocked	• None
OFF	ON	ON	Emitter/receiver pair blocked with dirty lens	• Clean lenses • Align emitter and receiver
ON	ON	ON	Receiver error	• Replace receiver
ON	Flashing @ 2 Hz	OFF	Degraded mode; emitter/receiver pair aligned	• Clean lenses • Align emitter and receiver*
OFF	Flashing @ 2 Hz	ON	Degraded mode; emitter/receiver pair blocked	• Clean lenses • Align emitter and receiver*
Flashing @ 2 Hz	OFF	Flashing @ 2 Hz	Emitter is not functioning	• Connect emitter
Emitter LED Condition			Emitter Status	Possible Action
Red ON			Emitter operating properly	• None
Red Flashing @ 1 Hz			Emitter is degraded	• Replace emitter
Red Flashing @ 5 Hz			Emitter has power, but receiver is not hooked up	• Connect or replace receiver

* If after cleaning the emitter and receiver lenses, the emitter diagnostic is solid Red, consider replacing the receiver.

3.4 Optical Alignment

After connecting the cables per Figure 3-5, apply 16-30V dc power to the sensor. Rotate the emitter and/or receiver as necessary to align them. When aligned, the receiver Green LED is ON. Align the emitter and receiver until the receiver's Green LED is ON and the Yellow and Red LED are OFF.

Appendix A. Serial Communication

Appendix A describes the serial communication data format and commands that are available to serially communicate over the EIA-485 interface. The serial commands can be used to initiate scanning, request sensor light channel information, request system status, and request one or two sensor measurements. The serial communication data format utilized by the sensor is described and related to the sensor commands; examples follow.

Command Value (Hexadecimal)	Command Description
0x53	Request Sensor to Scan
0x64	Request Sensor to Transmit Each Optical Channel State (0-clear, 1-blocked)
0x66	Request Sensor to Transmit System Status Information
0x67	Request Sensor to Transmit One or Two Measurement Values

Table A-1.

Serial Communication Data Format

The serial communication utilizes a standard universal asynchronous receiver/transmitter architecture. The sensor baud rate can be 9600, 19200, or 38400. The data will have one start bit, one stop bit, no parity, eight data bits and is transmitted least significant bit first. The serial communication string format will consist of a start-of-header byte, a sensor-identification byte, a command byte, a count of the data bytes, the data bytes, and a two-byte check sum.

All serial communication will follow this data format. The start-of-header byte will always have hexadecimal value 0xF4 (244 decimal). The sensor identification byte can have hexadecimal values ranging from 0x41 through 0x5A (65 through 90 decimal). The command bytes used for the sensor are listed in Table A-1.

The count of the data bytes defines the number of data bytes that will be transmitted for the particular command. For instance, if four data bytes are transmitted, then the value for the number of data bytes will equal four. The actual data bytes follow the byte representing the number of data bytes. The check sum is a two-byte value that is calculated by summing the previous bytes in the string. Once the sum is known, then a ones complement of the sum is calculated and used as the string check sum value. Examples will be given in the description of each command.

Request Sensor to Scan Command (Command 0x53)

This command will be used when the sensor is configured for host scanning. This command is useful for instances where multiple sensors are present and sensor cross talk is an issue. Assuming the sensor ID is 0x41, the command string would be as follows:

Transmit string to sensor: 0xF4, 0x41, 0x53, 0x00, 0x77, 0xFE

Receive string from sensor: 0xF4, 0x41, 0x53, 0x01, 0x06, 0x70, 0xFE

This receive string would be interpreted as follows:

0xF4 is the start-of-header byte

0x41 is the sensor-identification byte

0x53 is the command requesting the sensor scan initiation

0x01 is the number of data bytes

0x06 is the valid response stating that the sensor initiated a scan

The last two bytes are the check sum in low-byte, high-byte order and calculated as follows:

$0xF4 + 0x41 + 0x53 + 0x01 + 0x06 = 0x18F$.

The ones complement of $0x18F = 0xFE70$.

Hence the low-byte, high-byte order would be 0x70, 0xFE.

Request Sensor to Transmit all Receiver Channel State (Command 0x64)

This command requests the sensor to provide the state of each optical channel. The two states for each optical channel are clear (value =0) and blocked (value =1). Eight optical channels of information are transmitted in each data byte. The first data byte contains the information for the eight optical channels located closest to the sensor cable end cap. The following data bytes will contain information for eight successive optical channel sections. For a data byte, each bit of the data byte is directly related to the status of an individual optical channel. For example, if the first eight optical channels have the following states:

Optical Channel Position	Status	Binary Value	Optical Channel Position	Status	Binary Value
1	blocked	1	5	clear	0
2	clear	0	6	blocked	1
3	blocked	1	7	clear	0
4	blocked	1	8	clear	0

Then the data byte would be 0x2D. If the array has 32 optical channels, then there would be four data bytes representing the status of all 32 optical channels. Assume that the sensor ID is 0x41 and the following serial transmission occurs:

Transmit string to sensor: 0xF4, 0x41, 0x64, 0x00, 0x66, 0xFE

Receive string from sensor: 0xF4, 0x41, 0x64, 0x04, 0x2D, 0x03, 0xC0, 0x81, 0xF1, 0xFC

This receive string would be interpreted as follows:

- 0xF4 is the start-of-header byte
- 0x41 is the sensor-identification byte
- 0x64 is the command requesting the sensor optical channel information
- 0x04 is the number of data bytes
- 0x2D optical channels 1, 3, 4, 6 are blocked; optical channels 2, 5, 7, 8 are clear
- 0x03 optical channels 9 and 10 are blocked; optical channels 11-16 are clear
- 0xC0 optical channels 17-22 are clear; optical channels 23 and 24 are blocked
- 0x81 optical channels 25 and 32 are blocked; optical channels 26-31 are clear
- The last two bytes are the check sum in low-byte, high-byte order

Request Sensor to Transmit System Status Information (Command 0x66)

This command will be used to extract information about the sensor. The information that can be received includes the following six data bytes:

- Number of Emitter Channels
- First Emitter Failed Channel
- Number of Receiver Channels
- First Bad Receiver Channel
- State
 - 0 – System is working properly
 - 1 – System detects weak alignment
 - 2 – System detects dirty lens
 - 3 – System detects degraded emitter (faulty emitter element)
 - 4 – System detects emitter is not functioning
- Degraded Channel

Assume that the system has 48 channels and the system detects weak alignment. The transmit and receiver strings would be as follows:

Transmit string to sensor: 0xF4, 0x41, 0x66, 0x00, 0x64, 0xFE

Receive string from sensor: 0xF4, 0x41, 0x66, 0x06, 0x30, 0x00, 0x30, 0x00, 0x01, 0x00, 0xFD, 0xFD

This receive string would be interpreted as follows:

0xF4 is the start-of-header byte

0x41 is the sensor-identification byte

0x66 is the command requesting the sensor status information

0x06 is the number of data bytes

0x30 there are 48 emitter channels

0x00 all emitter channels are OK

0x30 there are 48 receiver channels (that's good, because the emitter has 48 channels also!)

0x00 all receiver channels are OK

0x01 the system detects weak alignment

0x00 there are no degraded channels

The last two bytes are the check sum in low-byte, high-byte order.

Request Sensor to Transmit One or Two Measurement Values (Command 0x67)

This command requests the sensor to transmit the previous scan's measurement values (one or two measurement values). The command will transmit either two or four bytes (as specified by the sensor configuration). Assume that the sensor ID is 0x41 and the sensor is configured to transmit the First Beam Blocked and Total Beams Blocked information. Also assume that the twentieth light channel happens to be the first beam blocked and a total of 15 light channels are blocked.

Transmit string to sensor: 0xF4, 0x41, 0x67, 0x00, 0x63, 0xFE

Receive string from sensor: 0xF4, 0x41, 0x67, 0x04, 0x14, 0x00, 0x0F, 0x00, 0x3C, 0xFE

This receive string would be interpreted as follows:

0xF4 is the start-of-header byte

0x41 is the sensor-identification byte

0x67 is the command requesting the sensor measurement information

0x04 is the number of data bytes

0x14, 0x00 is the low-byte, high-byte integer value for the first beam blocked = 20

0x0f, 0x00 is the low-byte, high-byte integer value for the total beams blocked=15

The last two bytes are the check sum in low-byte, high-byte order. The check sum is calculated as follows:

$$0xF4 + 0x41 + 0x67 + 0x04 + 0x14 + 0x00 + 0x0F + 0x00 = 0x1C3.$$

The ones complement of 0x1C3 = 0xFE3C.

Hence the low-byte, high-byte order would be 0x3C, 0xFE.



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