

Measuring lightcurtain in robust aluminium housing

F3EM

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The F3EM provides easy to install and set up height and profile measurement. The analog output provides a simple overall height detection and the serial output models provide single beam evaluation for profile measurements.

- Robust aluminium housing
- Analog output for simple height detections
- Serial output with single beam evaluation for profile measurement



Ordering Information

Sensor type	Measurement range (Max _M)	Pitch ¹	Sensing distance	Channels	Connection method				Order code	
									Analog output	RS232 output ²
 Through-beam (measuring)	150	5 mm	3 m	30	—	5 pin	—	—	F3EM-005-150-AV	F3EM-005-150-D2
		18 mm	15 m	8	—		—	—	F3EM-018-150-AV	F3EM-018-150-D2
	300	5 mm	3 m	60	—		—	—	F3EM-005-300-AV	F3EM-005-300-D2
		18 mm	15 m	16	—		—	—	F3EM-018-300-AV	F3EM-018-300-D2
	600	5 mm	3 m	120	—		—	—	F3EM-005-600-AV	F3EM-005-600-D2
		18 mm	15 m	32	—		—	—	F3EM-018-600-AV	F3EM-018-600-D2
	900	5 mm	3 m	180	—		—	—	F3EM-005-900-AV	F3EM-005-900-D2
		18 mm	15 m	48	—		—	—	F3EM-018-900-AV	F3EM-018-900-D2
	2000	5 mm	3 m	400	—		—	—	—	F3EM-005-2000-D2
	2100	18 mm	15 m	112	—		—	—	F3EM-018-2100-AV	F3EM-018-2100-D2

¹ Models with 7.5 mm pitch are available. Contact your OMRON representative.

² Models with RS485 serial output are available. Contact your OMRON representative.

Lightcurtain accessories

Shape	Type	Comment	Order Code
	Laser alignment kit	snap-on Laser beam generator and level	F39-TGR-LLK2-SB
	Protective tube	for F3ET-_-150	F3ET-IP150
		for F3ET-_-300	F3ET-IP300
		for F3ET-_-600	F3ET-IP600
		for F3ET-_-900	F3ET-IP900

Rating/Specifications

Item	Through-beam	
	F3EM-005_	F3EM-018_
Sensing distance	0 to 3 m	0 to 15 m
Vertical measurement range	0 to Max _M mm; Max _M : 150, 300, 600, 900, 2000 ¹	0 to Max _M mm; Max _M : 150, 300, 600, 900, 2100 ²
Minimum detectable object size	10 mm	30 mm
Pitch	5 mm	18 mm
Control output	Analog models	0-10 VDC, max. load current 30 mA
	Serial models	RS 232
Response time	Analog output: 5 ms + 0,18 x channels; Serial output: 4.5 ms + 0.38 x channels at 4800 bps	
Light source (wave length)	Infrared LED (950 nm)	
Power supply voltage	24 VDC ±10%	
Ambient temperature	0 to 50°C	
Degree of protection	IEC 60529 IP65	
Dimensions (see also page 4)	35 x 45 x (55 + 1.06 x Max _M) mm	35 x 45 x (55 + 0.98 x Max _M) mm
Material	Case	Aluminium
	Cover	Polycarbonate

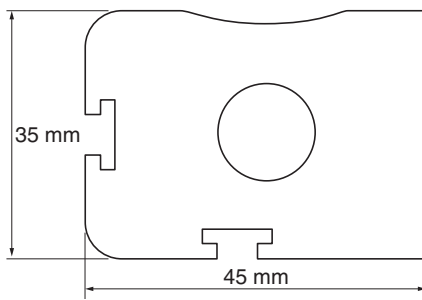
¹ Models with different measurement ranges between 150 mm and 2000 mm are available in 50 mm intervals. Please note that measurement ranges between 1000 mm and 2000 mm are only available for serial output models.

² Models with different measurement ranges between 150 mm and 2100 mm are available in 150 mm intervals.

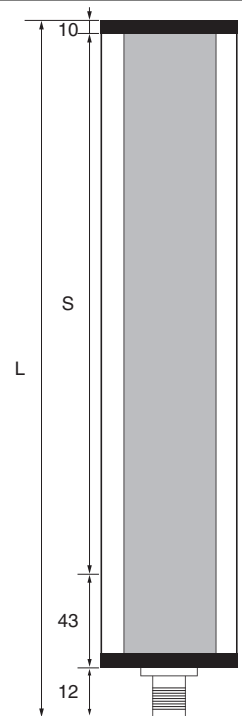
Output circuits

Type	Output circuit
Receiver analog output	<p>Connector pin arrangement</p>
Receiver serial output	<p>Connector pin arrangement</p>
Emitter	<p>Connector pin arrangement</p> <p>Note: Terminal 2, 4 and 5 are not used</p>

Dimensions



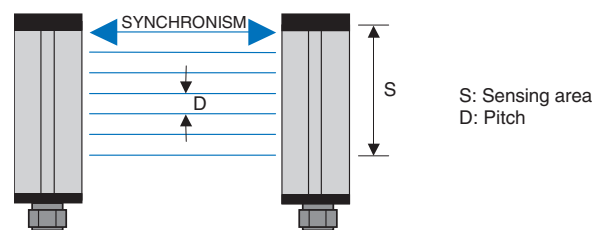
Item number	Sensing area S (mm)	Total length L (mm)
F3EM-005-150-__	159	225
F3EM-018-150-__	147	213
F3EM-005-300-__	318	384
F3EM-018-300-__	294	360
F3EM-005-600-__	636	702
F3EM-018-600-__	588	654
F3EM-005-900-__	954	1020
F3EM-018-900-__	882	948
F3EM-005-2000-D2	2120	2186
F3EM-018-2100-__	2058	2124



Operation

The F3EM measuring lightcurtain features optical synchronization. This function is provided by the upper beam located on the opposite side of the connector (see illustration below). During operation this beam must always be kept free. Otherwise it will result a loss of synchronism between the transmitter and receiver.

For applications where all beams are interrupted there are special models with synchronization by wire. Please contact your OMRON representative.



Indicator LEDs

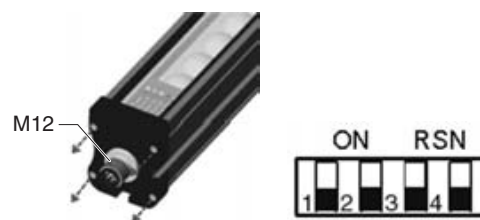
For functions of indicator LEDs please refer to the tables below:

	Name of indicator	Colour
	Power	Green
	Run ok	Yellow
	Out on	Green
	Out off	Red
Near/Far	Yellow	

	Name of indicator	Colour
	Power	Green
Status ok	Yellow	

Selector switches (dip switches)

Operation mode, distance setting (analog models) and transmission speed (serial models) can be changed by selector switches. To access selector switches unscrew the end cap of the receiver unit:



Note: Selector setting must only be carried out when the receiver is not connected to the power supply.

Analog Output Models (F3EM-_-AV)

DIP Switch Settings

If F3EM is operated in a distance < 1m, the sensitivity can be set to NEAR operation. This could be necessary, if multiple light curtains are installed close to each other, or if the light curtain detects semi-transparent objects.

The analog output can operate either in STANDARD mode or INVERTED mode:

- STANDARD mode: 0 V (if no beams is interrupted) to 10 V (if all beams are interrupted)
- INVERTED mode: 10 V (if no beams is interrupted) to 0 V (if all beams are interrupted)

Please find the DIP switch setting below:

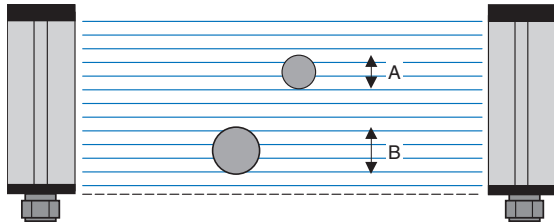
Switch			
1	2	3	4
not used	not used	Distance setting (NEAR position recommended if distance is <1 m)	
		ON	NEAR
		OFF	FAR (default)
		ON	DECREASING
		OFF	INCREASING (default)

Analog output value

The output value is related linear to the number of beams interrupted by the object to be measured. For STANDARD mode:

$$\text{Output voltage} = (10 / n^\circ \text{ of optical units}) * n^\circ \text{ of interrupted beams [VDC]}$$

If multiple objects are inside the sensing area, the system will read the total number of beams interrupted accordingly. Referring to the illustration below, the F3EM provides an output signal in proportion with the sum of A+B:



Serial Output Models - RS232 (F3EM-_-D2)

The RS232 serial interface of F3EM is specified as follows:

- Full duplex operation
- Data format: 8-N-1 (bit start - 8-bit data - 1-bit stop - no parity)

Transmission speed setting (Baud Rate)

The baud rate can be set by DIP switch 1 and 2.



The baud rate must be set both on the receiver bar dip-switches as well as the transmitter bar dip-switches to align the timing synchronism of the two bars.

DIP Switch 1	DIP Switch 2	Baud Rate (bps)
OFF	OFF	4800
OFF (default)	ON (default)	9600 (default)
ON	OFF	19200
ON	ON	38400

Communication protocol

The communication of serial interface provides two possible operation modes:

- Command-response
- Triggered by external input

A) In command-response mode the command is 1 byte:

Command (hexadecimal) = 'BF'

The light curtain responds with a fixed number of bytes depending on the number of light beams.

E.g. the response of a light curtain with 20 beams is 3 bytes:

1 st byte	8	7	6	5	4	3	2	1
2 nd byte	16	15	14	13	12	11	10	9
3 rd byte	0	0	0	0	20	19	18	17

The response bytes are composed by each bit representing the status of each beam in the order as in the example above. Remaining unused bits in the last byte are set to zero.

Each bit signals:

- 0 = BEAM NOT INTERRUPTED
- 1 = BEAM INTERRUPTED

This drawing shows how the beams are numbered on the light curtain



As a result each response byte contains 8 beams. The following formula applies for the calculation if the number of response bytes:

$$\text{number of bytes} = \text{INT} (\text{number of optical units} + 7) / 8$$

The maximum number of optical beams that can be managed is 400.

B) Trigger by external input

Alternatively the response can be forced by signal on the STROBE input (PNP logic); the light curtain responds on the serial line with the same protocol explained above.

Measurement method

In order to avoid missing information the light curtain stores interruption of beam signals until the status is sent in the next protocol response. After the response is sent the interruption status is reset (all bits to zero).

The beams are scanned sequentially. Therefore it can occur that a command or trigger arrives before the scan is completed. In this case the scan is interrupted and the status of the scan before is transferred in the response protocol.

Mounting

Mechanical attachment and alignment

Standard Mounting Bracket (provided with the sensor)

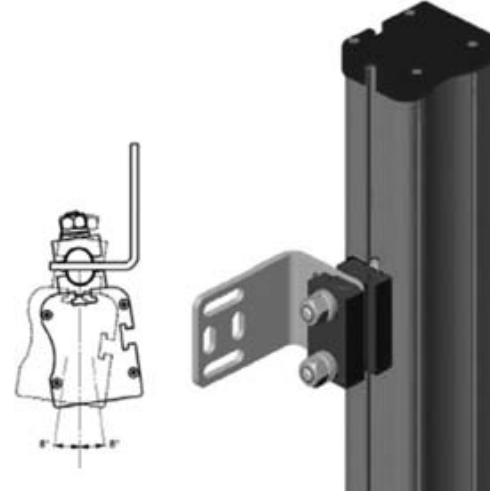
When the mounting bracket is attached to the surface, the mounting screws can be inserted into the mounting rail of the light curtain. This allows a vertical position adjustment.



Adjustable Mounting Bracket

Order separately under: F39-TGR-ST-ADJ

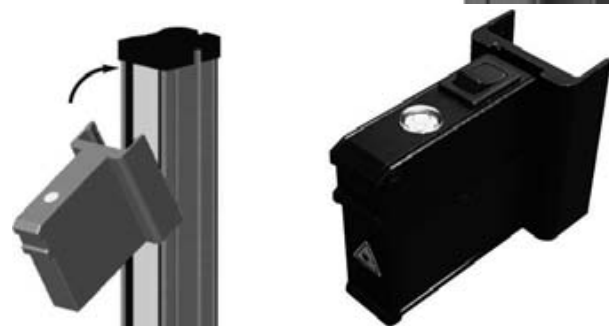
For adjustment of the optical axis angle, the adjustable mounting bracket allows a turning of the light curtain.



Laser Alignment




Order separately under: F39-TGR-LLK2-SB

The laser alignment kit can be snapped onto the light curtain and emits a high visibility laser beam for ensuring the optimal optical axis angle adjustment.



Cable connectors

For pin arrangement and connecting the wires refer to Output Circuits.

Size	Shape	Type	Features	Material		Order code	
				Nut	Cable		
M12		General purpose (screw)	5 wire	Brass (CuZn)	PVC 2M	XS2F-M12PVC5S2M	XS2F-M12PVC5A2M
					PUR 2M	XS2F-M12PUR5S2M	XS2F-M12PUR5A2M

Precautions

⚠ WARNING

The F3EM multi-beam photoelectric sensor with beam evaluation function is not a safety component for ensuring the safety of people which is defined in EC directive (2006/42/EC) or by any other regulations or standards.

Power Supply Voltage and Output Load Power Supply Voltage

Do not connect an AC power supply to the Sensor. If AC power (100 VAC or more) is supplied to the Sensor, it may explode or burn. Make sure that the power supply to the Sensor is within the rated voltage range. If a voltage exceeding the rated voltage range is supplied to the Sensor, it may explode or burn.

Operating Environment

Do not use the sensor in locations with explosive or flammable gas. Make sure that the product is operated in accordance with IP65 standards.

Do not subject the sensor to excessive shock when mounting. When you use the sensor in the vicinity of an inverter motor, be sure to connect the protective earth ground wire of the motor to earth. Failure to ground the motor may result in malfunction of the sensor.

Mounting the Sensor

Do not strike the sensor with a hammer or any other tool during the installation of the Sensor.

Cleaning

Never use paint thinners or other organic solvents to clean the surface of the product

M12 Connector

Always turn OFF the power supply to the sensor before connecting or disconnecting the metal connector. Hold the connector cover to connect or disconnect it.

Secure the connector cover by hand. Do not use pliers; otherwise the connector may be damaged.

If the connector is not connected securely, it may be disconnected by vibration or the proper degree of protection of the sensor may not be maintained.

Cat. No. E62E-EN-01A

In the interest of product improvement, specifications are subject to change without notice.

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