

TMAS

**Illuminance Sensor for Tunnel Lighting Control Systems
INSTALLATION AND MAINTENANCE MANUAL (IMM)**

PLC  **Multipoint**



1 INTRODUCTION

1.1 General

- 1. Please read these instructions carefully to prevent any possible injury or equipment damage.*
- 2. Installer must be a qualified and experienced service technician.*
- 3. Verify the product ratings to confirm that this product will satisfy your requirements and application.*

2 OVERVIEW

The TMAS is an Illuminance Sensor designed to provide an analog signal, measuring the light that a motorist sees from the roadway, portal and sky as they approach and enter a tunnel, to a Tunnel Lighting Controller.

2.1 The Sensor

The TMAS utilizes a blue-enhanced photometric sensor to produce a linear, analog signal.

2.2 Power

The TMAS requires 24VAC @ 50VA to operate the Heater properly.

2.3 Circuit Protection

The TMAS utilizes two surge suppressors: one for the 24VAC power and one for the DC current loop signal.

2.4 Analog Signal

The TMAS provides a linear, analog, output signal that is proportional to the light it measures. This is accomplished through a 4-20mA current loop. The range of the TMAS is 0-5,000 Footcandles (Fc).

2.5 Environmental Protection

The TMAS is housed in a weatherproof, NEMA 4X enclosure with a window. The housing is protected from solar heat by a sun shroud and includes a heater/defroster that will maintain a minimum of 35°F internal temperature to prevent icing and condensation during cooler seasons.

2.6 Mounting

The TMAS should be mounted 1 stopping distance away from tunnel portal, facing the portal so that the sensor observes the ambient light that the motorist is experiencing. It can be pole or wall mounted.

2.7 Wiring

The TMAS requires 5 field conductors. 3 - #14 AWG conductors are utilized for the 24VAC power and a single, shielded, twisted-pair of #14 AWG wire are needed for the analog signal. These conductors will terminate at 5 terminal blocks within the TMAS enclosure.

3 THE SENSOR

3.1 Function

The TMAS tunnel Illuminance sensor provides analog measurement in Footcandles (Fc) that target reflected and ambient light at each traffic direction's entrance portal.

TMAS Tunnel Illuminance sensors see a restricted field of view, e.g. 20° and are aimed at the tunnel portals composing the field of vision that a driver at a safe stopping distance before entering the portal.

Long distance signal transmission, up to 1,000 feet, is accomplished through a 4-20mA current loop.

The TMAS sensor can measure outdoor ranges of 0 to 5,000 Fc.

3.2 Process

The TMAS tunnel Illuminance sensor utilizes a blue-enhanced sensor with a photometric filter accuracy of 1% total area error (with a CIE function error of 2%) to provide analog measurement in Fc.

The current output passes through a DC surge suppressor (SS-DC) and then out to the tunnel lighting controller.

A differential analog input reads the 4-20ma reading

The DC current returns to the TMAS.

4 POWER

The TMAS housing heater operates on 24VAC power.

4.1 External

If the TMAS is connected to a PLC-Multipoint T4 or T5 series Tunnel Lighting Controller (TLC), a properly fused and protected 24VAC circuit is provided specifically for this purpose in the control panel.

If the TMAS is connected to a non-PLC-Multipoint TLC, a 24VAC @ 50VA minimum circuit must be supplied to the TMAS via 3 #14 AWG conductors (L, N, and GND).

If the TMAS is connected to a non-PLC-Multipoint TLC, it is highly recommended that the power circuit is properly fused in the TLC and has proper surge protection.

4.2 Internal

Inside the TMAS, the 24VAC power passes through an AC surge suppressor (SS-AC).

The 24VAC power circuit powers the enclosure's 30W heater/defroster (PCB).

4.3 Local Power Option

The TMAS can be placed at a maximum distance of 1000' from the controller.

This restriction is due to the drop in 24VAC power at distances beyond 1000'.

At 1000' distance, the 24VAC input power is reduced to 21VAC. This is the minimum voltage required for the TMAS heater to function correctly.

If the TMAS is installed beyond 1000' from the controller, then the TMAS local power option (TU24) must be selected.

The TU24 option places a local control power transformer on the light pole or wall to step down from any one of the line voltages of 480/277/120VAC to 24VAC.

With the local power option, the TMAS can be up to 2000' maximum from the controller.

Local power Option wiring gauge requirements are identical as described above.

5 CIRCUIT PROTECTION

The TMAS's 24VAC heater circuit and the 4-20mA current loop are protected by individual UL 497B listed, High Energy Silicon Avalanche Diode (SAD) surge suppressors with a Peak Pulse Current of 46.5A.

It is highly recommended that corresponding surge suppression be located in these circuits in the TLC enclosure.

All PLC-Multipoint TLC enclosures have appropriate surge suppression in their design.

6 ANALOG SIGNAL

The TMAS provides a linear, analog, output signal that is proportional to the light it measures.

The TMAS produces a 4-20mA current loop output signal.

The photosensitivity range of the TMAS is 0-5,000 Fc.

4mA = 0 Fc and 20mA = 5,000 Fc.

Linearity +/- 2% at 70°F (21°C).

Accuracy - Overall Tolerance: ±12% over the specified light & temperature range.

7 ENVIRONMENTAL PROTECTION

The TMAS is housed in a weatherproof, NEMA 4X enclosure with a high optic grade, soda lime glass window.

Wiring enters the enclosure through pre-punched penetrations which also have 2 weatherproof PG11 compression strain relief fittings (0.47" diam cable max).

The TMAS housing is protected from solar heat by a sun shroud.

The TMAS housing is protected from accumulated snow and ice using a thermostatically controlled heater that will activate to maintain a minimum 35° F internal temperature.

The device turns on at 37°F (3°C) and turns off at 59°F (15°C).

The TMAS enclosure's hinged lid is fastened with Torx security screws (pin-in-star, M5).

8 MOUNTING

The TMAS can be pole or wall mounted.

Mounting the TMAS correctly is important for three reasons; functionality, survivability, and electrical concerns.

8.1 Designed Functionality

The TMAS should be mounted one safe stopping-distance away from the tunnel portal. (See AASHTO Table)

The TMAS is targeted to the portal of the tunnel aiming at a scene consisting of the tunnel portal facade, roadway and surrounding terrain

The TMAS sees a restricted field of view composing the field of vision of a motorist at one safe stopping-distance before entering the portal.

The field of view is 20°

Please review the Typical Mounting Location Diagram and AASHTO Stopping Sight-Distance Table (Abbreviated).

For a more detailed Table that also considers road grades, please consult the IES publication RP-8-18. See Chapter 14 Tunnel Lighting.

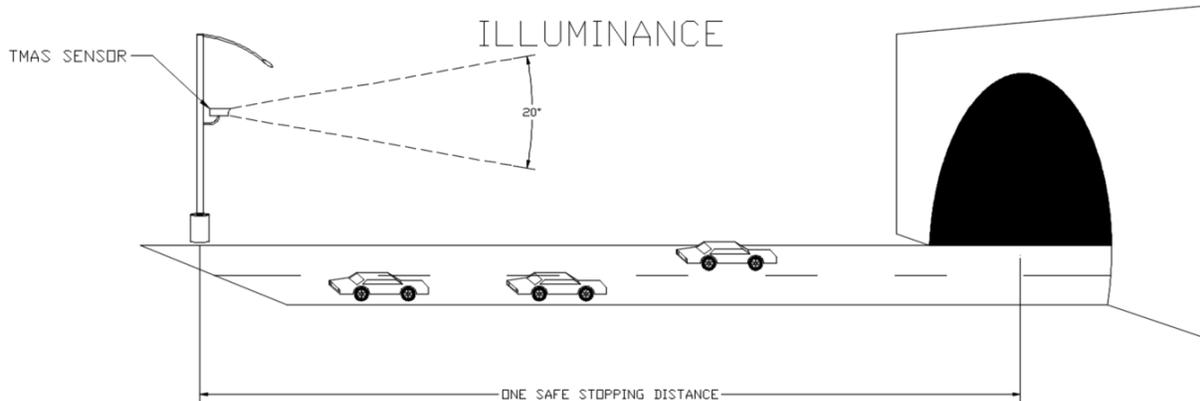


FIGURE 1: TYPICAL MOUNTING LOCATION DIAGRAM

Traffic Speed	Stopping Sight Distance (Feet)
30 mph	200
40 mph	305
50 mph	425
60 mph	570
70 mph	730

TABLE 1:

AASHTO STOPPING SIGHT DISTANCE TABLE (ABBREVIATED) FROM IES PUB. RP-8-18

8.2 Survivability

The TMAS is typically mounted at a minimum height of 15' and positioned on the side of the tunnel approach roadway out of the range of snow clearing equipment.

8.3 Electrical

The TMAS can be placed at a maximum distance of 1000' from the controller.

This restriction is due to the drop in 24VAC power at distances beyond 1000'.

At 1000' distance, the 24VAC input power is reduced to 21VAC. This is the minimum voltage required for the TMAS heater to function correctly.

If the TMAS is installed beyond 1000' from the controller, then the TMAS Local Power Option (TU24) must be selected.

The TU24 option places a local control power transformer on the light pole to step down from 480/277/240/120VAC to 24VAC.

With the local power option, the TMAS can be at a 2000' maximum from the controller.

Local Power Option wiring gauge requirements are identical as described in the Wiring Gauge Requirements section above.

8.4 Pole Mount

The Pole Mount bracket features a manually adjustable swivel head and a cable feedthrough hole to conceal wiring.

Multiple mounting holes on the tilt table provide maximum 360-degree horizontal positioning of the TMAS enclosure.

The Pole Mount bracket must be mounted on vertical pipes or poles having a 3-inch to 8-inch diameter.

Two ¼-20 mounting bolts (supplied) are required to secure the TMAS enclosure to the mount.

The Local Power Option TU24 can be pole mounted with a provided pole-mounting kit if ordered. Please review the Typical Pole Mount Application.

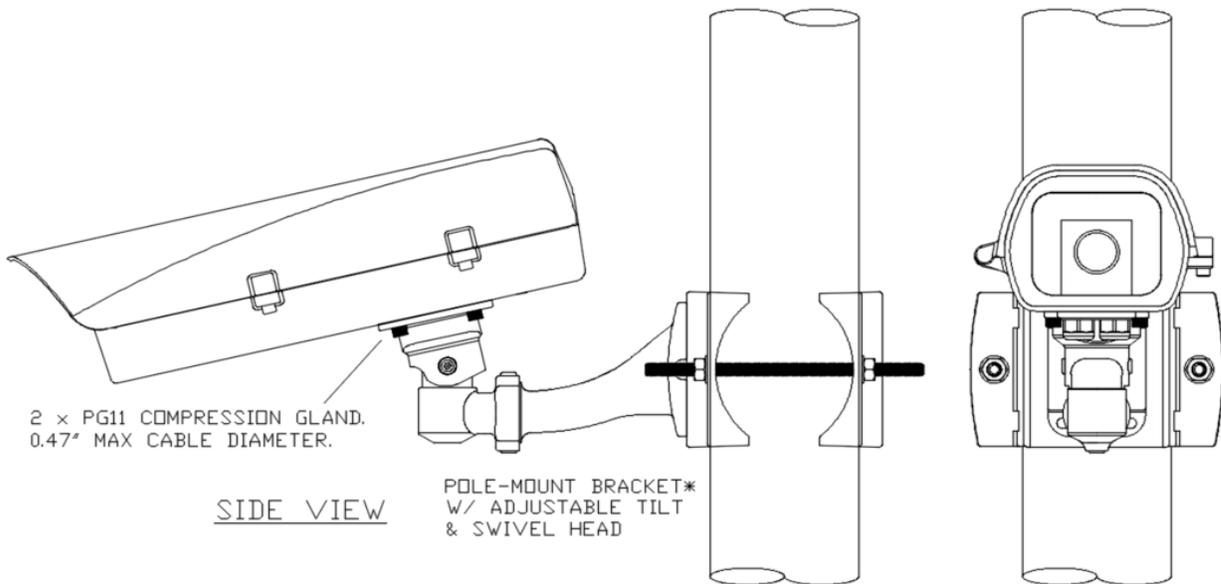


FIGURE 2: TYPICAL POLE MOUNT APPLICATION

8.5 Wall Mount

The Wall Mount bracket features a manually adjustable swivel head.

Multiple mounting holes on the tilt table provide maximum 360-degree horizontal positioning of the TMAS enclosure.

The Pole Mount bracket must be mounted to a wall or other vertical surfaces.

Two ¼-20 mounting bolts (supplied) are required to secure the TMAS enclosure to the mount.

The Local Power Option TU24 can also be wall mounted.

Please review the Typical Wall Mount Application.

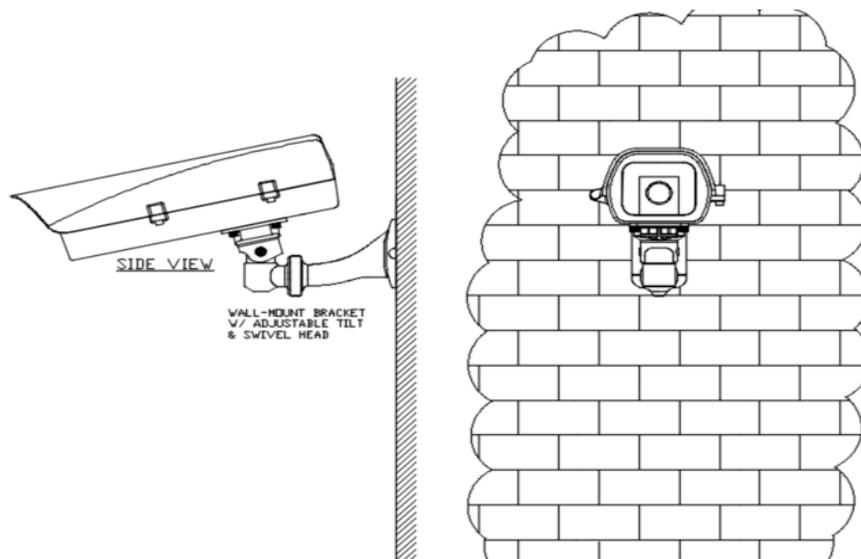


FIGURE 3: TYPICAL WALL MOUNT APPLICATION

9 WIRING

9.1 TMAS

The TMAS requires 5 field conductors for installation.

The field conductors must be a minimum of #14AWG wire gauge for compliance with the 1000' maximum distance.

The 24VAC heater power connection requires three conductors.

The 4-20mA signal connection requires one shielded, twisted pair.

The TMAS has 5 terminal blocks for these connections that are assigned as follows:

- TB1-1 24VAC Line
- TB1-2 24VAC Neutral
- TB1-3 Ground
- TB1-4 4 – 20mA signal
- TB1-5 4 – 20mA return

Please review the Field Wiring Schematic.

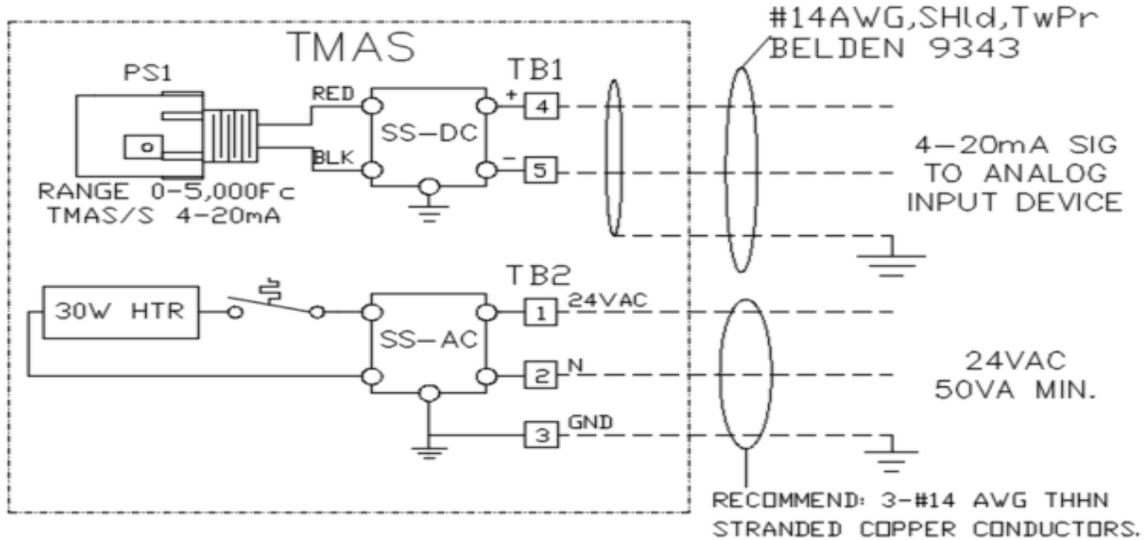


FIGURE 4: FIELD WIRING SCHEMATIC

9.2 TU-24 Wiring

The TU-24 (Local Power Option) has multiple primary voltages which it can utilize to provide 24VAC to the TMAS.

These include, 480VAC, 277VAC, 240VAC, and 120VAC.

All primary voltages are single phase.

The TU-24 multi-tap transformer leads are each brought out to terminal blocks.

Only one primary voltage input must be used to power the transformer.

Please review the TU24 Wiring Schematic.

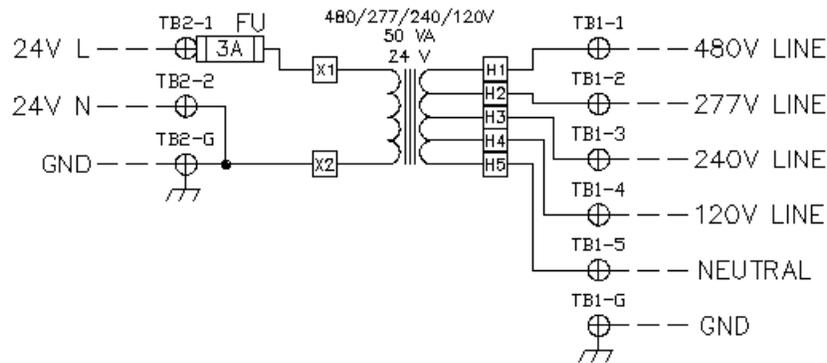


FIGURE 5: TU24 Wiring Schematic

9.3 Controller

Typically, the Tunnel Lighting Controller will provide fused and surge protected 24VAC power to the TMAS.

If the TMAS is located more than 1000' from the controller, it is recommended that a TU24 Local Power Option be used to provide 24VAC power to the TMAS.

The TU24 will transform 480/277/240/120VAC to 24VAC.

Typically, the Tunnel Lighting Controller will provide a surge protected terminal block to connect the TMAS's 4-20mA signal to an Analog Input.

Please review the Typical Controller Wiring Schematic.

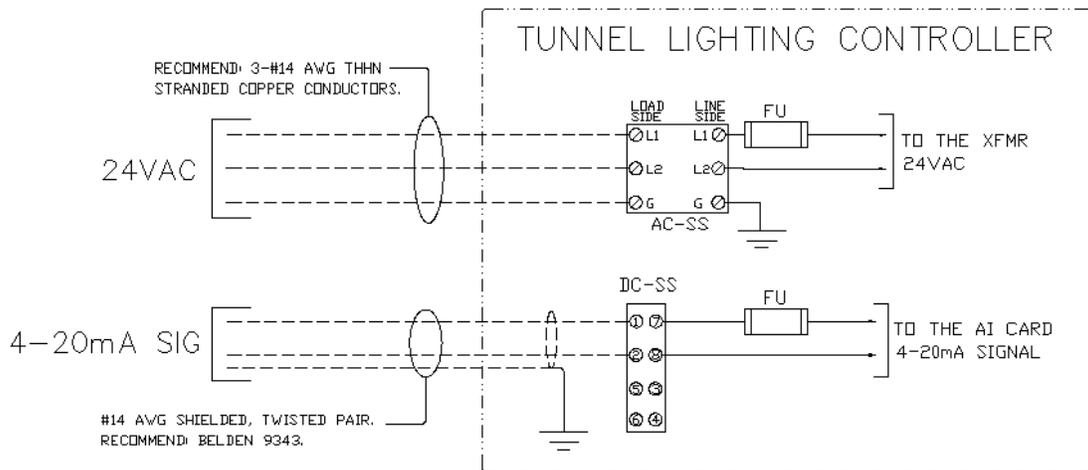


FIGURE 6: TYPICAL CONTROLLER WIRING SCHEMATIC

10 OPERATION

This section defines the operational states of the TMAS.

10.1 Unpowered State

Unpowered State: defined as device has no heating active, device sends 0mA signal to the controller which interprets this as "not working."

10.2 Power-On State

Power-On State: defined as device can activate heating; 4-20mA signal is available within 1 second of powering on.

10.3 Normal Operation

Normal Operation: defined as device can activate heating element, sensor outputs 4-20mA signal scaled as 0 – 5,000 Fc.

Controlled lighting circuits will switch on or off in a manner described in Diagram 1.

11 TROUBLESHOOTING

The TMAS is a very precise light measuring instrument that has been manufactured and calibrated with great attention to sustaining accuracy for many years.

In the event of a malfunction, the TMAS will probably need to be returned to PLC-Multipoint for servicing and recalibration.

Before returning it, a few tests can be performed to determine if the problem is with the TMAS or external to it.

If a voltage or signal does not appear where it should and power is being properly supplied, the problem will likely be a loose connection or malfunctioning component.

Please review the TMAS Troubleshooting Chart and the TMAS Component Test Schematic to guide you in these tests.

CHECK	TEST
POWER FROM TLC OR TU24	CONFIRM 24VAC POWER @TEST POINTS A & B
SS-AC & POWER TO HEATERS	CONFIRM 24VAC POWER @TEST POINTS C & D
SS-DC & SIGNAL TO TLC	CONFIRM 4-20mA SIGNAL @TEST POINTS E & F 4mA IN DARK, 20mA IN BRIGHT LIGHT

TABLE 2: TMAS TROUBLESHOOTING CHART

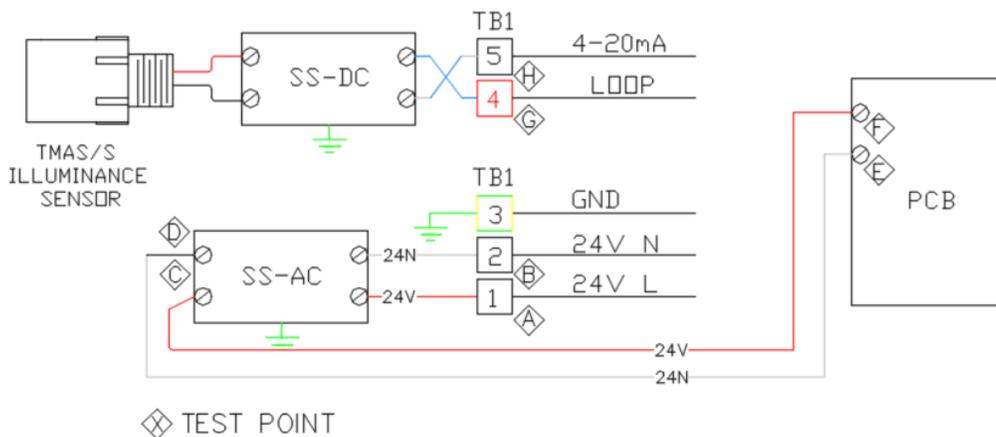


FIGURE 6: TMAS COMPONENT TEST SCHEMATIC

12 SPECIFICATIONS

Sensor Type:	Blue-enhanced Photo Diode
Sensor Ranges:	Factory Calibration 0-5,000 Fc
Housing:	NEMA 4X
Input Voltage:	24VAC
Field of View:	20°
Protection:	UL 497B listed, High Energy Silicon Avalanche Diode (SAD) surge suppressors with a Peak Pulse Current of 46.5A Peak Pulse Current of 46.5A
Accuracy:	Repeatability +/- 1% Linearity +/- 2% at 70°F (21°C)
Temperature:	+/- 10%
Overall Tolerance:	+/- 12% over the specified light & temperature range
Operating Temp:	-40°F to 140°F (-40°C to 60°C)
Internal Heating Element:	ON at 50°F (10°C) and OFF at 80°F (27°C)
Sensor Output:	4.0 - 20mA + .1/ - .1mA
Notes:	Photometric filter accuracy of 1% total area error w/ a CIE function error of 2%
Power Requirement:	24VAC, minimum 50VA
Sensor Dimensions:	5.5"W x 17"L x 4.25"H
Mounting:	Pole or Wall mount
Communication:	4 – 20mA with controller
ROHS Compatibility:	2002/95/EC
Listing:	UL508A, CAN/CSA C22.2 NO 14-M91

If you have any questions, please call us toll-free at 1-866-998-5483

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