F3EM2

Measuring Light Curtain

OPERATION MANUAL

OMRON

$C\epsilon$

Precautions

WARNING

The F3EM2 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.

GENERAL INFORMATION

The instructions in this manual must be followed in order to safeguard correct installation. The barrier does not contain any parts that are subject to maintenance; do not remove any electronic parts from the housing for any reason. In case of malfunction, please contact your sales representative with a description of the failure found and its period of operation. Do not touch the front protective cover with your hands as dust and/or grease may decrease performance.

OPERATING ENVIRONMENT

Do not use the light curtain in locations with explosive or flammable gas. Make sure that the product is operated in accordance with IP65 standards. Do not subject the light curtain to excessive shock when mounting. When using the light curtain 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 light curtain. Further it is recommended to use shielded cables and to connect the shield to the ground in such cases.

CLEANING

When cleaning the front covers please do not use woollen cloths or organic solvents. The interval between cleaning depends on conditions in the environment (dust, fog).

POWER SUPPLY VOLTAGE AND OUTPUT LOAD

Do not connect an AC power supply to the Sensor. If AC power (100 VAC or more) is supplied to the Sensor, it may be permanently damaged. 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 it may be permanently damaged.

Table Of Contents

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Overview

1-1   Applications

F3EM2 is a multi-beam measuring light curtain designed for easy height and profile measurement for various applications. Programming via dip switches makes it easy to set up F3EM2 everywhere without external controller or Remote PC. Due to its robust housing F3EM2 is also suitable for hash environments in industry.
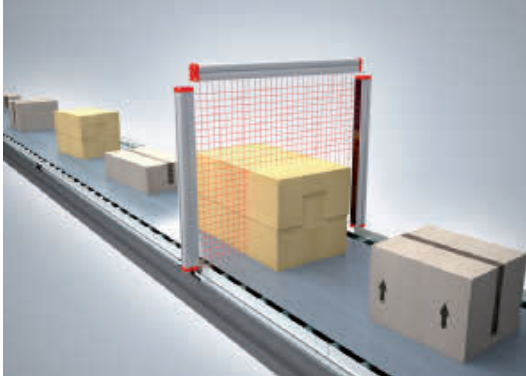
Volume measurement

Position control
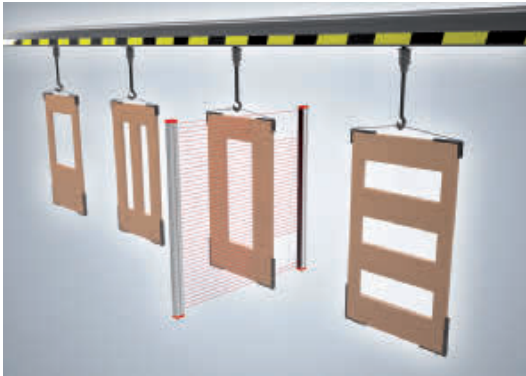
Profile scan
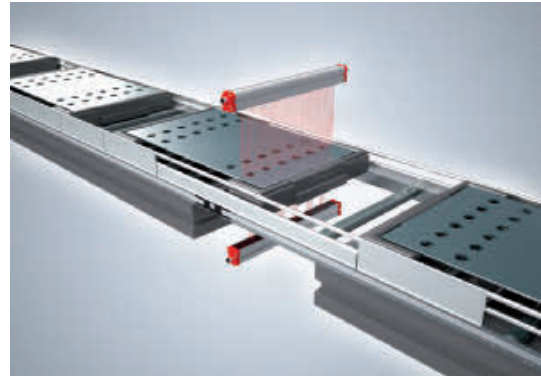
Hole detection
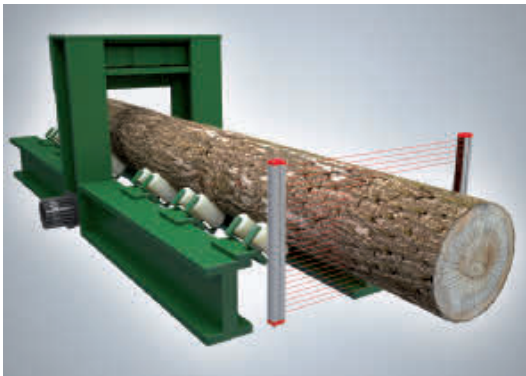
Wood industry

1-2 Model line up

F3EM2 is provided with 3 output versions:

* Analogue 0-10 V
* RS-232C + analogue 0-10 V
* RS485 + analogue 0-10 V (on request)

F3EM2 is available in two resolutions:

Model	Sensing distance	Pitch resolution	Min. detectable object
F3EM2-005-[…]	0 to 3 m	5 mm	10 mm
F3EM2-018-[…]	0 to 15 m	18 mm	30 mm

Models with 7.5mm resolution are available upon request.

Due to its modular design F3EM2 can be provided in various sizes. For standard sizes please refer to model list in chapter 6.

1

Overview

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Installation

2-1   General

The light curtain consists of one bar with light emitting optical elements and of one with receiving optical elements. The photosensitive elements are scanned in sequence, thus broken rays are detected.

F3EM2 features optical synchronisation and does not require synchronization wire between transmitter and receiver. The sync-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.

X: measuring direction

L: Maximum measurement area
D: System resolution
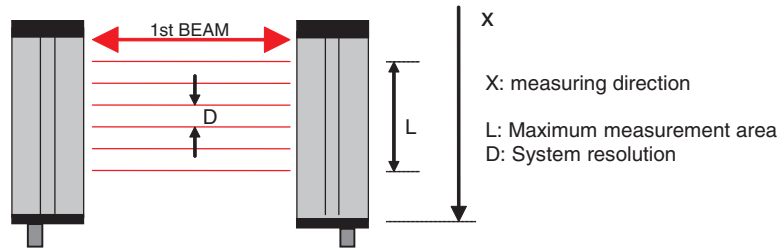
For applications where also the upper beam is needed for measurement synchronization by wire can be activated (see '4-1 DIP switch setting' on page 4-2). In this case transmitter and receiver must be connected by a sync-wire (see '2-5 Wiring & output circuit' on page 2-5).

X: measuring direction

L: Maximum measurement area
D: System resolution
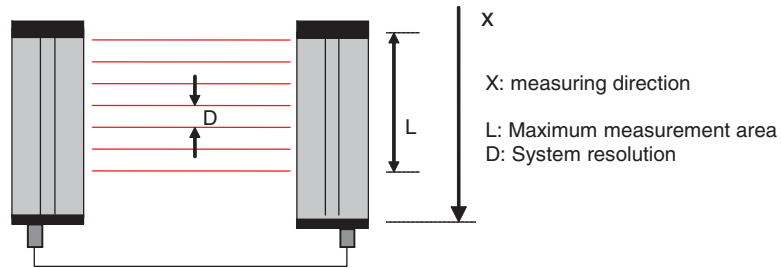
2-2   Mechanical installation

Mounting accessories

The F3EM2 system is mechanically installed by using the T-slots on the two sides or the back-side of the housing.
Use the movable bolts, washers, growers and nuts to fix the mounting brackets as shown in the picture

ID	Description
1	movable M6 bolt
2	fixing braket
3	M6 washer
4	M6 Grower
5	M6 nut
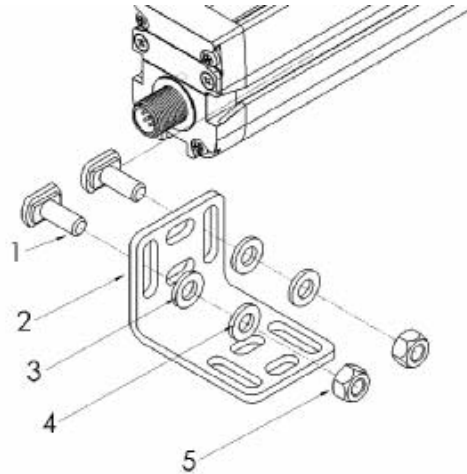
Note: Shipment contains different quantity of brackets, depending on the length of the SLC. Longer SLC contains a higher number of brackets, following the rule of every 400 mm one bracket.

Additional mounting rigidity

It is recommended that the distance between the mounting brackets is 400 mm or less for optimum performance of the F3EM2 system.
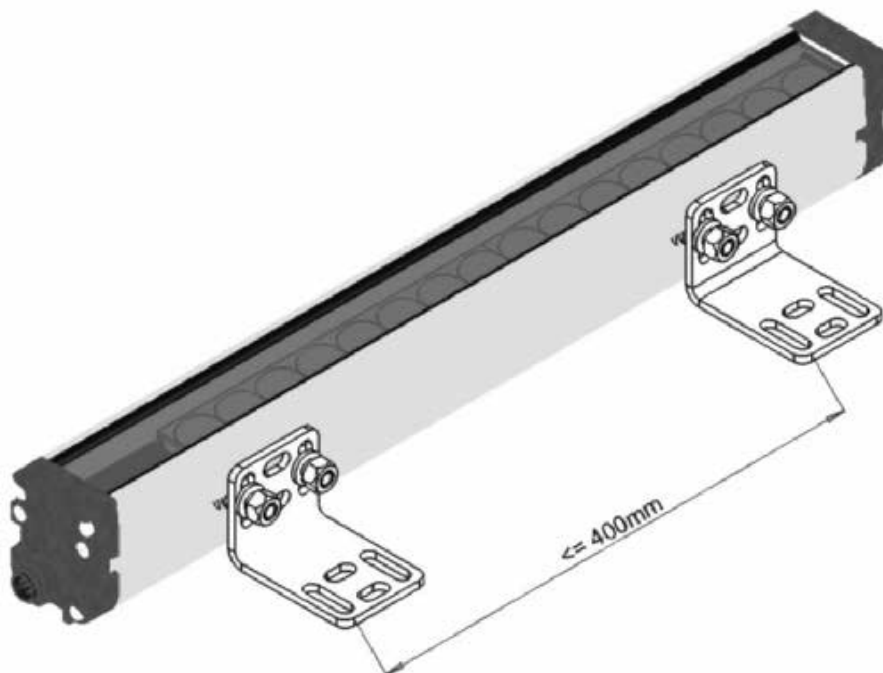
Mechanical Mounting

Please mount the light curtains in proper alignment as shown in the pictures below by using the brackets provided with the light curtains.

OK   NG   NG
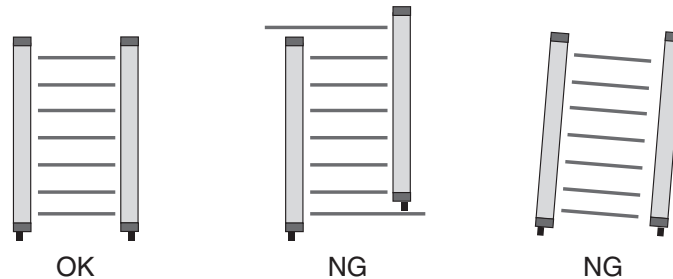
For serial output models the STROBE input can be used for easier alignment. Please follow this procedure:
- Turn on the light curtain with the STROBE input connected to +24 VDC
- Move the light curtain to reach the alignment using the led indication on receiver (see led table 5-1)
- Turn off the light curtain and remove the +24 VDC strobe input connection

If F3EM2 is installed at long distances the laser alignment aid F39-TGR-LLK2-CL provides a visible laser spot for simplified installation.
If several light curtains are installed close to each other, interference of the light curtains must be avoided. In this case the assembly should be carried out as follows:


TX   RX   RX   TX
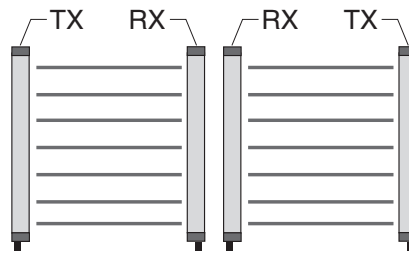
2-3   Operating environment

The area for the installation of the light curtain must be suitable according to the technical specifications. The temperature of the environment, interference caused by electromagnetic disturbance and ambient light must be considered. Please contact the manufacturer for any information not contained in this manual.

2-4   Operating distances

The operating distances, which are given in the technical specifications, are guaranteed values for reliable operation. Operating F3EM above the specified sensing distance may cause greater sensitivity to vibration and possible electro magnetic disturbances.

If the F3EM2 is operated in a distance <1m, the sensitivity can be set to NEAR operation by dip-switch setting at transmitter (see '4-1 DIP switch setting' on page 4-2).
This should be considered for following application conditions:
   a) Multiple light curtains are installed close to each other (avoiding mutual interference)
   b) Detection of small or semi-transparent objects
If none of above mentioned cases applies, FAR setting should be kept in order to provide maximum detection reliability.

2-5 Wiring & output circuit

The F3EM2 can be operated with analogue output or serial output. Please connect the light curtain as described below:

2-5-1 Analogue models
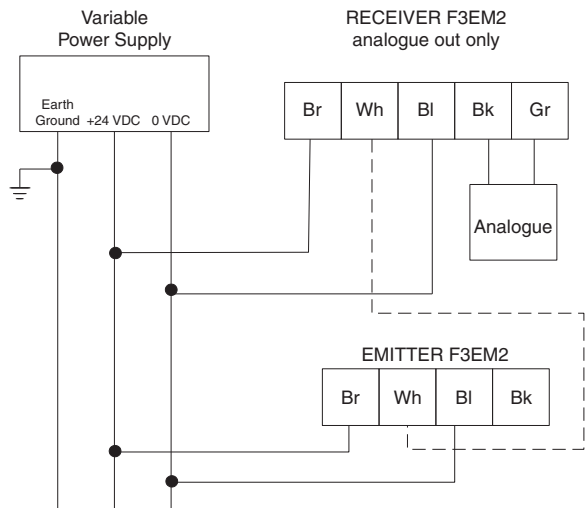
Connector PIN assignment - Receiver

Type	Internal wiring	Pin	Colour	Signal name
M12 n5 pole		1	Brown	+Vs
		2	White	Wire sync
		3	Blue	0V
		4	Black	Analogue +
		5	Gray	Analogue reference

Connector PIN assignment - Transmitter

Type	Internal wiring	Pin	Colour	Signal name
M12 n4 pole		1	Brown	+Vs
		2	White	Wire sync
		3	Blue	0V
		4	Black	Not used

For synchronization by wire please connect white wires of transmitter and receiver.

Note: Provide shielded cable when extension of the standard cable is required.

2-5-2 Models with serial & analogue output
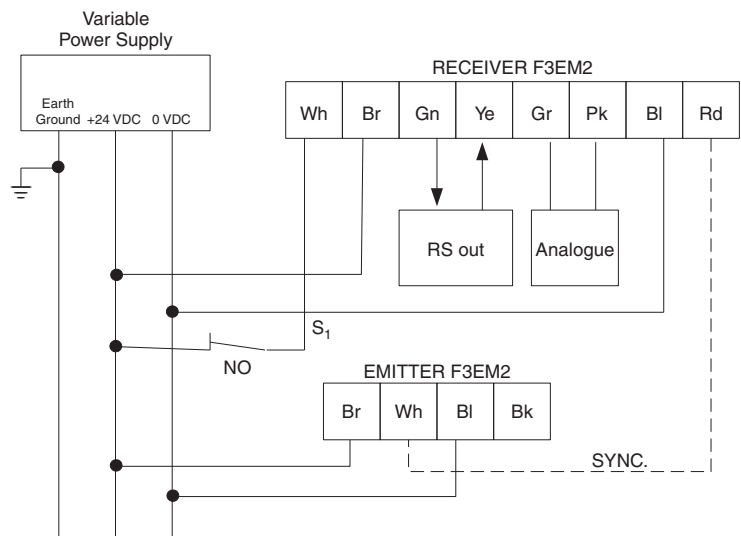
Connector PIN assignment - receiver

Type	Internal wiring	Pin	Colour	Signal name
M12 n8 pole		1	White	Strobe input/alignment (normally open)
		2	Brown	+Vs
		3	Green	RS+ or RS TX
		4	Yellow	RS- or RS RX
		5	Gray	Analogue +
		6	Pink	Analogue reference
		7	Blue	0V
		8	Red	Wire synch

Connector PIN assignment - transmitter

Type	Internal wiring	Pin	Colour	Signal name
M12 n4 pole		1	Brown	+Vs
		2	White	Wire sync
		3	Blue	0V
		4	Black	Not used

For synchronization by wire please connect the red wire of receiver with white wire of transmitter.

🔊 Safety Points

We recommend protecting the control unit with an external fuse, whose rated breaking current must be 1A, even if the appliance is provided with its own internal, self-resetting fuse.

2-5-2-1 Wiring for RS232

Please use a cross serial line cable to connect the F3EM2 to a computer or PLC.

RS232 Pin assignment

RS232 Pin assignment	Signal	F3EM2 cable assignment
Pin 2	RX	Green (Pin 3)
Pin 3	TX	Yellow (Pin 4)
Pin 4	GND	Blue (Pin 7)
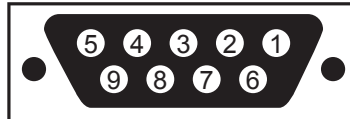
DB9: View looking into female connector

Note: This is a typical RS232 interface: if the host provide different kind of connection, take it in account.

Maximum cable length for RS232 connection

Data rate (bps)	Distance
9600	15 m
19200	7.5 m
38400	3.5 m
76800	2 m

It is recommended using shielded cables.

2-5-2-2 Wiring for RS485

Please use a cross serial line cable to connect the F3EM2 to a computer or PLC.

RS485 Pin assignment

RS485 Pin assignment	Signal	F3EM2 cable assignment
Pin 2	RS+	Green (Pin 3)
Pin 3	RS-	Yellow (Pin 4)
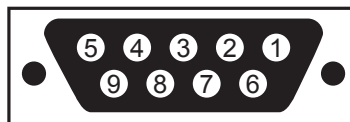
DB9: View looking into female connector

It is recommended using shielded cables.

2-6 Setting the internal selector-switches

 Precautions for Correct Use

All the operations listed below must only be carried out when the receiver is disconnected to the power supply.

Settings like operation mode, baud rate and distance can be changed by selector switches.
To access the selector switches unscrew the end cap of the receiver and transmitter unit:
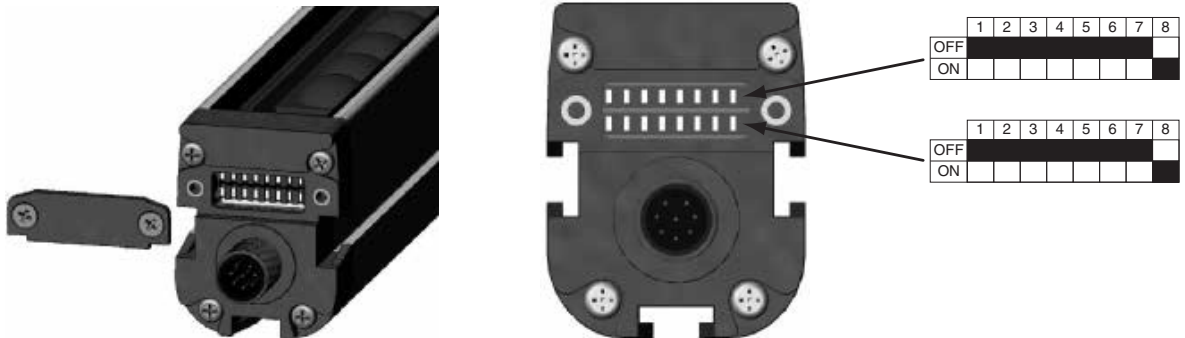
There are two lines of dip switches in each transmitter and receiver. The settings must be done for both lines. Change the setting of the dip-switch and close the cap again. The light curtain can now be reconnected to the power supply.
The functions of dip-switches are explained in chapter 4-1 'DIP switch setting' on page 4-2.

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Operation - General aspects and definitions

F3EM2 is not a safety device. The usage of F3EM2 as Safety protection equipment is dangerous and prohibited and expose personnel to serious injury.

⬙ Safety Points

F3EM2 is not a safety device. The usage of F3EM2 as Safety protection equipment is dangerous and prohibited and expose personnel to serious injury.

The light curtain consists of an array of beams that can be obscured by an object between transmitter and receiver. The status of each beam (open or blocked) is controlled every scan cycle and the output reflects the current status accordingly. Thus size and position of objects can be detected.

Different output modes are available to adapt F3EM2 operation to the given application and to simplify installation into the machine.

3-1   Beam order

Beams are numbered in the way as shown in the picture; starting from beam 1 opposite to connector to the last beam at the connector side of the light curtain.

Beam status in the protocol is defined as follows:

Beam open = 0
Beam blocked = 1

**Operation - General aspects and**

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3-2 Output modes

The F3EM2 light curtain can provide various output modes and combination of these to describe the position and the size of an object:

FBB (First Beam Blocked)	First beam in chain obscured by object
FBM (First Beam Made)	First beam in chain that is open
NBB (Number of Beams Blocked)	Total number of blocked beams - no holes included
NAB (Number of Area Blocked)	Number of beams from 1st blocked to last blocked beam (including holes)
LBB (Last Beam Blocked)	Last blocked beam in the chain
LBM (Last Beam Made)	Last open beam in the chain
Bitmap	The status of each beam (serial models)

Example:
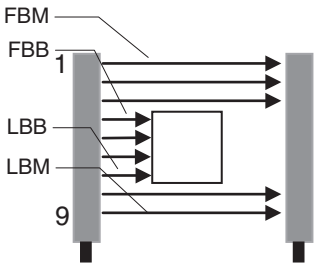
In serial operation F3EM2 can transmit status of each single beam or a combination of two output values. See 3 examples how this is reflected for each function:

Examples:
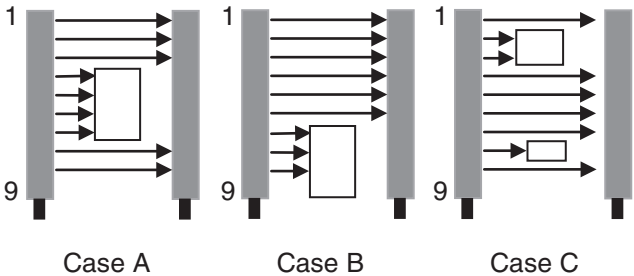
Function	Case A	Case B	Case C
	Output values	Output values	Output values
Bitmap	F3EM2 provides the status of each single beam	F3EM2 provides the status of each single beam	F3EM2 provides the status of each single beam
FBB + NBB	4 and 4	7 and 3	2 and 3
FBM + NAB	1 and 4	1 and 3	1 and 7
LBB + NBB	7 and 4	9 and 3	8 and 3
LBM + NAB	9 and 4	6 and 3	9 and 7

Specification and settings of each function and the serial protocol configuration are described in chapter 5 'Operating serial output models (RS-232C)' on page 5-1.

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Operation - General aspects and defi-

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Operation - Analog models

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4-1 DIP switch setting

Transmitter:

Dip-SW	Status		Function
1	OFF		Optical Sync (default)
	ON		Wire sync
2			Not used
	3	**4**	**Output signal**
	OFF	OFF	NAB (default)
3 + 4	OFF	ON	LBB
	ON	OFF	NBB
	ON	ON	FBB
5	OFF		FAR (default)
	ON		NEAR
6			Not used
7			Not used
8			Not used

Receiver:

Dip-SW	Status		Function
1	OFF		Optical Synch (default)
	ON		Wire synch
2	OFF		0 to 10V (default)
	ON		10 to 0V
	3	**4**	**Output signal**
	OFF	OFF	NAB (default)
3 + 4	OFF	ON	LBB
	ON	OFF	NBB
	ON	ON	FBB
5			Not USED
6			Not USED
7			Not USED
8			Not USED

There are two lines of dip switches in each transmitter and receiver. The settings must be done for both lines.

4-2   Analog output value

The output value has linear relationship to the number of interrupted beams (NBB or NBM setting) or to the position index of beam (FBB or LBB).

Example for NAB setting:

$$\text{Output voltage} = \frac{(\text{total No}° \text{ of beams blocked}) \times 10}{\text{Total numbers of beams}}\text{VDC}$$

Example for FBB setting:

$$\text{Output voltage} = \frac{(\text{index No}° \text{ of first beam blocked}) \times 10}{\text{Total numbers of beams}}\text{VDC}$$

The analogue output is refreshed every scanning cycle.

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Operation - Analog models

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Operating serial output models (RS-232C)

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The RS-232C 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)
- The signal on analogue output is calculated as shown in chapter 4-2 'Analog output value' on page 4-3

Note: For a real time refreshing of analog output, please use an AV model.

Note: The analog output value of F3EM2 with serial communication, is refreshed only upon interrogation code request.It can't be used independently from the serial interface.

5-1 DIP switch setting - Overview

Dip switch setting transmitter:

Dip-SW	Status		Function	
1	OFF		Optical Synch (default)	
	ON		Wire synch	
2+3	**RS baud rate**			
	2	**3**	**Speed**	
	OFF	OFF	9600bps (default)	
	OFF	ON	19200bps	
	ON	OFF	38400bps	
	ON	ON	76800bps	
4			Not used	
5	OFF		FAR (default)	
	ON		NEAR	
6+7+8	**Output function**			
	6	**7**	**8**	**Serial output**	**Analogue output**
	OFF	OFF	OFF	Bitmap of optics (default)	NAB (default)
	OFF	OFF	ON	FBB + NBB (4 byte total)	NAB
	OFF	ON	OFF	FBM + NAB (4 byte total)	LBB
	OFF	ON	ON	LBB + NBB (4 byte total)	NBB
	ON	OFF	OFF	LBM + NAB (4 byte total)	FBB
	ON	OFF	ON	Continuous bitmap transmission	disabled
	ON	ON	OFF	FBB + LBB (4 byte total)	NBB
	ON	ON	ON	Holes detection	disabled

5   **Operating serial output models**

Dip-switch setting receiver:

Dip-SW	Status		Function	
1	OFF		Optical Synch (default)	
	ON		Wire synch	
2+3	**RS baud rate for serial operation**			
	2	**3**	**Speed**	
	OFF	OFF	9600bps (default)	
	OFF	ON	19200bps	
	ON	OFF	38400bps	
	ON	ON	76800bps	
4+5	**Interrogation byte for serial operation**			
	4	**5**	**Hexadecimal code / binary code**	**Analogue output**
	OFF	OFF	FAh 11111010 (default)	0-10V (default)
	OFF	ON	FBh / 11111011	0-10V
	ON	OFF	FCh / 11111100	10-0V
	ON	ON	FDh /11111101	10-0V

Dip-SW	Output function				
	6	**7**	**8**	**Serial output**	**Analogue output**
6+7+8	OFF	OFF	OFF	Bitmap of optics (default)	NAB (default)
	OFF	OFF	ON	FBB + NBB (4 byte total)	NAB
	OFF	ON	OFF	FBM + NAB (4 byte total)	LBB
	OFF	ON	ON	LBB + NBB (4 byte total)	NBB
	ON	OFF	OFF	LBM + NAB (4 byte total)	FBB
	ON	OFF	ON	Continuous bitmap transmission	disabled
	ON	ON	OFF	FBB + LBB (4 byte total)	NBB
	ON	ON	ON	Holes detection	disabled

There are two lines of dip switches in each transmitter and receiver. The settings must be done for both lines.

Note: The analog output value is not always available (please see dip switch setting) and it is refreshed only when an interrogation code is received by the F3EM2.

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Operating serial output models (RS-

5-2 Transmission speed (baud rate)

The baud rate can be set by DIP switch 2 and 3.

RS baud rate		
2	3	Speed
OFF	OFF	9600bps (default)
OFF	ON	19200bps
ON	OFF	38400bps
ON	ON	76800bps

Precautions for Correct Use

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.

# 5-3 Beam aquisition and data aquisition

In order to understand the functions of F3EM2 and to choose the right operation mode it is important to differentiate:

Beam acquisition = Conditions of beams checked at one scanning cycle of the light curtain.

Data acquisition = Sum of beam acquisitions gathered in the time frame between 2 external interrogations.

The light curtain saves the beam acquisition made at each scanning cycle and executes a logical "OR" between the status of new acquired beams and the previous one.
See an example of a data acquisition resulting from two beam acquisitions:

Previous beam acq.
Last beam acq.

Data ready to be sent
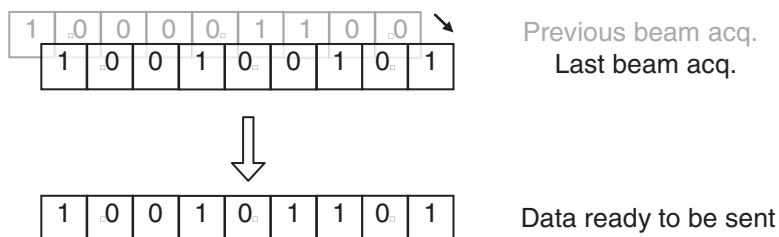
Triggered by an interrogation code the light curtain sends the acquired data and cleans the beam status memory again.

In practice this process enables for example the measuring of the maximum height of an irregular shaped object that is moving through the light curtain. Thus only the relevant information is transmitted.

Because the beams are scanned sequentially 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.

Note:F3EM2 also provides continuous bitmap transmission. In this mode the light curtain continuously sends each beam acquisition to the host / PLC. In this case however the host has to process a much higher amount of data.

5-4 Communication protocol for serial output

The communication of the serial interface provides various possible operation modes depending the dip-switch setting. All of them respect the following timeline:

Host sends interrogation code

↓

F3EM2 reply with acquired data & cleans the data memory.

↓

F3EM2 starts again with data acquisition & waits for next interrogation code

The interrogation codes can be set by dip switches 4+5 (see chapter 5-1 on page 5-2).

Note:After power-on F3EM2 starts automatically with data acquisition (without interrogation code).

The communication can also be forced by signal on the STROBE input (PNP logic); the light curtain responds on the serial line with the desired data.

Note: This STROBE line can be used also as a check for the correctness of the serial wiring and/or communication protocol.

The different operation modes are described below.

Bitmap of optics

Dip switch setting:

6	7	8	Type of function
OFF	OFF	OFF	Bitmap of optics (default)

The light curtain responds with a serial of bytes. The quantity of bytes depends on the total number of beams.
Each beam status is reflected by one bit. The beam index numbers are addressed to bits as shown in the example below. Remaining unused bits in the last byte are set to zero.

E.g. the response of a light curtain with 20 beams is 3 bytes.
The numbers in the table reflect the beam index No:

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

The beam with index 1 starts opposite from the connector.

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 by serial interface is 400.

Bit signal vs. beam status is:

0 = BEAM NOT INTERUPTED
1 = BEAM INTERRUPTED

FBB + NBB

Dip switch setting:

6	7	8	Type of function
OFF	OFF	ON	FBB + NBB

The reply received from the light curtain is composed of 4 bytes.

The first two bytes are related to FBB data
The second two bytes are related to NBB.

FBB data is the binary conversion of the FBB id number.
NBB data is the binary conversion of the NBB number.

Example of the response protocol of a light curtain with 9 beams and FBB + NBB settings:

FBB = 4, NBB = 4 (HEX FORMAT)

1st byte H FBB	0	0	0	0	0	0	0	0
2nd byte L FBB	0	0	0	0	0	1	0	0
3rd byte H NBB	0	0	0	0	0	0	0	0
4th byte L NBB	0	0	0	0	0	1	0	0

H = high order byte
L = low order byte

FBM + NAB

Dip switch setting:

6	7	8	Type of function
OFF	ON	OFF	FBM + NAB

The reply received from the light curtain is composed of 4 bytes.

The first two bytes are related to FBM data
The second two bytes are related to NAB.

FBM data is the binary conversion of the FBM id number.
NAB data is the binary conversion of the NAB number.

The order of bytes in the protocol is same as example described for FBB + NBB setting.

LBB + NBB

Dip switch setting:

6	7	8	Type of function
OFF	ON	ON	LBB + NBB

The reply received from the light curtain is composed of 4 bytes.

The first two bytes are related to LBB data
The second two bytes are related to NBB.

LBB data is the binary conversion of the LBB id number.
NBB data is the binary conversion of the NBB number.

The order of bytes in the protocol is same as example described for FBB + NBB setting.

LBM + NBM

Dip switch setting:

6	7	8	Type of function
ON	OFF	OFF	LBM + NAB

The reply received from the light curtain is composed of 4 bytes.

The first two bytes are related to LBM data
The second two bytes are related to NAB.

LBM data is the binary conversion of the LBM id number.
NAB data is the binary conversion of the NAB number.

The order of bytes in the protocol is same as example described for FBB + NBB setting.

Continues bitmap transmission

Dip switch setting:

6	7	8	Type of function
ON	ON	OFF	Bitmap + Analogue out (FBB)

This setting allows the light curtain to transmit the bitmap of optics every cycle time.

The interrogation code is used as a start and stop trigger.
After power-on the LC waits for the interrogation code to start transmitting.
When interrogation code was received the LC continuously sends out the updated bitmap of optics every cycle time. When the light curtain receives a further interrogation code it stops transmitting and waits for the next interrogation code to start again the transmission.

The order of bitmaps is described in 'Bitmap of optics' on page 5-5.

Bitmap + Analogue out (FBB)

Dip switch setting:

6	7	8	Type of function
ON	OFF	ON	Continuous bitmap transmission

In this set-up the light curtain drives together the Serial and the analogue output.

Note: Transmit data start only after interrogation code reception and stop after another interrogation code reception. The serial output, on the contrary, transmit its data only after interrogation code receipt.

The order of bitmaps is described in 'Bitmap of optics' on page 5-5.

Holes detection function

Dip switch setting:

6	7	8	Type of function
ON	ON	ON	Holes detection

This function transmits the bitmap of beams with inverted bit signals.

The default setting
"0 = beam free and 1 = beam broken"
is converted into
"0 = beam occupied and 1= beam free".

Thus without object the bitmap of all optics will show "1", if the light curtain is aligned correctly.

Acquired data reflects the sum of beam acquisitions and is sent on interrogation code as described in 5-3 'Beam aquisition and data aquisition' on page 5-4.

The order of bitmaps is described in 'Bitmap of optics' on page 5-5.

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Order codes

Order code		Measurement range	Pitch[1]	Sensing distance	Channels
RS232C Serial/ analogue output models[2]	Analogue models				
F3EM2-005-150	F3EM2-005-150-AV	150	5 mm	3 m	30
F3EM2-018-150	F3EM2-018-150-AV		18 mm	15 m	8
F3EM2-005-300	F3EM2-005-300-AV	300	5 mm	3 m	60
F3EM2-018-300	F3EM2-018-300-AV		18 mm	15 m	16
F3EM2-005-450	F3EM2-005-450-AV	450	5 mm	3 m	90
F3EM2-018-450	F3EM2-018-450-AV		18 mm	15 m	24
F3EM2-005-600	F3EM2-005-600-AV	600	5 mm	3 m	120
F3EM2-018-600	F3EM2-018-600-AV		18 mm	15 m	32
F3EM2-005-900	F3EM2-005-900-AV	900	5 mm	3 m	180
F3EM2-018-900	F3EM2-018-900-AV		18 mm	15 m	48
F3EM2-005-1200	F3EM2-005-1200-AV	1200	5 mm	3 m	240
F3EM2-018-1200	F3EM2-018-1200-AV		18 mm	15 m	64
F3EM2-005-1500	F3EM2-005-1500-AV	1500	5 mm	3 m	300
F3EM2-018-1500	F3EM2-018-1500-AV		18 mm	15 m	80
F3EM2-005-1800	F3EM2-005-1800-AV	1800	5 mm	3 m	360
F3EM2-018-1800	F3EM2-018-1800-AV		18 mm	15 m	96
F3EM2-018-2100	F3EM2-018-2100-AV	2100	18 mm	15 m	112

*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.

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Order codes

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Technical specifications

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7-1   Ratings

Models	F3EM2-005-…	F3EM2-018-…
Operating distance	3 m	15 m
Light source (wave length)	Infrared (880 nm)	
Pitch	5.3 mm	18.3 mm
Max. number of beams	400 max on serial output	
Operation temperature	−10° to +55°C	
Storage temperature	−10° to +75°C	
Degree of protection	IP65 (IEC 60529)	
Operating voltage	24 VDC ±20%	
Current consumption	150 mA max (excluded load on digital)	
Power-on delay	<1 s	
Response time	4 ms + 80 µs x number of beams (+ transmitting time for serial operation*1)	
Outputs	RS-232C / RS485 / Analogue 0-10 V (12 bits)	
External input	Strobe input	
Protective circuits	Reverse polarity protection, output short-circuit protection	
Max. load on analog output	15 mA	
Insulation resistance	>20 MΩ	
Dielectric voltage strength	350 VAC (1 min)	
Configuration	By dip-switches	
Operating modes	Analogue output 0-10 V or 10-0 V Serial output: RS-232C (RS485 on request)	
Housing material	Aluminum	
Front Window Material	Acrylic Lexan	
End Cap and Connector	ABS	
Sealing Gasket Material	EPDM	

*1) Serial transmission time = 1/bps x 10 x number of transmitted byte

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Technical specifications

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LED indicators and error indication

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Meaning of symbols

SYMBOL	MEANING
	Diagnosis LED off
	Diagnosis LED on
	Diagnosis LED blinking

8-1 LED indication on receiver unit

Status of Receiver is displayed by 5 LEDs:

Disposition of indicator	Name of indicator	Colour
POWER RUN FREE BREAK STATUS RX	POWER	Green
	RUN	Yellow
	FREE	Green
	BREAK	Red
	STATUS	Yellow

Normal operation indication on receiver:

LED signal pattern	Description
	No object in field. Running ok
	No object in field. Transmitting data
	Object in field. Running ok
	Object in field. Transmitting data
	Correct alignment reached

LED error indication on receiver:

ID	LED signal pattern	Description
1		Low supply voltage
2		Error on microcontroller
3		Error on optical system
4		Wrong dip switch configuration

LED indicators and error indication

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8-2   LED indication on emitter unit

Status of Emitter is displayed by 4 LEDs:

Disposition of indicator	Name of indicator	Colour
POWER STATUS 1 RANGE STATUS 2 TX	POWER	Green
	STATUS 1	Yellow
	RANGE	Green
	Not used	Red
	STATUS 2	Yellow

Normal operation indication on emitter:

LED signal pattern	Description
	Emitter working, short range selected
	Emitter working, long range selected

LED error indication on emitter:

ID	LED signal pattern	Description
1		Low supply voltage
2		Error on microcontroller
3		Error on optical system
4		Wrong dip switch configuration

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LED indicators and error indication

8-3   Troubleshooting for error indication

| ID	Actions
1	Check if power supply is within specification of 24Vdc ± 20%
2	Turn the unit ON and OFF again. If the error persist, please contact manufacturer
3	Turn the unit ON and OFF again. If the error persist, please contact manufacturer
4	Check the setting of switches

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Dimensions

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L: Total length
E: Detection zone
A: Dead zone without detection capability
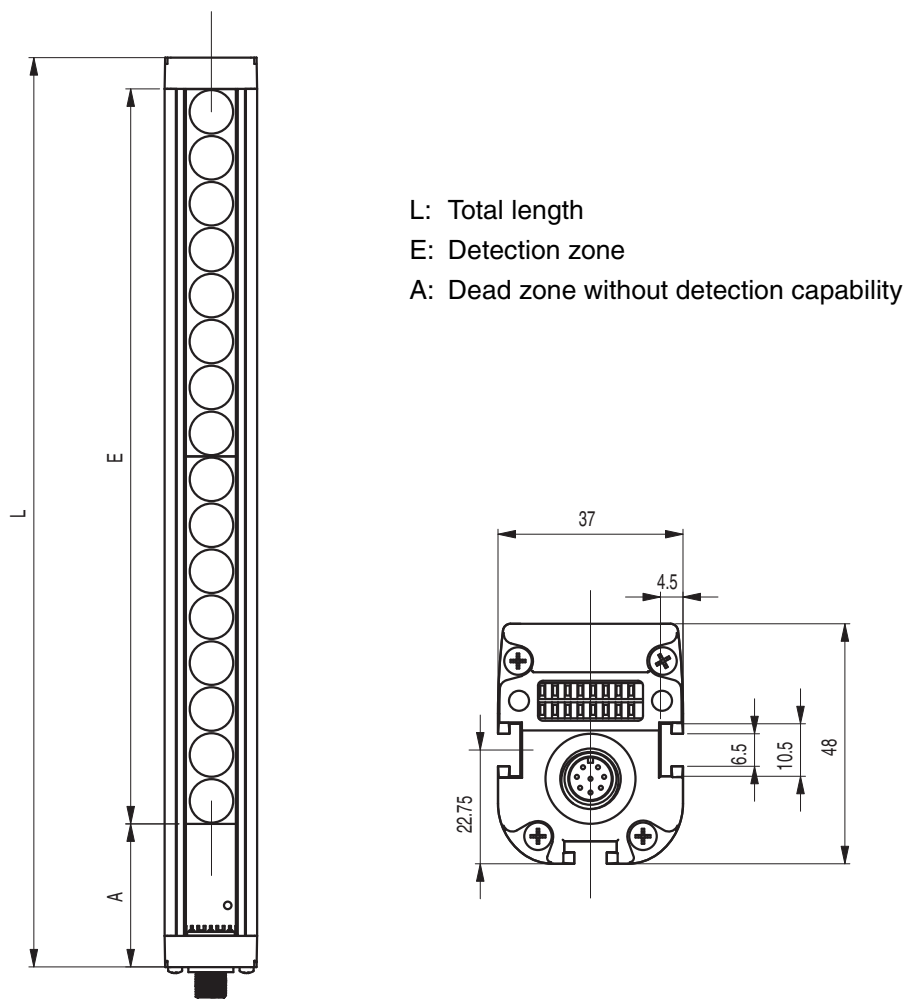
All dimensions shown are in mm

Item number	Detection Zone E (mm)	Total length L (mm)
F3EM2-005-150(-AV)	159	231.4
F3EM2-018-150(-AV)	147	218.7
F3EM2-005-300(-AV)	318	390.4
F3EM2-018-300(-AV)	294	364.7
F3EM2-005-450(-AV)	477	549.4
F3EM2-018-450(-AV)	441	511.7
F3EM2-005-600(-AV)	636	708.4
F3EM2-018-600(-AV)	588	658.7
F3EM2-005-900(-AV)	954	1026.4
F3EM2-018-900(-AV)	882	952.7
F3EM2-005-1200(-AV)	1272	1344.4
F3EM2-018-1200(-AV)	1176	1246.7
F3EM2-005-1500(-AV)	1470	1662.4
F3EM2-018-1500(-AV)	1470	1540.7
F3EM2-005-1800(-AV)	1908	1980.4
F3EM2-018-1800(-AV)	1764	1834.7
F3EM2-018-2100(-AV)	2058	2128.7

Dimensions

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Accessories

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10-1 Mounting bracket

(provided with the product)
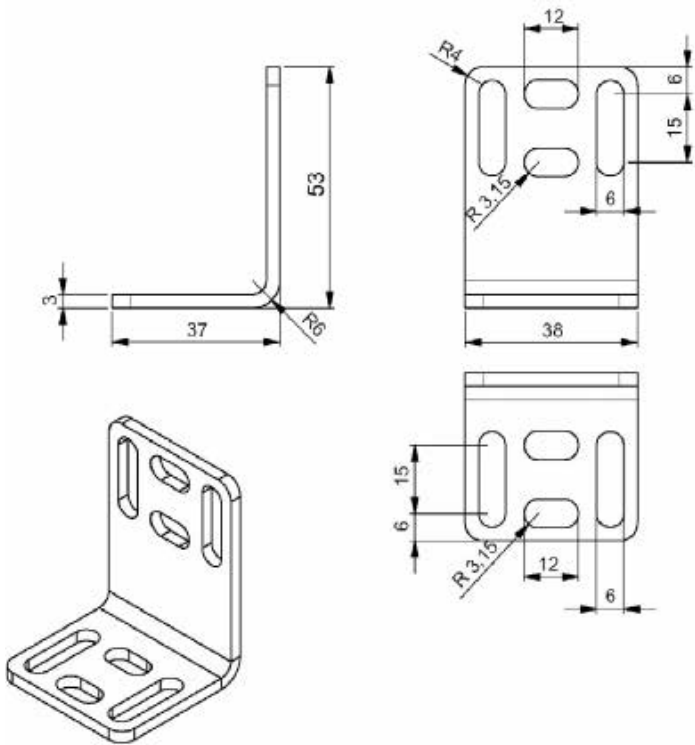
10-2 Cables

	Order Code	Length
M12-8pin (straight, shielded)	Y92E-M12PURSH8S2M-L	2 m
	Y92E-M12PURSH8S5M-L	5 m
M12-5pin (straight)	XS2F-M12PVC5S2M	2 m
	XS2F-M12PVC5S5M	5 m
M12-5pin (angled)	XS2F-M12PVC5A2M	2 m
	XS2F-M12PVC5A5M	5 m

For other accessories like alignment kit, special brackets or connector cables please contact your sales representative.

Manual Revision History

The manual revision symbol is an alphabet appended at the end of the manual number found in the bottom left-hand corner of the front or back cover.

Example

Man.No. **E77E-EN-01**

Revision symbol

Revision symbol	Revision date	Description of revision and revised page
01	January 2012	First Print.
02	November 2014	- Update RS232/RS485 connection - Update CAD data
03	January 2015	- Update RS232 (Note) - Update 5-4 - Bitmap + Analogue out (FBB)

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