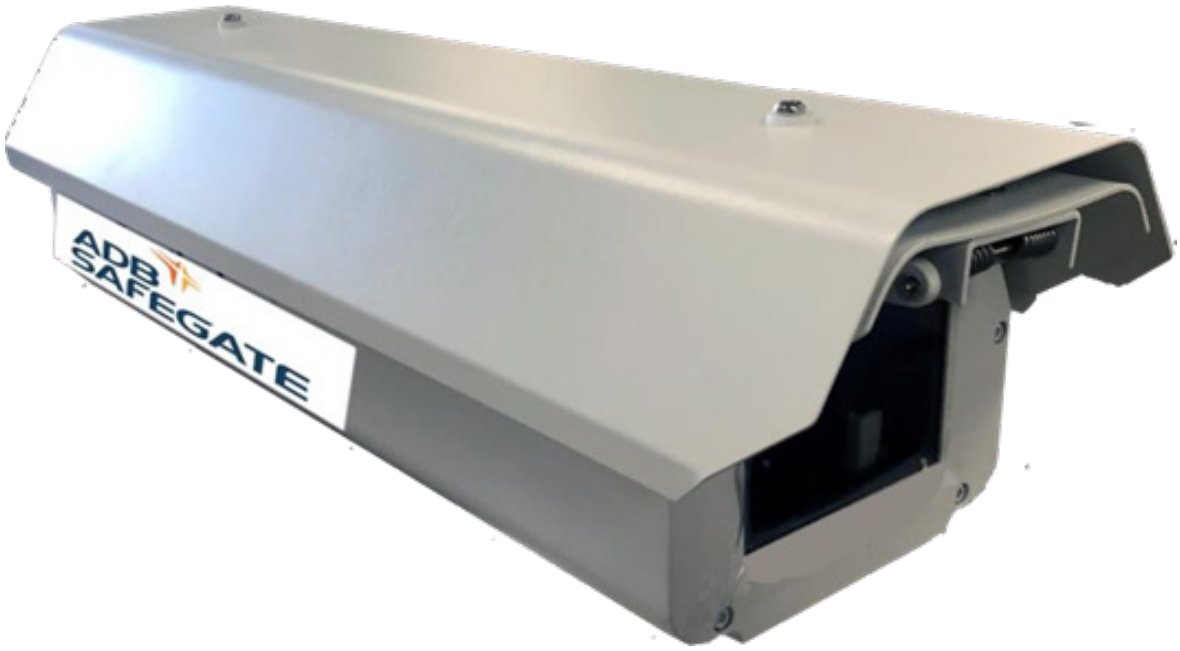

Model 5000

Background Luminance Sensor

PRODUCT MANUAL

5000/Rev A

ADB SAFEGATE

A.0 Disclaimer / Standard Warranty

CE certification

The equipment listed as CE certified means that the product complies with the essential requirements concerning safety and hygiene. The European directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

ETL certification

The equipment listed as ETL certified means that the product complies with the essential requirements concerning safety and C22.2 No.180:13 (R2018) regulations. The CSA directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

All Products Guarantee

ADB SAFEGATE will correct by repair or replacement per the applicable guarantee below, at its option, equipment or parts which fail because of mechanical, electrical or physical defects, provided that the goods have been properly handled and stored prior to installation, properly installed and properly operated after installation, and provided further that Buyer gives ADB SAFEGATE written notice of such defects after delivery of the goods to Buyer. Refer to the Safety section for more information on Material Handling Precautions and Storage precautions that must be followed.

ADB SAFEGATE reserves the right to examine goods upon which a claim is made. Said goods must be presented in the same condition as when the defect therein was discovered. ADB SAFEGATE furthers reserves the right to require the return of such goods to establish any claim.

ADB SAFEGATE's obligation under this guarantee is limited to making repair or replacement within a reasonable time after receipt of such written notice and does not include any other costs such as the cost of removal of defective part, installation of repaired product, labor or consequential damages of any kind, the exclusive remedy being to require such new parts to be furnished.

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Standard Products Guarantee

Products manufactured by ADB SAFEGATE are guaranteed against mechanical, electrical, and physical defects (excluding lamps) which may occur during proper and normal use for a period of two years from the date of ex-works delivery, and are guaranteed to be merchantable and fit for the ordinary purposes for which such products are made.

NOTE

See your applicable sales agreement for a complete warranty description.

Replaced or repaired equipment under warranty falls into the warranty of the original delivery. No new warranty period is started for these replaced or repaired products.

FAA Certified products manufactured by ADB SAFEGATE

ADB SAFEGATE L858 Airfield Guidance Signs are warranted against mechanical and physical defects in design or manufacture for a period of 2 years from date of installation, per FAA AC 150/5345-44 (applicable edition).

ADB SAFEGATE LED products (with the exception of obstruction lighting) are warranted against electrical defects in design or manufacture of the LED or LED specific circuitry for a period of 4 years from date of installation, per FAA EB67 (applicable edition). These FAA certified constant current (series) powered LED products must be installed, interfaced and powered with and through products certified under the FAA Airfield Lighting Equipment Program (ALECP) to be included in this 4 (four) year warranty. This includes, but is not limited to, interface with products such as Base Cans, Isolation Transformers, Connectors, Wiring, and Constant Current Regulators.

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Revision History

Revision	Date	Summary of Changes
A	2025 Aug 15	Initial release in new format

1. Overview

The Model 5000 Background Luminance Sensor measures the background sky intensity that is used with transmissometers or visibility sensors to calculate the Runway Visual Range (RVR). The sensor is pointed away from the sun and measures the sky ambient light level over a range of 0–45,000 cd/m^2. This measurement is used in conjunction with the Meteorological Optical Range (MOR) and the runway light intensity to calculate RVR, the distance at which a pilot can see the runway.

The sensor's optoelectronics assembly is mounted inside a weatherproof enclosure with a heated glass front window and integral hood. A high-stability silicon photodiode with a linear response of over 7 orders of magnitude measures the background sky intensity. The photodiode characteristic is compensated for by a photopic correction filter centered on 555 nm to ensure that the reading conforms to within 3% of the CIE Photopic response.

The optoelectronic assembly is temperature controlled and features a logarithmic characteristic to ensure accurate readings through the whole range of the sensor when used with a standard analog-to-digital converter.

2. Description

The sensor consists of an optical head connected to a signal processor card. The optical head is directly behind a window that is heated thermostatically to remain free of any condensation. The window heater remains on until the temperature inside the enclosure is above 55°C, and does not turn on again until the temperature drops below 50°C.

A photodiode inside the optical head measures the background luminance.

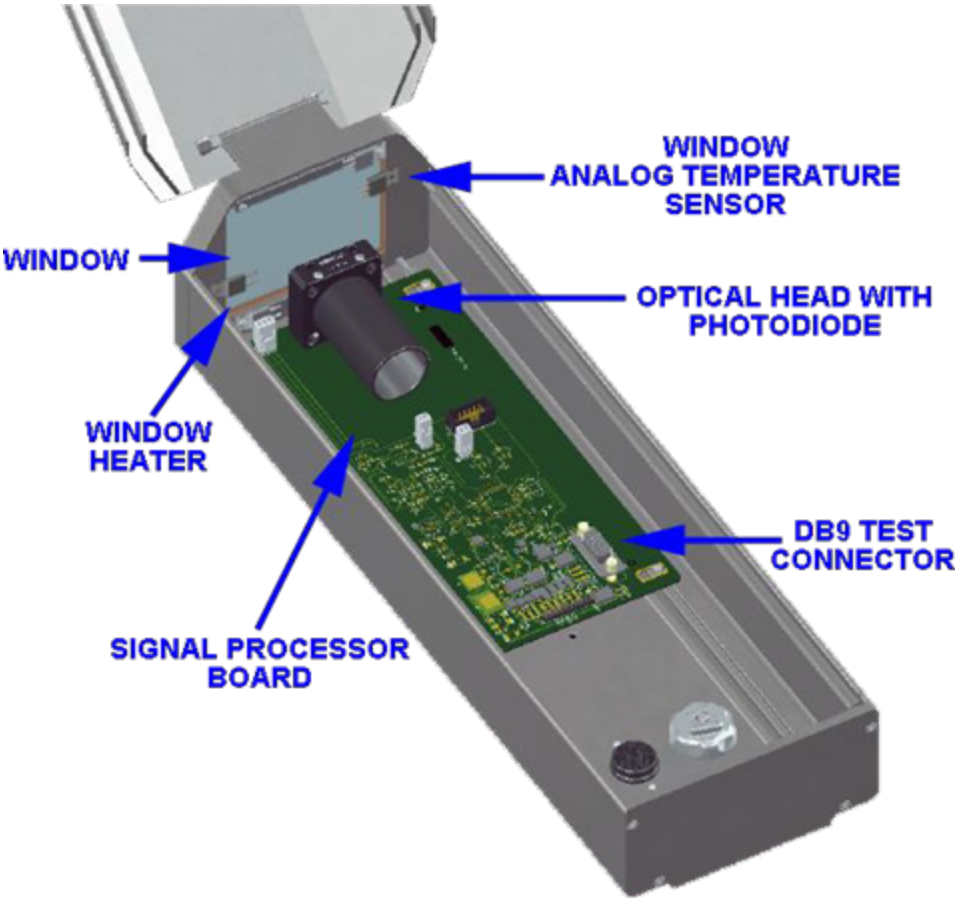


Figure 1. Background Luminance Sensor Components

The photodiode is enclosed in a tubular aluminum assembly with a lens mounted at the aperture end that allows for a 12-degree field of view. The aluminum assembly is also heated thermostati- cally to remain free of any condensation. The aluminum assembly is mounted with the Signal Processor Board inside the enclosure.

The enclosure is mounted on a pan-tilt mounting and a window. The enclosure may be mounted on the Transmitter pole of the 8400-eMOR Transmissometer or in the vicinity of the Model 1192 Data Collection Platform (when used with a Visibility Sensor).

2.1 Theory Of Operation

The photodiode has a nominal sensitivity of 16 nA/lux, when combined with the lens there is a nominal logarithmic relationship between the luminance and the photocurrent. The spectral response of the photodiode approximates that of the human eye.

Luminance (cd/m^2)	Photocurrent
3	6 nA
10	65 nA
100	650 nA
1000	65 µA
10,000	65 µA
30,000	195 µA

Table 1. Relationship Between Luminance and Photocurrent

Overall, the analog section of the Signal Processor Board provides a transconductance function, converting the photosensor current into a voltage.

The logarithmic amplifier is mounted on the Signal Processor Board operates as a ratio metric device and the reference current is trimmed by the output from a DAC (digital to analog) converter. Currents of 1 nA to 10 µA are converted to output voltages of 0–5 VDC.

The output of the logarithmic amplifier is amplified by a variable exponent stage and a clamp prevents negative voltage at the ADC (analog to digital) converter.

Regulators U5 and U6 reduce the raw DC supply to +5 VDC and +3.3 VDC.

The microcontroller operates a program in firmware to operate the ADC converter, U9. The firmware performs an ADC conversion every second and outputs a serial data message on the RS-232 port. This is the format of the message output.

#L : XXXXX [CR]

Because the input to the ADC converter is logarithmic, the microcontroller uses an exponentiation routine to convert to linear luminance readings.

3. Installation

3.1 Unpacking

The Model 5000 Background Luminance Sensor is shipped in a container that contains the measurement unit, mounting arm, accessories, calibration certificate and documentation.

NOTE

If possible keep the original packaging to allow the safe future shipment or storage of the device.

When opening the packaging crate, placed it on a clear level surface with the side indicated as “top” facing upwards.

WARNING

Do not drop the sensor. Exercise caution when removing it from the packaging.

Contact ADB Safegate immediately If there are signs that obvious mishandling has occurred.

3.2 Mounting

The sensor is normally mounted to point at either the north sky (in the Northern Hemisphere) or the south sky (in the Southern Hemisphere), away from the sun.

Point the sensor is pointed at an angle of about 15–20 degrees to the sky above the horizon towards the end of the runway.

The sensor is used in tandem with a transmissometer or a visibility sensor. In either case, it is mounted on the Transmitter pole (transmissometer) or in the vicinity of the Model 1192 Data Collection Platform (when used with a visibility sensor).

3.2.1 Model 8400-Emor Transmitter Pole

Install the Model 5000 Background Luminance Sensor on either side of the Transmitter pole — the connector panel side and the front side do not have mounting locations for it. The sensor is mounted on a mounting arm that may be rotated on its vertical and horizontal axes to point the sensor at the sky in the opposite direction from where the sun crosses the zenith. The sensor is normally pointed between 15 and 20 degrees above the horizon.

1. Select the mounting location and secure the mounting arm using ¼-20 screws (M012004-00), lock washers (M009032-00), and flat washers (M009041-00). Note that the location for this mounting arm is below the location where the M482306-00 Visibility Sensor could be installed.

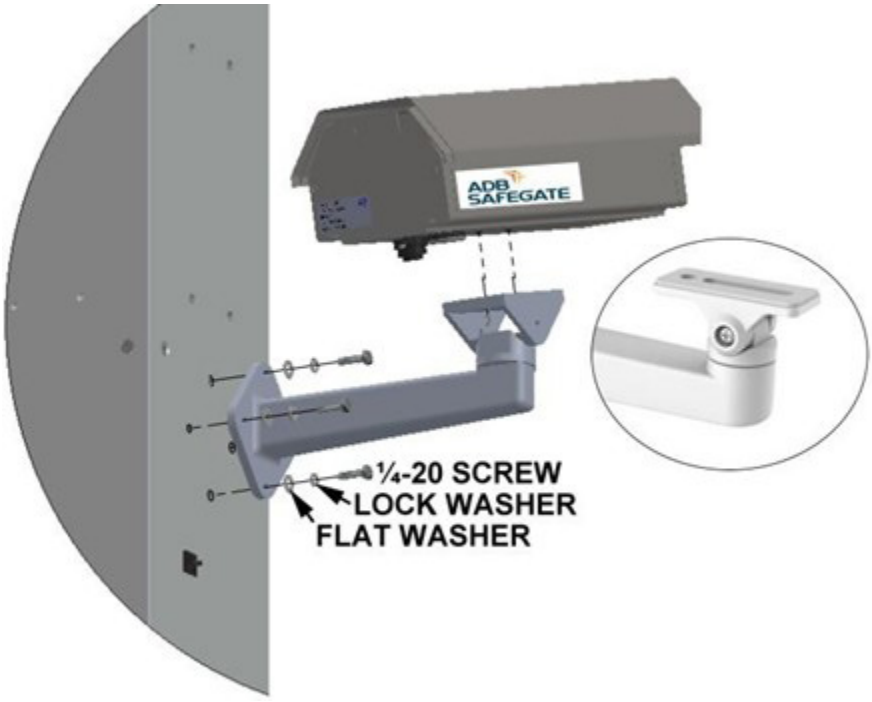


Figure 2. Install Model 5000 Background Luminance Sensor

2. Slide the Model 5000 Background Luminance Sensor onto the slot in the mounting arm and secure it with the bolt provided with the mounting arm.

3. Plug the M493202-00 cable into the connector of the Model 5000 Background Luminance Sensor and route the cable down the Transmitter pole to the Control Box using cable tie mounts and cable ties every 18 cm (7"). Secure the cable to the mounting arm with a 25 cm (10") cable tie.

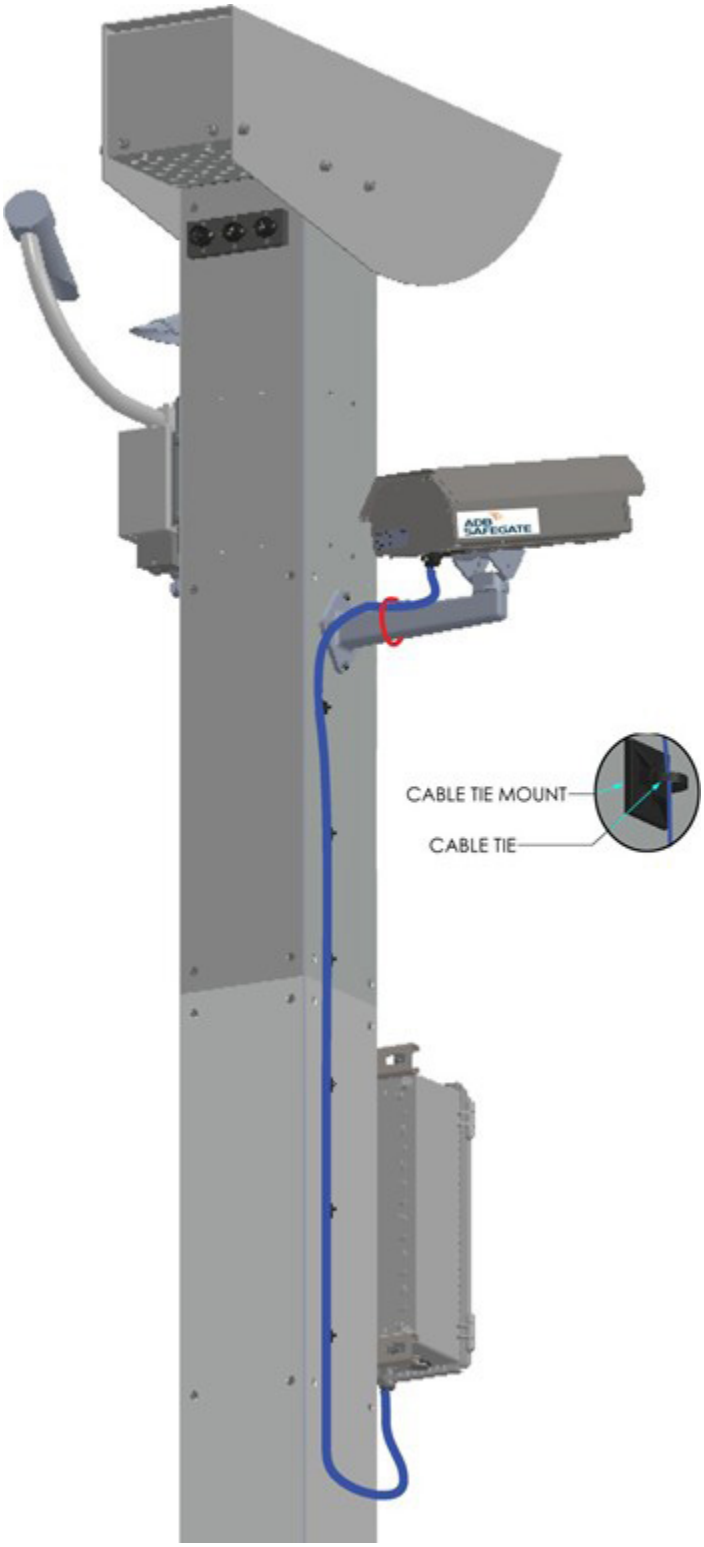


Figure 3. Connect M493202-00 Cable and Secure to Pole

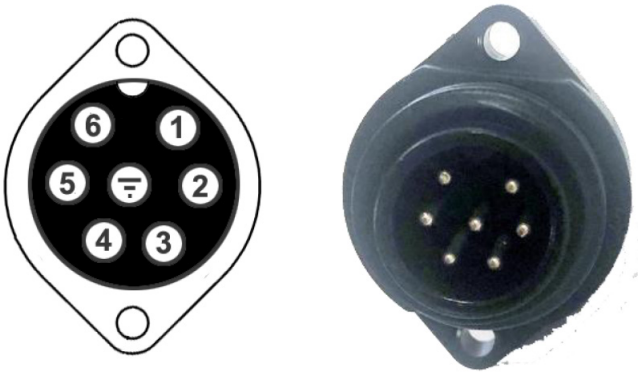
3.2.2 Other Poles

Contact ADB Safegate for other mounting options.

3.3 Power And Signal Connections

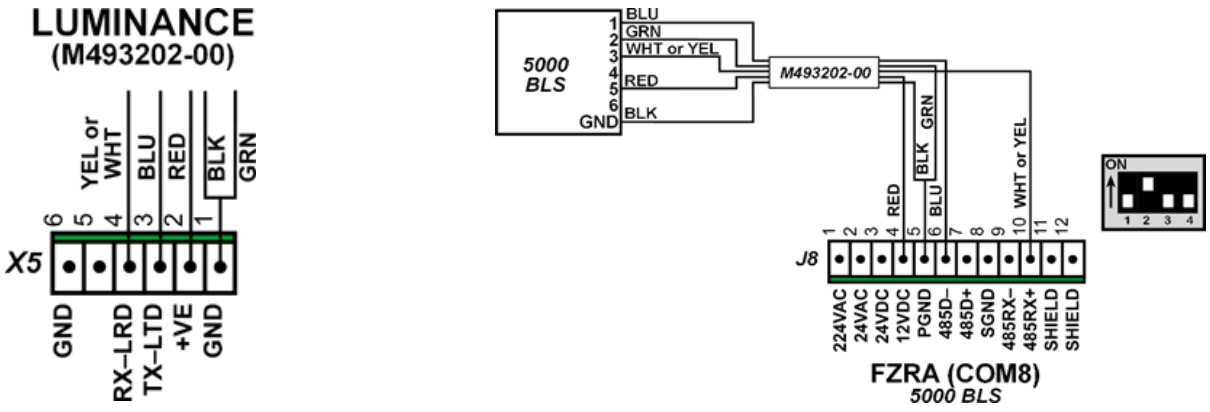
There is one connector on the enclosure for power and data.

3.3.1 Connector Pinout



Power/Data	Pin	Wire Color
232 RX	1	BLU
VIN RTN	2	GRN
232 TX	3	WHT or YEL
	4	
VIN/HEAT+	5	RED
	6	
VIN RTN	GND	BLK

The ADB Safegate M493202-00 cable is used to connect the Model 5000 Background Luminance Sensor to a terminal block connector in the Model 8400-eMOR Transmissometer Transmitter Control Enclosure or to the Model 1192 Data Collection Platform. The cable has a Hirschmann CA 6 LD connector to connect it to the connector on the Model 5000 Background Luminance Sensor and bare wires at the other end.



8400-eMOR **1192 Data Collection Platform**

Figure 4. Wiring Diagram for 8400-eMOR Transmissometer and Model 1192 DCP

It is recommended that ferrules be used for wires connected to a terminal block connector.

4. Commands

4.1 Connection Setup

The Model 5000 Background Luminance Sensor may be accessed in one of two ways to exchange troubleshooting or setup commands.

- Via the DB9 connector on the Signal Processor Board. Use a DB9 to USB cable to connect a laptop to the DB9 connector on the Signal Processor Board.

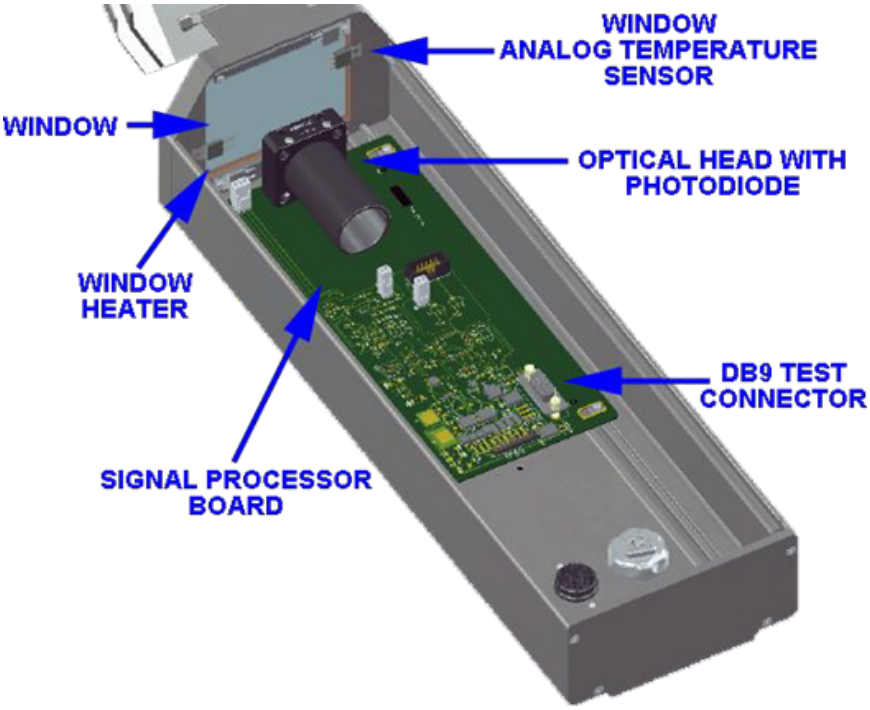


Figure 5. DB9 connector on the Signal Processor Board

- While using the Model 5000 Background Luminance Sensor with the Model 8400-eMOR Transmissometer.

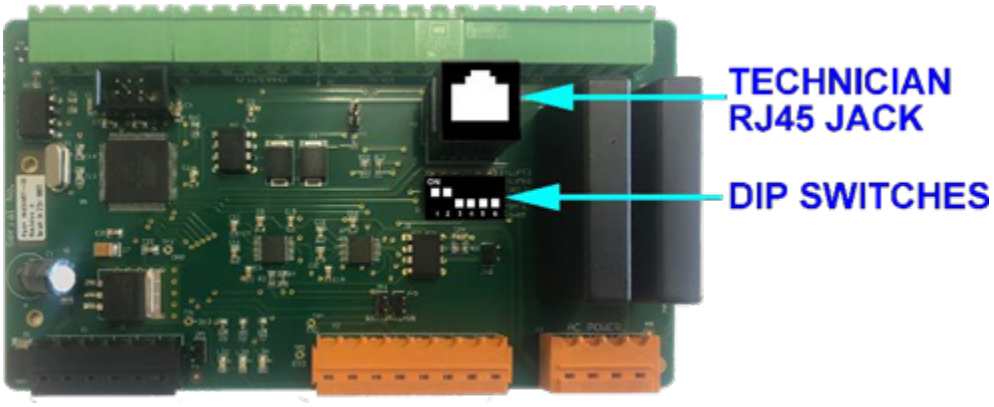


Figure 6. Technician Jack and DIP Switches (Main Control Board)

1. Set the DIP switches as shown in Figure 6 to access the Model 5000 Background Luminance Sensor.
2. Connect the RJ45 plug on the M493205-00 Technician Adapter cable to the technician jack on the Main Control Board.
3. Connect the DB9 connector on a USB to serial converter to the DB9 connector on the other side of access the M493205-00 Technician Adapter cable.
4. Connect the USB connector on the USB to serial converter to a USB port on your computer.

Follow these steps to set up the connection.

1. Identify the COM port related to the USB cable connection on the computer. To identify the COM port related to a USB cable in a computer running Windows, open the Device Manager located in the Control Panel. Go to the Ports (COM & LPT) area and expand the tree. Unplug the USB cable, wait for 30 seconds or so, and then plug the USB cable back in. A communications port will appear in the device manager when the USB cable is connected. This is the communications port directly related to the USB cable.
2. Open a terminal emulation utility such as PuTTy and select the serial COM port related to the USB cable.
3. Set up the terminal emulation utility serial port as follows.

   Baud Rate: 9600

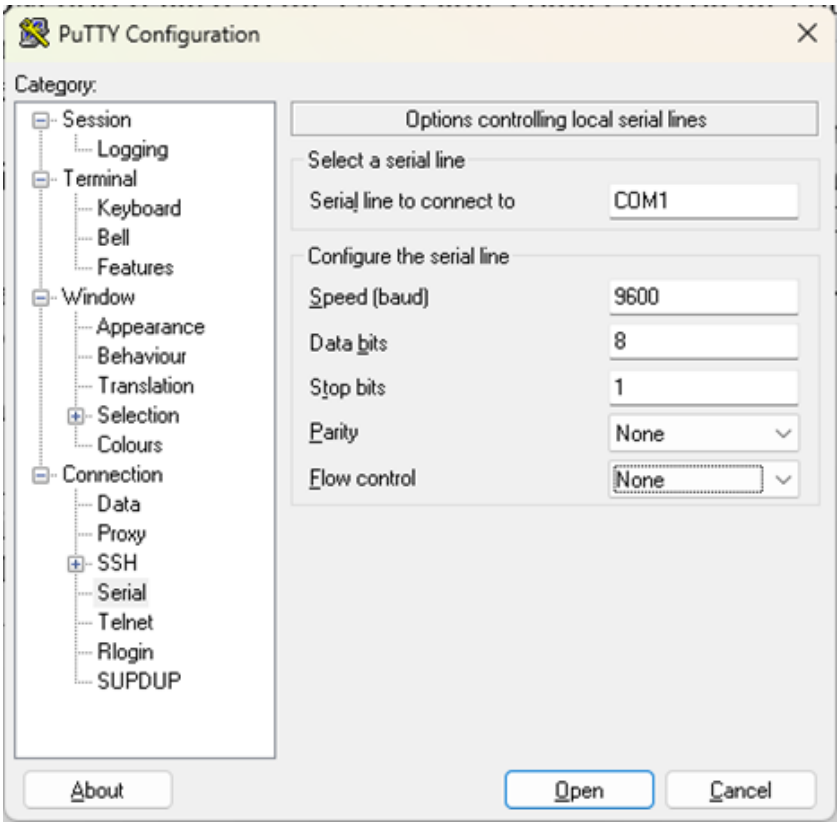
   Data Bits: 8

   Parity: None

   Stop Bits: 1

   Flow Control: None
4. Click OK.

A communication session with the 5000 sensor has now been established.



4.2 Command Listing

Command	Description
$RESET	Resets the sensor.
?CONFIG	Returns current configuration
$AV=	Sets averaging interval in seconds
$LOFFS=	Sets the offset current in raw DAC counts.
$CALINx=	Sets calibration input x (x = 0–4)
$CALOUTx=	Sets calibration output x (x = 0–4)
?CALINx=	Returns calibration input x (x = 0–4)
?CALOUTx=	Returns calibration output x (x = 0–4)
$DEFAULTS	Sets all parameters to their default values (not recommended)
?HEAT	Prints out temperatures and heater status
?TINT	Prints out window heater temperature in 0.1°C

These commands are useful for troubleshooting; the remaining commands are normally used at the factory to calibrate the sensor.

$RESET

?CONFIG

?CALINx=

?CALOUTx=

?HEAT

?TINT

5. Maintenance

5.1 Monthly Maintenance

1. Clean optical window glass.

Cleaning may have to be done more frequently, depending on the atmospheric conditions at the site.

5.2 Triannual Maintenance

1. Verify the daytime reading against a field luminance sensor.
2. The output should be less than or equal to 3 cd/m^2 at night.

5.3 Annual Maintenance

No additional procedures.

6. Troubleshooting

Standard electronics tools such as a multimeter and screwdriver are needed.

6.1 Luminance Readings

Check the luminance reading.

- If the nighttime luminance is above 5 cd/ m^2, replace the sensor.
- Luminance readings are greater than 1000 cd/ m^2 during the day, and may exceed 30,000 cd/ m^2 when brightly sunlit clouds are present. Replace the sensor if the daytime reading is outside this range.

6.2 Failures

General test procedures involve checking communications links, starting at the end of the cable and terminating with the serial output of the sensor.

If physical damage is found, or the basic checks in this chapter fail, return the sensor to ADB Safegate for testing or replacement.

7. Specifications

Parameter	Specification
Field of View	12°
Measurement Range	0 to 45,000 cd/m²
Spectral Response	400 nm – 700 nm (within 3% of CIE Photopic response) matches human eye approximately
Accuracy	±0.2 cd/m² < 2 cd/m², ±10% > 2 cd/m²
Resolution	1.0 cd/m²
Peak Wavelength	550 nm
Serial Port Settings	
Standards	RS-232 (no CTS/RTS)
Baud Rate	9600 bps, 8-N-1
Power Requirements	
Supply Voltage	12 – 14.7 VDC
Power Consumption	100 mA
Window Heater	10 mW
Environmental	
Operating Temperature	-40 to +60ºC (-40 to +145ºF)
Storage Temperature	-50 to +85ºC (-58 to +145ºF)
Relative Humidity	5–100%, noncondensing
Mechanical	
Enclosure	NEMA 4X, IP67
Mounting	Pole or Universal Bracket
Dimensions	45.5 cm × 16.9 cm × 11 cm (17.97" L × 6.7" W × 4.3" H)
Weight	2.5 kg (5 lb)
Shipping Weight	4.0 kg (9 lb)
Operational	
ICAO Compliance	ICAO Doc 9328 para 9.15

8. Wiring Diagram

REVISIONS				DWG NO. M403624-00-019
REV	ECO	DESCRIPTION	DATE	APPROVED
A	5775	INITIAL RELEASE	6-23-2025	BRG

M403624-00
BACKGROUND LUMINANCE SENSOR ASSY

M404955-00
LUMINANCE SENSOR PCB

OPTICS ASSY

PHOTODIODE

W1

BLK — X1 pin 1
BLK — X1 pin 2
X1 pin 1 — 3V3REF

M463280-00

OPTICS TEMP SENSOR

+VS 1
GND 2
OUT 3

W4

BRN — X9 pin 1 — +5V
RED — X9 pin 2 — SENSOR TEMP
ORG — X9 pin 3 — GND
YEL — X9 pin 4 — GND
GRN — X9 pin 5
BLU — X9 pin 6
VIO — X9 pin 7
GRY — X9 pin 8
WHT — X9 pin 9 — HEAT+
BLK — X9 pin 10 — HEAT+

M468355-00

OPTICS HEATER

M477442-00

WINDOW HEATER

M477442-00

W3

BLK — X5 pin 1 — HEAT+
BLK — X5 pin 2

WINDOW TEMP SENSOR

+VS 1
GND 2
OUT 3

M468355-00

W2

BLK — U20 pin 1 — +5V
BLK — U20 pin 2 — BODYTEMP
BLK — U20 pin 3 — 0VA

X2

VIN 1
VIN RTN 2
D+ 3
D− 4
232RX 5
232TX 6
7
HEAT+ 8
9
10

W5

RED — X2 pin 1 — VIN
BLK — X2 pin 2 — VIN RTN
BLU — X2 pin 5 — 232RX
WHT — X2 pin 6 — 232TX
RED — X2 pin 8 — HEAT+

BLU — 6 PIN MALE CIRCULAR CONNECTOR pin 1
BLK — pin 2
WHT — pin 3
RED — pin 4
RED — pin 5
BLK — pin 6 — GND

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
XX=±.010 ANGLES ±1/2°
XXX=±.005 FRACTIONS=±.02
DO NOT SCALE DRAWING

MATL: SEE BILL OF MATERIALS
FINISH: N/A
TREATMENT:

DRAWN BY: B. GALARPE	6-23-2025	
REVISED BY:		
CHECKED BY:		
DESIGN ENGINEER: A. HUSTEAD	6-23-2025	
PROJECT MANAGER:		
APPROVALS	DATE	

TITLE: WIRING DIAGRAM, BACKGROUND LUMINANCE SENSOR, 8400-eMOR-120/240

ADB SAFEGATE

SIZE D | DWG NO. M403624-00-019

SCALE NONE | RELEASE DATE 6-23-2025 | SHEET 1 OF 1

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