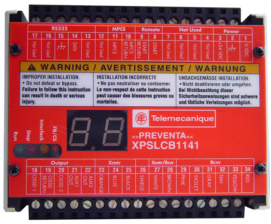
XUS-LM

Safety light curtain type 4
Barrière immatérielle de sécurité type 4
Unfallschutz-Lichtvorhang Type 4
Barrera inmaterial de seguridad tipo 4
Barriera immateriale di sicurezza tipo 4
Barreira immaterial de segurança tipo 4

User's manual
Manuel d'instructions
Bedienungsanleitung
Instrucciones de servicio
Istruzioni d'uso
Manual do utilizador



English
Français
Deutsch
Español
Italiano
Português

a brand of Schneider Electric

Telemecanique

XUS-LM

Safety light curtain type 4

English

User's manual

a brand of Schneider Electric

Telemecanique

HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label on the product indicates that an electrical hazard exists which will result in personal injury or death if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result** in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result** in death, serious injury, or equipment damage.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result** in minor or moderate injury, or equipment damage.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result** in equipment damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

CONTENTS

English

English

English

English

SECTION 1: QUICK START INSTRUCTIONS

This section has been prepared to help you get your XUS-LM Safety Light Curtain into service quickly. It is not intended as a substitute for the User's Manual and does not cover installation of accessories such as shock mount kits or mirrors. Please consult the appropriate sections of this manual for complete information when installing, wiring, and programming the light curtain and accessories.

The steps covered in Section 1 are:

1. Configuring the DIP Switches
2. Mounting and Wiring the Light Curtain System
3. Start Up
4. Checking the LEDs
5. Aligning the Transmitter and Receiver
6. Programming ECS/Blanking (Optional)
7. Troubleshooting

English

Parts List

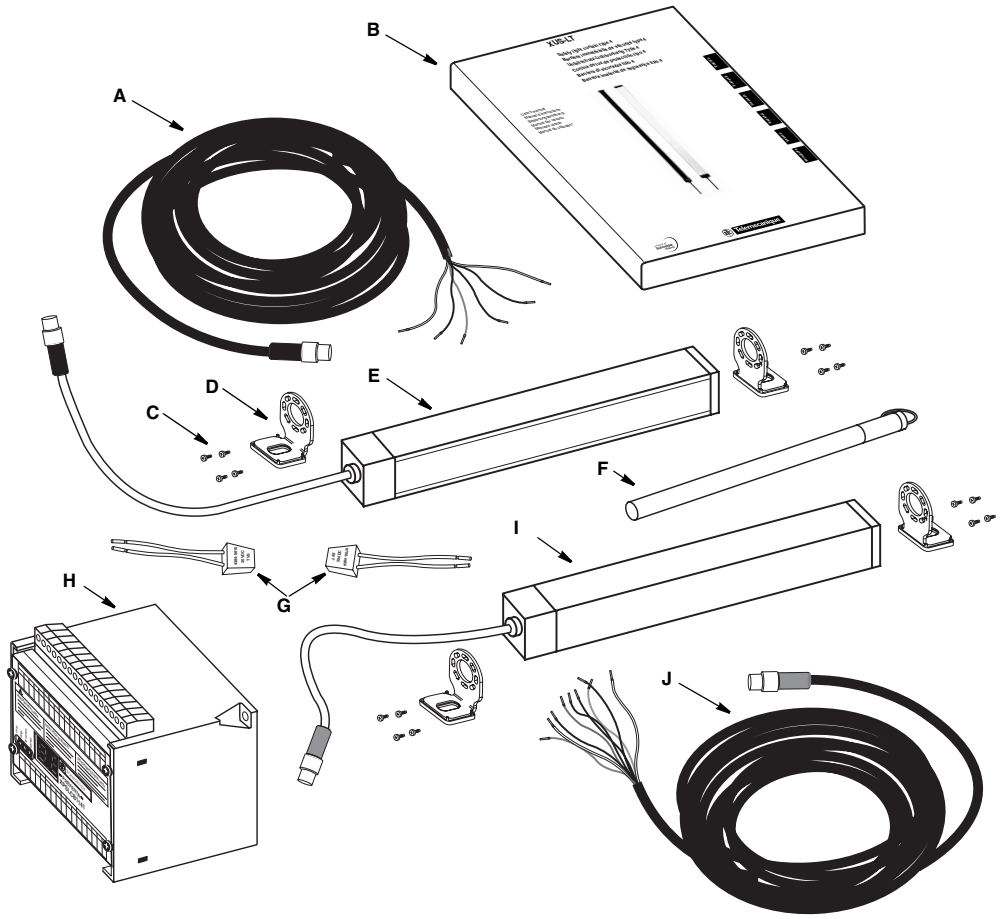


Figure 1: XUS-LM Parts

A. Transmitter Cable XSZMCT (ordered separately)
B. User's Manual
C. Mounting Bracket Hardware (2 sets)
D. Mounting Brackets (4)
E. Transmitter
F. Test Object
G. Arc Suppressors (2)
H. XPSLCB Controller
I. Receiver
J. Receiver Cable XSZMCR (ordered separately)

Step 1: Configuring the DIP Switches

⚠WARNING

HAZARDOUS VOLTAGE

Disconnect all power before removing the controller cover.

Failure to follow this instruction can result in death or serious injury.

The DIP switches are factory set for:

- Automatic start
- Normally closed start mode
- EDM/MPCE[1] not active
- Exact Channel Select/Blanking not active
- Non-safety auxiliary outputs on in Fault state

If these settings are suited to your application, proceed to “Step 2: Mounting and Wiring the Light Curtain” on page 13. Otherwise, perform the following instructions.

You must remove the controller cover to access the DIP switches. To access the DIP switches:

1. Loosen and remove four screws (**A**). Place the blade of a thin flat blade screw driver between the cover and the main controller housing (**B**) and gently pry the cover off. The cover is not hinged and can be completely removed.
2. The DIP switches are on the inside of the controller. Refer to the illustration and tables on page 12 for information on setting the switches for the various modes and options. Refer to Sections 6–8, beginning on page 26, for complete information on the modes and options.
3. After configuring the DIP switches, replace the controller cover and secure it with the four cover screws.

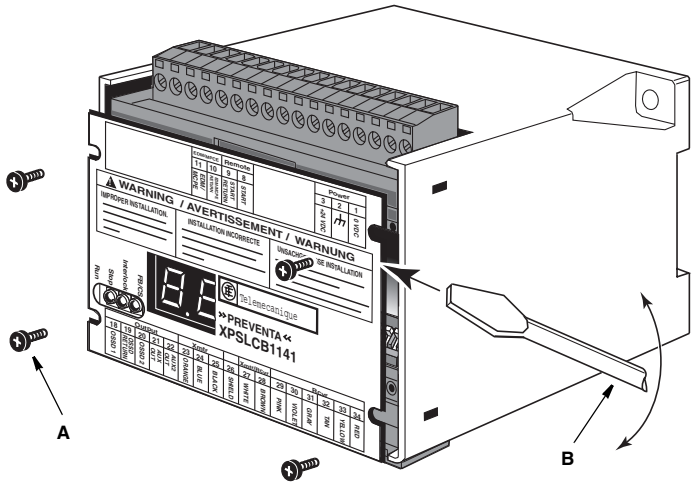


Figure 2: Controller Cover Removal

1. External Device Monitoring/Machine Primary Control Element

English

NOTE: Settings other than those described in the tables below will result in an alarm condition.

Any mismatch between the settings of Switch Bank A and Switch Bank B will also result in an alarm condition.

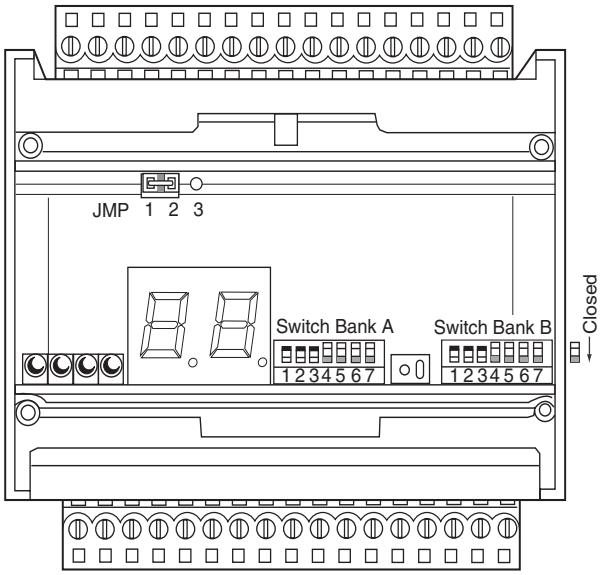


Figure 3: Dip Switches (Default Settings Shown)

Operating Modes:	Switch Bank A		Switch Bank B	
	1	2	1	2
Automatic Start (Default Setting)	Closed	Closed	Closed	Closed
Start Interlock	Open	Closed	Open	Closed
Start/Restart Interlock	Open	Open	Open	Open
Not Allowed	Closed	Open	Closed	Open

NOTE: Any mismatch between the start button wiring and the JMP setting requires that the start button be pressed and released twice before the system will enter the run state. For example, if the start button is normally closed and JMP is set for normally open start mode, you must press and release the start button twice before the system will enter the run state.

Start Mode:	Install Jumper (JMP) On:
Normally Closed (Default Setting)	Pin 1 and Pin 2
Normally Open	Pin 2 and Pin 3

EDM/MPCE States:	Switch Bank A	Switch Bank B
	3	3
Active	Open	Open
Not Active (Default Setting)	Closed	Closed

Detection Options:	Switch Bank A			Switch Bank B		
	4	5	6	4	5	6
ECS/B[1] Active	Closed			Closed		
ECS/B[1] Inactive (Default Setting)	Open			Open		
One-Channel FB[2] Active		Closed	Open		Closed	Open
Two-Channel FB[2] Active		Open	Closed		Open	Closed
FB Inactive (Default Setting)		Open	Open		Open	Open
Not Allowed		Closed	Closed		Closed	Closed

Non-Safety Alarm Output Operating Mode:	Switch Bank A	Switch Bank B
	7	7
Non-safety auxiliary outputs on in RUN state (Default Setting)	Open	Open
Non-safety auxiliary outputs on in FAULT state	Closed	Closed

1 ECS/B: Exact Channel Select Blanking
2 FB: Floating Blanking.

Step 2: Mounting and Wiring the Light Curtain

⚠WARNING

HAZARDOUS VOLTAGE

Disconnect all power before removing the controller cover.

Failure to follow this instruction can result in death or serious injury.

To mount the light curtain system:

1. Install the mounting brackets (**A**) on both ends of the receiver (**B**) and transmitter (**C**) with the mounting screws (**F**) provided.
2. Connect the cables to the receiver and the transmitter. The receiver cable ends (**D**) have a red 8-pin connector, and the transmitter cable ends (**E**) have a black 5-pin connector.
3. Install the receiver and the transmitter on the machine in the same plane and at equal heights. Refer to Step 5 on page 16 for alignment considerations. **Refer to "Section 10: Safe Mounting Distance" beginning on page 39 and to "Section 11: Installation" beginning on page 44 for complete installation instructions.**
4. The controller must be placed inside a control panel enclosure. It can be mounted on a DIN rail or panel mounted with two screws.
5. Wire the light curtain system as illustrated in Figure 5 on page 14. Refer to "Section 12: Connecting to the Machine Control Circuit" beginning on page 50 for complete wiring information.

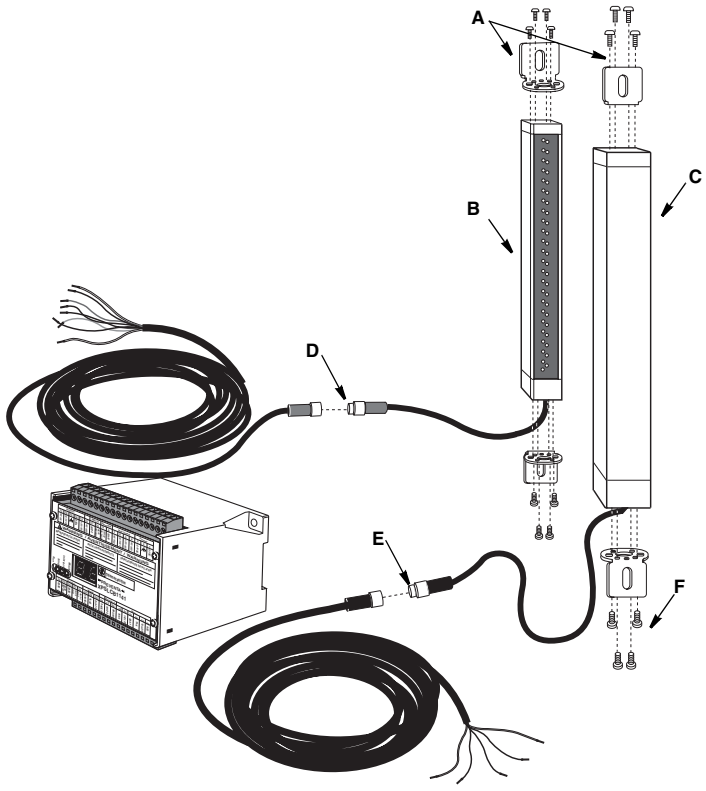
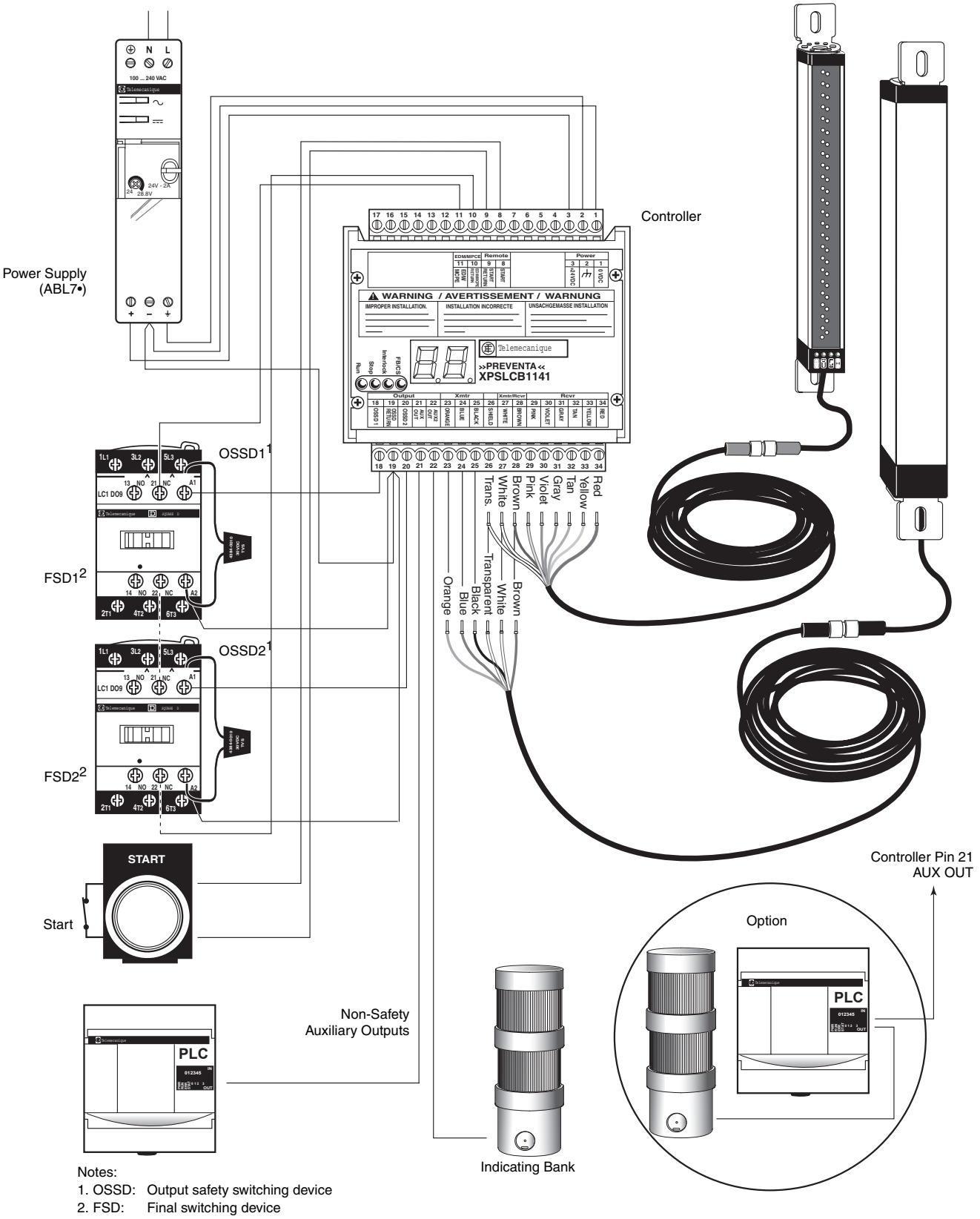


Figure 4: Mounting the Light Curtain

English

English



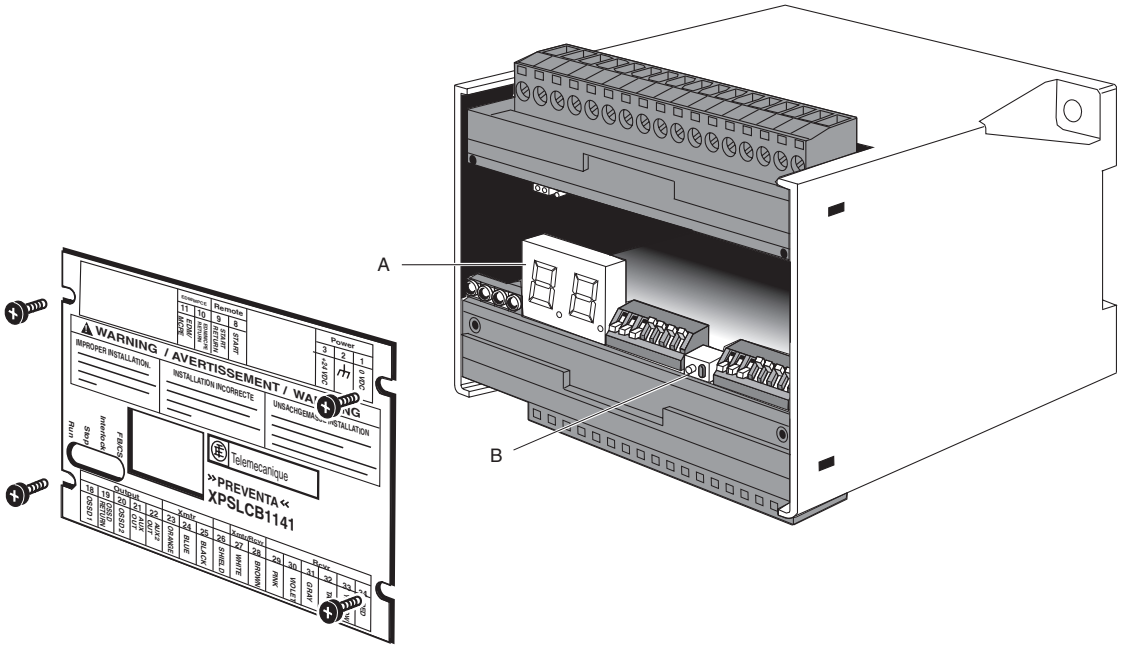
Notes:
1. OSSD: Output safety switching device
2. FSD: Final switching device

Figure 5: Wiring with Final Switching Devices

English

Step 3: Start Up

1. Apply power to the system.
2. Check the LEDs (**C**) and two-digit diagnostic display (**A**) on the front of the controller as described in “Step 4: Checking the LEDs” on page 16. Refer to “Step 7: Troubleshooting” on page 17 for an explanation of the diagnostic display codes.
3. Adjust the alignment of the transmitter and the receiver using the beam indicators. See “Step 5: Aligning the Transmitter and Receiver” on page 16.



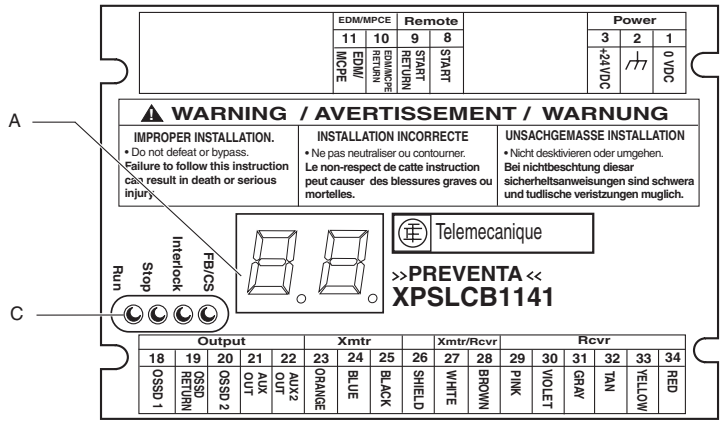
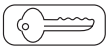
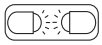


Figure 6: LEDs and Diagnostic Display

Step 4: Checking the LEDs

Table 1: LEDs

Controller and Receiver LEDs			
Amber: FB or ECS/B[1] 	Yellow: Interlock 	Red: Stop 	Green: Run 
When **illuminated**, the light curtain is operating in a reduced resolution mode.	When **illuminated**, the light curtain is waiting for the start button to be pushed, and the guarded machine is not operating. When **blinking**, the system is in an alarm condition. Check the two-digit display on the front of the controller and refer to "Step 7: Troubleshooting" on page 17.	When **illuminated**, the light curtain is blocked and the guarded machine is not operating.	When **illuminated**, the guarded machine is operating.

1 Refer to page 12 for setting Exact Channel Select/Blanking.

Step 5: Aligning the Transmitter and Receiver

When the whole bank of indicators is illuminated, the transmitter and receiver are not in alignment. When individual indicators are illuminated, the associated safety beams are blocked.

Aligning the transmitter is easiest when the XUS-LM system is in the automatic start operating mode with Exact Channel Select/Blanking inactive. Ensure that the receiver and transmitter are in the same plane and at equal heights. To ensure that the alignment position is stable, verify that a small deviation of the receiver (or the transmitter) around the alignment position does not cause any beam indicator to come on.

Step 6: Programming ECS/Blanking (Optional)

Refer to "Section 6: System Operation" on page 26 for complete information on Exact Channel Select/Blanking. To program an Exact Channel Select/Blanking pattern:

1. Ensure that the DIP switches are set for Exact Channel Select/Blanking. See page 12.
2. Ensure that the XUS-LM system is in the machine stop state. The red LED on the receiver will be illuminated.
3. Access the programming button (item **B** on page 15) by removing the front cover of the controller.
4. Block the appropriate area of the detection zone. For self learning, press then release the programming button.
5. After programming the Exact Channel Select/Blanking pattern, the Amber, Red, and Yellow LEDs will illuminate. The code "01" will appear on the two-digit display (item **A** on page 15).
6. To enter machine run mode, press and release the Start button, or cycle the power. The Amber and Green LEDs will illuminate, and the two-digit display will change to code "03" to indicate that the light curtain system is operating in Exact Channel Select/Blanking and in Run mode.
7. Check that the blanked beams are illuminated when the object is withdrawn.

Step 7: Troubleshooting

The controller has a two-digit diagnostic display, which presents numeric codes indicating both normal operation and system fault status. The codes are described in the following tables.

Table 2: Operational Codes

Code Displayed	System Status	Corrective Action
88	Power-up indication	None required
00	Normal operation: no floating blanking or Exact Channel Select/Blanking	None required
01	Normal operation: waiting for start signal	Press and release the start switch
02	Normal operation: floating blanking active	None required
03	Normal operation: Exact Channel Select/Blanking active	None required
04	Normal operation: floating blanking and Exact Channel Select/Blanking active	None required

Table 3: DIP Switch Fault Codes

Code Displayed	System Status	Corrective Action
20	General DIP switch fault	1. Check the setting of operating mode DIP switches 1 and 2. 2. Check the setting of floating blanking DIP switches 5 and 6.
21	Invalid DIP switch setting	Ensure that the settings of DIP switches 1 through 7 are valid and identically set between switch banks A and B.
22	DIP switch settings changed during operation	Press and release the start button or cycle power.
23	Invalid channel select or EDM/MPCE DIP switch settings	Ensure that the channel select and EDM/MPCE DIP switches settings are valid.

Table 4: Safety Output (OSSD) Faults

Code Displayed	System Status	Possible Cause/Corrective Action
30	General safety output (OSSD) fault	1. OSSD 1 is shorted to OSSD 2. Check the wiring. Wire according to manual. 2. OSSD 1 or OSSD 2 is shorted to power. Check the wiring. Wire according to manual. 3. OSSD 1 or OSSD 2 is shorted to ground. Check wiring. Wire according to manual.

Table 5: EDM/MPCE Faults

Code Displayed	System Status	Corrective Action
40	General EDM/MPCE fault	Possible incorrectly wired EDM/MPCE circuit. Check and wire according to manual.
41	EDM/MPCE opens before safety output (OSSD) activation	Ensure that the EDM/MPCE circuit is closed before OSSD activation.
43	EDM/MPCE opens when power is applied	Ensure that the EDM/MPCE circuit is closed when power is applied.

English

Table 6: Controller Faults

Code Displayed	System Status	Corrective Action
50	Internal controller fault	Replace the controller.
51	Receiver fault	1. Check the receiver-to-controller wiring connections. Correct errors. 2. Check the receiver cable for cuts. Ensure that it is properly connected to the quick-disconnect fitting. Replace or properly connect the cable as required. 3. If none of the above, return the receiver to Schneider Electric for repair.
52	Transmitter fault	1. Check the transmitter-to-controller wiring connections. Correct errors. 2. Check the transmitter cable for cuts. Ensure that it is properly connected to the quick-disconnect fitting. Replace or properly connect the cable as required. 3. If none of the above, return transmitter to Schneider Electric for repair.
53	Transmitter and receiver length mismatch or transmitter and receiver not connected	1. Ensure that the transmitter and receiver are identical in protected height. 2. Ensure that the transmitter and receiver are properly connected to the controller and that their cables are not damaged.
59	24 V⎓ power supply fault	Check the voltage supplied to the unit. Ensure that it is 24 V⎓ ± 10%.
70	Ground Fault	Check the ground connections on the controller, the transmitter, and the receiver.

SECTION 2: IMPORTANT SAFETY WARNINGS

⚠WARNING

IMPROPER SETUP OR INSTALLATION

Read all responsibilities and requirements listed below before installing the XUS-LM system.

Failure to follow this instruction can result in death or serious injury.

An XUS-LM system is a general purpose presence sensing device designed to guard personnel working around moving machinery.

Meeting Full Compliance

Whether a specific machine application and XUS-LM system installation comply with safety regulations depends on the proper application, installation, maintenance, and operation of the XUS-LM system. These are the responsibility of the purchaser, installer, and employer. This product is designed to comply with:

- IEC 61496
- UL Type 4 requirements
- EN60954-1
- ANSI B11.19
- The relevant Essential Health and Safety Requirements (EHSRs) of the European Machinery Directive (98/37/EC)
- The relevant requirements of the Low Voltage Directive (73/23/EEC as amended by 93/68/EEC)
- The Essential Protection Requirements of the Electro Magnetic Compatibility (EMC) Directive (89/336/EEC, 92/31/EEC, and 93/68/EEC)

Employer Responsibilities

The employer is responsible for selecting and training the personnel necessary to properly install, operate, and maintain the machine and its safeguarding systems. The XUS-LM system must only be installed, checked, and maintained by a **qualified** person. A qualified person is defined as “a person or persons who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.” (ANSI B30.2-1983)

Additional Requirements

To use an XUS-LM system the following requirements must be met:

- The guarded machine **must** be able to stop anywhere in its cycle. Do not use a safety light curtain on a press with a full-revolution clutch.
- The guarded machine must not present a hazard from flying parts.
- The guarded machine must have a consistent stopping time and adequate control mechanisms.
- Severe smoke, particulate matter, and corrosives may degrade the efficiency of a safety light curtain. Do not use the XUS-LM system in this type of environment.
- All applicable governmental and local rules, codes, and regulations must be satisfied. This is the user’s and employer’s responsibility.
- All safety-related machine control elements must be designed so that an alarm in the control logic or failure of the control circuit does not lead to a failure.
- Additional guarding may be required for access to dangerous areas not covered by the XUS-LM system.

- Perform the test procedures on page 70 at installation and after maintenance, adjustment, repair, or modification to the machine controls, tooling, dies or machine, or to the XUS-LM system.
- Perform only the test and repair procedures outlined in this manual.
- Follow all procedures in this manual for proper operation of the XUS-LM system.
- All safety related machine control circuit elements, including pneumatic, electric, or hydraulic controls must be control reliable. Control reliable is defined as: “The device system or interface shall be designed, constructed, and installed such that a single component failure within the device, interface, or system shall not prevent normal stopping action from taking place, but shall prevent a successive machine cycle” (ANSI B11:19).
- Electro-sensitive protective equipment (ESPE) must not be used as a lock-out device to meet Occupational Safety & Hazard Administration (OSHA) lock-out/tag-out requirements.

The enforcement of these requirements is beyond the control of Schneider Electric. The employer has the sole responsibility to follow the preceding requirements and any other procedures, conditions, and requirements specific to his machinery.

SECTION 3: CATALOG NUMBERS

Refer to the following table for a key to interpreting XUS-LM Safety Light Curtain catalog numbers. This table is intended as an aid for interpreting product catalog numbers. It is not to be used for creating catalog numbers which may not exist. Transmitter and receiver cable lengths are sold separately.

Operation	Photoelectric **XU**										
Light Curtain	Safety **SL**										
Body Style		30 x 26 mm (1.18 x 1.02 in.) frame size **M**									
Sensing Distance			0.3 to 4.5 m (0.98 to 14.8 ft.) **N**								
			0.3 to 7 m (0.98 to 22.9 ft.) **P**								
			0.3 to 14 m (0.98 to 45.9 ft.) **U**								
Resolution				Finger protection **6**							
				Hand protection **5**							
Controller (3 box)					Controller (XPS) included **X**						
					No Controller (XPS) **W**						
					Transmitter only **E**						
Protection Height (mm)									XUSLM•6•	**0150**	
										0300	
									XUSLM•5•	**0450**	
										0600	
										0750	
										0900	
										1050	
										1200	
										1350	
										1500	
										1650	
										1800	
						Transmitter only					**T**
						Receiver only					**R**

English

SECTION 4: STANDARD FEATURES

- External Device Monitoring (EDM/MPCE Monitoring)
- Automatic Start Mode
- Start Interlock Mode
- Start/Restart Interlock Mode
- Adjustable Mounting Brackets
- Floating Blanking
- Exact Channel Select/Blanking
- Two Safety (PNP) Outputs
- Non-safety Auxiliary Output

SECTION 5: SYSTEM ACCESS, COMPONENTS, AND INDICATORS

Access to DIP Switches

Switches for configuring system features are located under the front cover of the controller. To access the switches:

1. Remove the four screws holding the cover in place (see Figure 7).
2. Place the blade of a thin flat-blade screwdriver between the cover and the main controller housing and gently lift the cover off (see Figure 7). The cover is not hinged and can be completely removed.
3. Refer to “Step 1: Configuring the DIP Switches” on page 11 for information on setting the DIP switches.

To replace the cover:

1. Correctly position one end of the cover and push down on the opposite end to snap it in place.
2. Replace the four screws to properly retain the cover. Torque the screws to 0.1 N•m (0.9 lb-in). See Table 35 on page 63 for replacement screws.

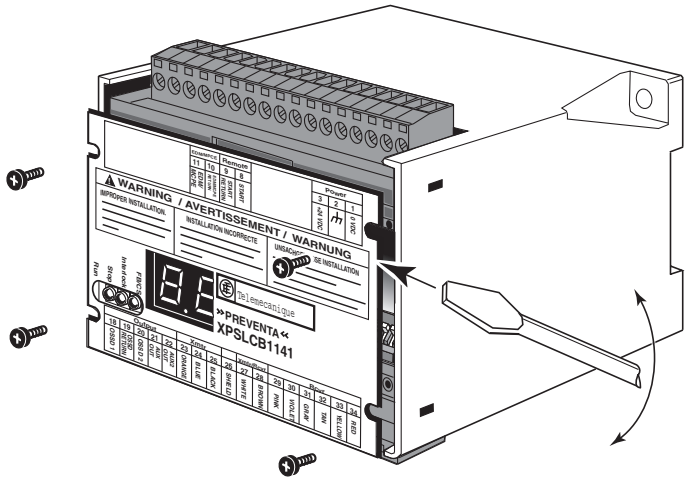


Figure 7: Accessing the DIP Switches

English

English

Location of the Components and Indicators

Refer to Figures 8 and 9 on page 25 for the location of the components and indicators listed in Table 7.

Table 7: System Component Identification

Item No.	Description
1	RECEIVER
2	Blocked Beam Indicators (one for each beam)
3	ECS/Blanking or Floating Blanking Indictor—Amber LED
4	Interlock or Fault Indicator—-Yellow LED
5	Machine Stop Indicator—Red LED
6	Machine Run Indicator—Green LED
7	TRANSMITTER
8	Detection Zone
9	CONTROLLER (XPSLCB1141)
10	ECS/Blanking or Floating Blanking Indicator—Amber LED
11	Interlock or Alarm Indicator—Yellow LED
12	Machine Stop Indicator—Red LED
13	Machine Run Indicator—Green LED
14	Diagnostic Code Display
15	Switch Bank A
16	Program Button
17	Switch Bank B
18	Removable Terminal Blocks for input and output connections
19	Start Switch Type Jumper

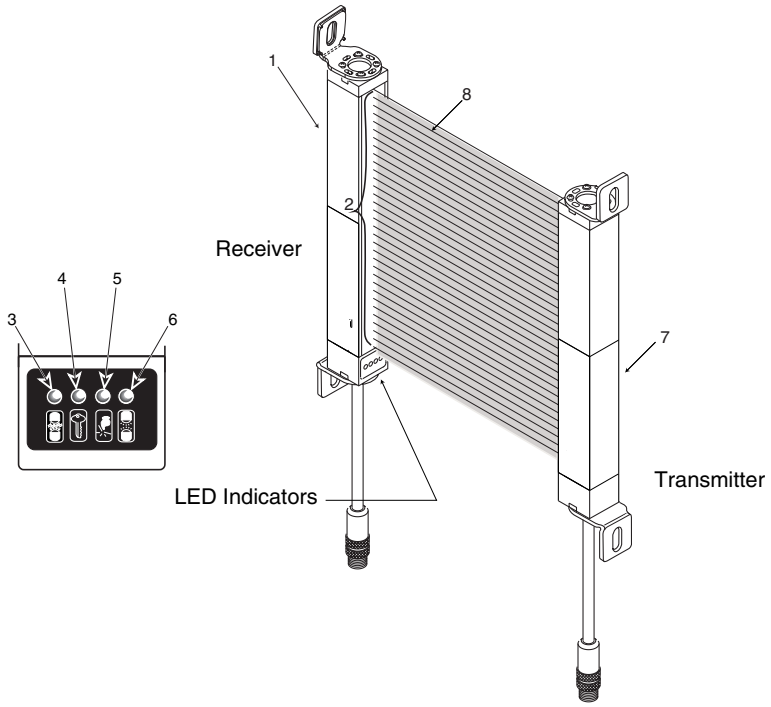
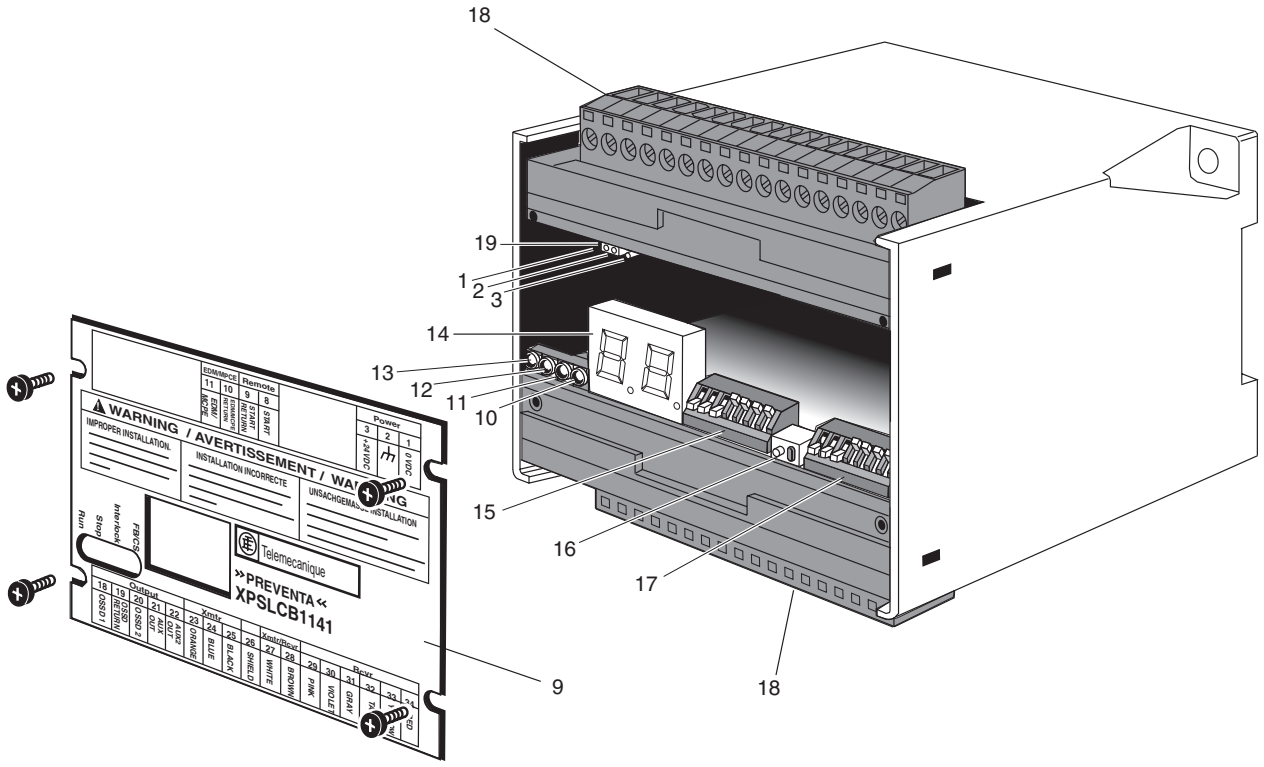


Figure 8: XUS-LM System Drawing



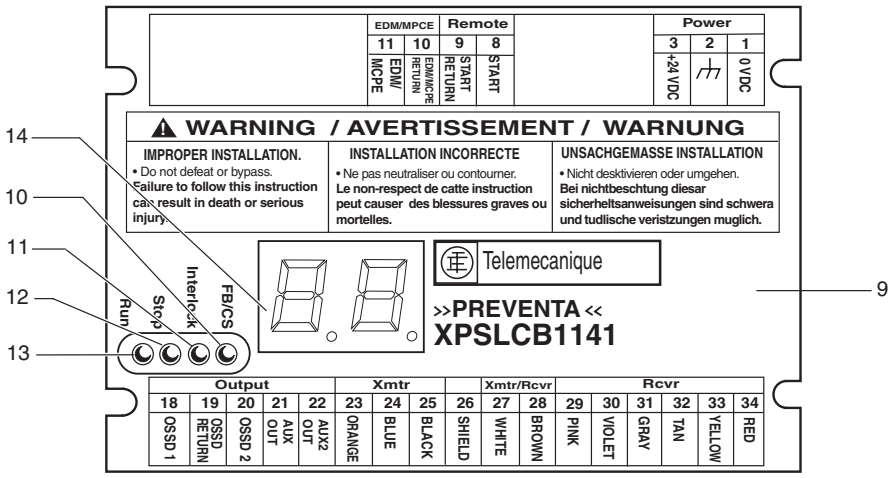


Figure 9: XPSLCB1141 Din Controller Drawing

SECTION 6: SYSTEM OPERATION

An XUS-LM system is a microprocessor-controlled, infrared transmitted-beam safety light curtain. The system consists of a receiver assembly and a transmitter assembly. Quick disconnect cables link the controller to the transmitter and receiver.

An XUS-LM system is often used where personnel protection is required. Typical applications include mechanical power presses, robotic work cells, filter presses, injection molders, food processing equipment, and automated assembly equipment.

Operating States

The operating condition of an XUS-LM system is described in terms of states. The XUS-LM has the following operating states:

Machine Run 
(ON State)

In the Machine Run state, the two system safety outputs are in the ON state, the green LED machine run indicator is lit, and the non-safety auxiliary output is in a state consistent with its configuration. See “Non-Safety Auxiliary Output” on page 38. The protected machine is allowed to operate. Pressing and releasing the Start button has no effect.

Machine Stop 
(OFF State)

In the Machine Stop state, the two system safety outputs are in the OFF state, the red LED machine stop indicator is lit, and the non-safety auxiliary output is in a state consistent with its configuration. See “Non-Safety Auxiliary Output” on page 38. The protected machine is not allowed to operate. Pressing and releasing the Start button has no effect.

Interlock 

In the Interlock state, the two system safety outputs are in the OFF state, the red LED machine stop indicator and yellow LED interlock indicator are lit. The non-safety auxiliary output is in a state consistent with its configuration. See “Non-Safety Auxiliary Output” on page 38. The interlock state does not allow the protected machine to operate until the detection zone is clear of obstructions and the Start button is pressed and released.

Alarm

In the Alarm state, the two system safety outputs are in the OFF state, the red LED machine stop indicator is lit, the yellow LED interlock indicator is flashing, and the non-safety auxiliary output is in the ON state. The alarm state does not allow the protected machine to operate. The primary difference between alarm and interlock is that the XUS-LM system will remain in the alarm state until power is recycled or the Start button is pressed and released and the system has run a self-test.

Operating Modes

System operating modes determine the start-up and operating behavior of an XUS-LM system. Operating mode definitions rely on the operating states presented above. Operating mode selection is performed via configuration switches located under the front cover of the controller.

NOTE: If internal faults are detected by the XUS-LM system during power-up or operation, it will enter the alarm state with its safety outputs in the OFF state.

Automatic Start

An XUS-LM system will power-up with its safety outputs OFF, and perform system initialization and self tests. The XUS-LM system will enter the machine run state if no obstructions are present in the detection zone. In this state, when an object is sensed entering the detection zone, the XUS-LM system will change from machine run to machine stop and remain in this state until the obstruction is removed. Once the detection zone is clear, the XUS-LM system will automatically change from machine stop to machine run.

Start Interlock

The XUS-LM system will power-up with its safety outputs OFF and perform system initialization and self-tests. If no alarms are detected in the protected zone (or an Exact Channel Select/Blanking pattern is satisfied), the XUS-LM will enter the interlock state. To enter the machine run state, the detection zone must be clear (or an Exact Channel Select/Blanking pattern satisfied), and then the operator must press and release the Start button. In the machine run state, when an object is sensed entering the detection zone the XUS-LM will change from machine run to machine stop. Once the detection zone is clear, the XUS-LM system will automatically change from machine stop to machine run.

Start / Restart Interlock

The XUS-LM system will power-up with its safety outputs OFF, and, if no alarms are detected, enter the interlock state. To enter the machine run state, the detection zone must be clear (or an Exact Channel Select/Blanking pattern satisfied), and then the operator must press and release the Start button. In the machine run state, when an object is sensed entering the detection zone, the XUS-LM system will change from machine run to interlock. The XUS-LM system will remain in the interlock state even after the obstruction is removed from the detection zone. To enter the machine run state, the operator must press and release the Start button. If any obstruction is present in the detection zone when the Start button is pressed and released, the XUS-LM system will remain in the interlock state.

NOTE: See Figure 27 on page 52 for start button wiring.

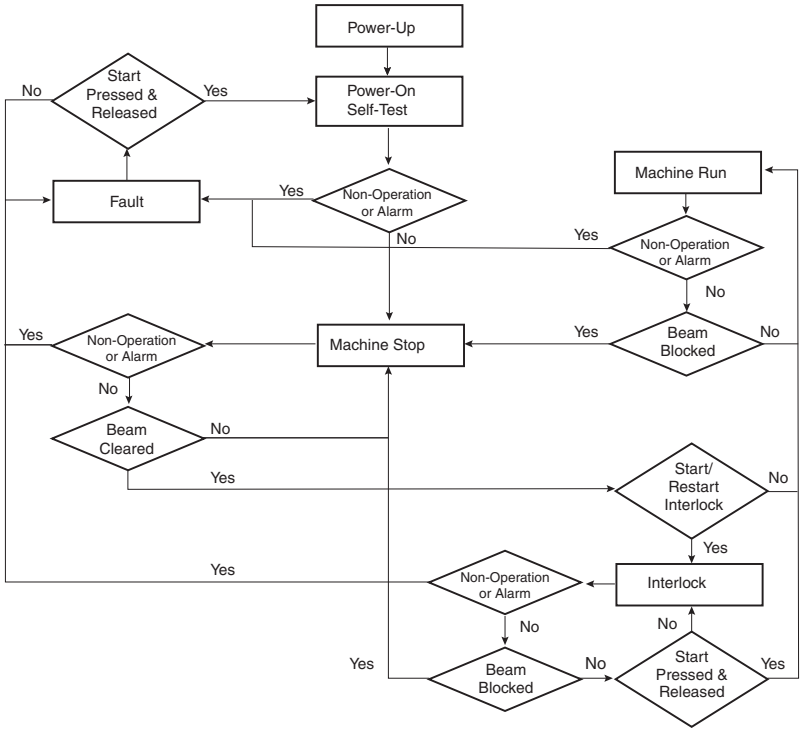


Figure 10: Functional Flow Diagram

English

English

Operating Mode Selection

The operating mode is selected by setting positions 1 and 2 of Switch Banks A and B, located under the controller cover. Refer to Table 8 for switch settings. **Any mismatch between the settings of Switch Banks A and B will result in an alarm condition.** In addition, if the configuration switch settings change while the system is on, it will enter the alarm state with the safety outputs off.

⚠ DANGER

HAZARDOUS VOLTAGE

- Disconnect power before accessing the controller assembly.
- Replace cover before re-applying power.

Failure to follow this instruction will result in death or serious injury.

Table 8: Operating Mode Switch Settings

	Switch Bank A		Switch Bank B	
Operating Mode	**1**	**2**	**1**	**2**
Automatic Start (default setting)	Closed	Closed	Closed	Closed
Start Interlock	Open	Closed	Open	Closed
Start/Restart Interlock	Open	Open	Open	Open
Not Allowed	Closed	Open	Closed	Open

Start Switch Type Selection

The type of Start switch (Normally Open or Normally Closed) used by the XUS-LM system is selectable by a jumper located under the controller cover. Refer to Figure 11. Placing the jumper between Pins 1 and 2 of JMP 1 selects a Normally Closed Start switch. Placing the jumper between 2 and 3 selects a Normally Open Start switch.

NOTE: Any mismatch between the start button wiring and the JMP setting requires that the start button be pressed and released twice before the system will enter the run state. For example, if the start button is normally closed and JMP is set for normally-open start mode, you must press and release the start button twice before the system will enter the run state.

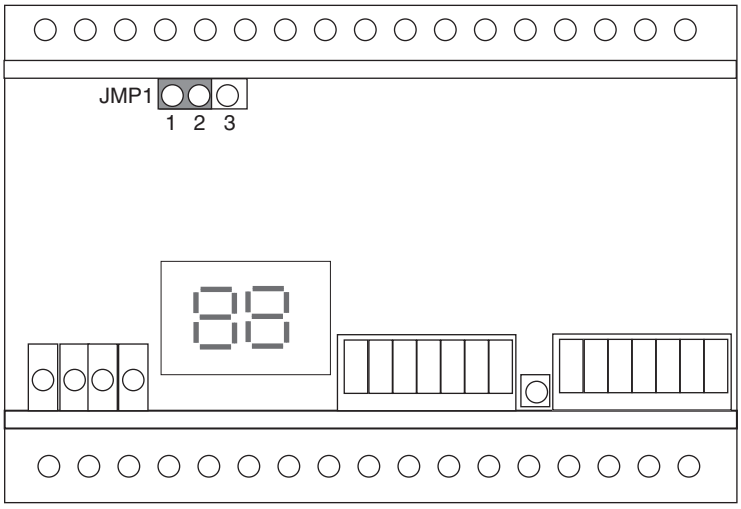


Figure 11: Start Switch Jumper Shown in Normally Closed Position

SECTION 7: DETECTION OPTIONS

⚠WARNING

LACK OF SENSITIVITY

- Using ECS/Blanking with Floating Blanking is an advanced feature. All situations which may occur to the XUS-LM system detection zone must be carefully considered. Read the following section carefully.
- ECS/Blanking and/or Floating Blanking create unprotected passages in the detection zone and make the XUS-LM safety light curtain less sensitive to objects in the detection zone. Improper use of either feature can result in severe hazard to personnel. Read Section 5 carefully.
- To prevent unauthorized modification of the detection zone, the system controller should be installed in an enclosure with supervisor-controlled access.
- If the object to be ignored by the ECS/Blanking beams does not completely prevent access to the hazardous area, then either use a hard guard or other means to block access or increase the minimum safe distance as required by the proper formula.
- Any beams which are not in alignment at the time of ECS/Blanking programming may be inadvertently deselected. Use the Test Procedure on page 70 to verify the correct configuration.
- After programming or activating ECS/Blanking or Floating Blanking, to avoid unexpected areas where the system may not sense an intrusion into the detection zone, use a proper size test object to perform the Test Procedure.

Failure to follow this instruction can result in death or serious injury.

English

Initial Switch Settings

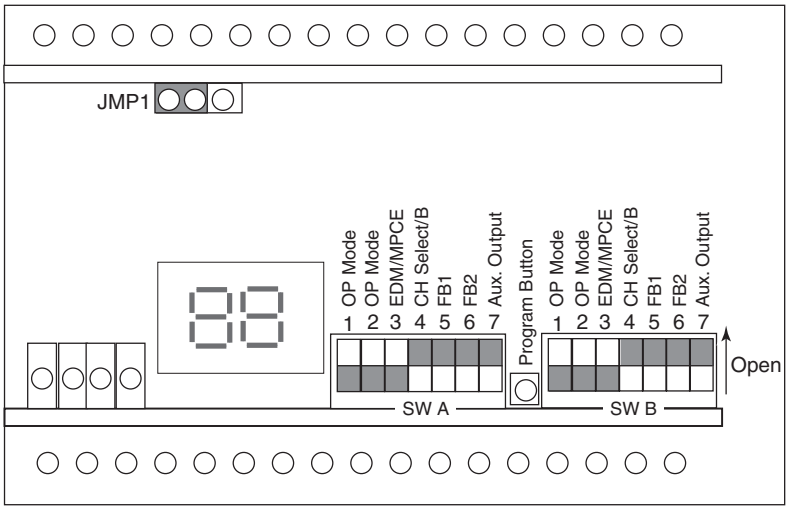


Figure 12: Switch Position Initial Setting

The initial switch settings are:

- Automatic start is active.
- EDM/MPCE is not active.
- ECS/Blanking is not active.
- FB/Floating blanking is not active.
- JMP1 is in the normally closed (NC) position.
- Aux. output is on in the Run state.

Exact Channel Select (ECS/Blanking)

ECS/Blanking disables selected, fixed areas of the detection zone by masking off specific, fixed beam locations. ECS/Blanking is helpful when stationary objects such as tooling and fixtures permanently obstruct a portion of the detection zone.

ECS/Blanking requires that any portion of the detection zone which is blocked remain blocked. If the obstruction is removed, the XUS-LM system will enter a machine stop state. When selecting channels to be masked, one channel must remain unblocked. A channel is defined as one transmitter/receiver pair or beam.

See Table 9 for a diagram of XUS-LM system response during operation with ECS/Blanking active.

Table 9: System Response to ECS/Blanking

Exact Channel Select Status	Inactive	Inactive	Active	Active	Active
Channel 1	○	○	○	⊗	○
Channel 2	○	○	⧻	⧻	⧻
Channel 3	○	⊗	⧻	⧻	△
Channel 4	○	○	⧻	⧻	⧻
Channel 5...	○	○	○	○	○
Safety Output Status	run	stop	run	stop	stop

Table 10: Icon Key for Table 9

Symbol	Description
○	Optical channel is not blocked.
⊗	Optical channel is blocked.
△	Optical channel is selected by ECS/Blanking.
⧻	Optical channel is selected by ECS/Blanking and is blocked.

Floating Blanking

Up to two channels can be disabled at any location in the detection zone without the XUS-LM system going to the machine stop state. The disabled channels are not fixed at a single location but “float” through the detection zone. See Table 11 for a diagram of XUS-LM system response during operation with Floating Blanking active.

Table 11: System Response to Floating Blanking

Number of Channels Selected	0	1	1	1	1	2	2	2	2	2	2	2
Floating Blanking Status	Inactive	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Channel 1	○	○	○	○	○	○	○	○	○	○	○	⊗
Channel 2	○	○	○	⊗	⊗	○	○	⊗	⊗	⊗	⊗	○
Channel 3	⊗	○	⊗	⊗	○	○	⊗	⊗	○	⊗	○	⊗
Channel 4	○	○	○	○	⊗	○	○	○	⊗	⊗	⊗	○
Channel 5...	○	○	○	○	○	○	○	○	○	○	⊗	⊗
Channel Blocked	1	0	1	2	2	0	1	2	2	3	3	3
Safety Output Status	stop	run	run	stop	stop	run	run	run	run	stop	stop	stop

Table 12: Icon Key for Table 11

Symbol	Description
○	Optical channel is not blocked.
⊗	Optical channel is blocked.

English

Using ECS/Blanking with Floating Blanking

⚠WARNING

LACK OF SENSITIVITY

- Using ECS/Blanking with Floating Blanking is an advanced feature. All situations which may occur to the XUS-LM system detection zone must be carefully considered.
- Improper use of ECS/Blanking and/or Floating Blanking will make the XUS-LM system less sensitive to objects in the detection zone.
- ECS/Blanking may require a hard barrier guard (see “Additional Guarding” on page 46).
- The XUS-LM system may be less sensitive to objects in the detection zone. ECS/Blanking or Floating Blanking may require an increase in the safety distance.
- Read the following section carefully.

Failure to follow this instruction can result in death or serious injury.

When both ECS/Blanking and Floating Blanking are selected, the floating channels are allowed to occur anywhere within the detection zone, even within the area selected by ECS/Blanking. In these areas, a channel that should normally be blocked is allowed to be clear.

The Effect of ECS/Blanking and Floating Blanking on Minimum Object Resolution

When ECS/Blanking and/or Floating Blanking is active, the safety distance is affected. ECS/Blanking and Floating Blanking desensitize the light curtain and increase the size of the minimum object detected. The increase is equal to the channel spacing distance for each channel that is disabled.

If the minimum size of the object detected by the XUS-LM system increases, the minimum safe distance must also increase. Use the minimum object sensitivity given in Tables 13 and 14 to determine the new figure to use when computing the safety distance.

Table 13: Sample S and D_{pf} Factors for XUSLM•6 (14 mm Finger Detection) System

Total Number of Beams Disabled by ECS/Blanking and/or Floating Blanking	Minimum Object Resolution S	Depth Penetration Factor, D_{pf} for use with ANSI Formula D_{pf} = 3.4 (S–0.276) in. [1]
None	0.55 in. (14 mm)	0.94 in. (24 mm)
1 Beam	0.98 in. (25 mm)	2.40 in. (61 mm)
2 Beams	1.41 in. (36 mm)	3.89 in. (99 mm)
3 Beams	1.85 in. (47 mm)	5.35 in. (136 mm)
4 Beams	2.28 in. (58 mm)	6.81 in. (173 mm)
5 Beams	2.71 in. (69 mm)	8.30 in. (211 mm)
Etc ...		

1. The ANSI formula for the depth penetration, D_{pf}, is for the USA only.

- An XUS-LM system with 14 mm (0.55 in.) minimum object resolution and one channel disabled has a minimum object sensitivity of:

  14 mm + 11 mm = 25 mm (0.98 in.)
- An XUS-LM system with 14 mm (0.55 in.) minimum object resolution and two channels disabled has a minimum object sensitivity of:

  14 mm + 11 mm + 11 mm = 36 mm (1.41 in.)

Table 14: Sample S and D_{pf} Factors for XUSLM•5 (30 mm Hand Detection) System

Total Number of Beams Disabled by ECS/Blanking and/or Floating Blanking	Minimum Object Resolution S	Depth Penetration Factor, D_{pf} for use with ANSI Formula D_{pf} = 3.4 (S–0.276) in. [1]
None	1.18 in. (30 mm)	3.07 in. (78.0 mm)
1 Beam	2.05 in. (52 mm)	6.03 in. (153.2 mm)
2 Beams	3.0 in. (74 mm)	8.96 in. (227.6 mm)
3 Beams	3.78 in. (96 mm)	11.91 in. (302.5 mm)
4 Beams	4.65 in. (118 mm)	14.87 in. (377.7 mm)
5 Beams	5.51 in. (140 mm)	17.80 in. (452.0 mm)
Etc ...		

1. The ANSI formula for the depth penetration, D_{pf}, is for the USA only.

- An XUS-LM system with 30 mm (1.18 in.) minimum object resolution and one channel disabled has a minimum object sensitivity of:

  30 mm + 22 mm = 52 mm (2.05 in.)
- An XUS-LM system with 30 mm (1.18 in.) minimum object resolution and two channels disabled has a minimum object sensitivity of:

  30 mm + 22 mm + 22 mm = 74 mm (2.91 in.)

English

Activating and Programming ECS/Blanking

⚠WARNING

UNAUTHORIZED OPERATION

To prevent unauthorized modification of the sense field, the system controller should be installed in an enclosure with supervisor-controlled access.

Failure to follow this instruction can result in death or serious injury.

ECS/Blanking is activated by setting position 4 of Switch Banks A and B, located under the controller cover. Refer to Table 15. **Any mismatch between the settings of Switch Banks A and B will result in an alarm condition.** To access Switch Banks A and B, see “Access to DIP Switches” on page 23.

⚠DANGER

HAZARDOUS VOLTAGE

- Disconnect power before removing the controller cover.
- Replace cover before re-applying power.

Failure to follow this instruction will result in death or serious injury.

To program an ECS/Blanking pattern, the XUS-LM system must be in the machine stop state. An ECS/Blanking pattern is stored by blocking the appropriate area of the detection zone and pressing, then releasing, the Program button (see Table 7 on page 24 for its location).

The XUS-LM system will then enter the interlock or machine stop condition, regardless of the operating mode. The Start button may be pressed and released or power may be cycled to enter the machine run state. Subsequent power cycles will result in operation in accordance with the configured operating mode.

A new ECS/Blanking pattern is recorded when the system is in the machine stop state with no alarms, the configuration switches are correctly set, and the Program button is pressed and released. If the configuration switches are subsequently set to disable ECS/Blanking, the stored ECS/Blanking pattern is cleared.

NOTE: Replace the controller cover and retention screws after changing the system configuration. See “Access to DIP Switches” on page 23 for details.

Table 15: Detection Option Switch Settings

	Switch Bank A			Switch Bank B		
Operating Mode	**4**	**5**	**6**	**4**	**5**	**6**
ECS/Blanking Active	Closed			Closed		
ECS/Blanking Inactive (default setting)	Open			Open		

Table 15: Detection Option Switch Settings (Continued)

	Switch Bank A			Switch Bank B		
Operating Mode	**4**	**5**	**6**	**4**	**5**	**6**
One-Channel Floating Blanking Active		Closed	Open		Closed	Open
Two-Channel Floating Blanking Active		Open	Closed		Open	Closed
Floating Blanking Inactive (default setting)		Open	Open		Open	Open
Not Allowed – Alarm Condition		Closed	Closed		Closed	Closed

Activating Floating Blanking

Floating Blanking (either one- or two-beam) is activated by setting positions 5 and 6 of Switch Banks A and B located under the cover of the XPSLCB1141 controller. Refer to Table 15. **Any mismatch between the settings of Switch Banks A and B will result in an alarm condition.** To access Switch Banks A and B, see “Access to DIP Switches” on page 23.

NOTE: When ECS/Blanking or Floating Blanking is active, the amber FB or ECS/B Indicator will illuminate to indicate that the XUS-LM system is operating in a less sensitive state.

Additional Guarding When Using ECS/ Blanking or Floating Blanking

Both ECS/Blanking and Floating Blanking create “holes” in the detection zone. These “holes” are required for certain applications. If an obstruction does not completely fill these “holes” one of two actions will need to happen:

1. The safe mounting distance will need to be increased to account for the larger opening in the curtain.
2. The area not filled by an obstruction must be guarded, typically by some method of hard guarding.

Hard guarding refers to mechanical barriers such as sheet or expanded metal. See Figure 13 for an example.

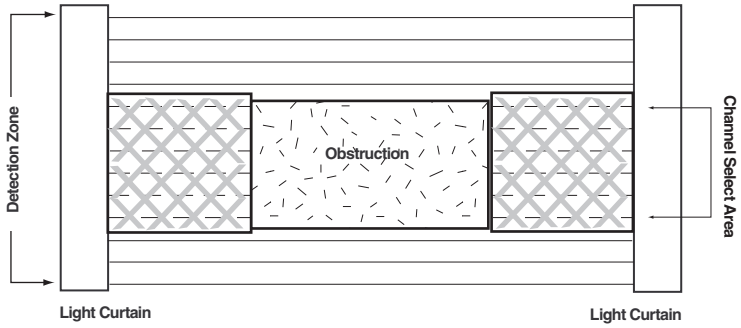


Figure 13: Adding Hard Guarding to Light Curtain When Using Exact Channel Select/Blanking

SECTION 8: DIAGNOSTIC AND TEST FEATURES

Diagnostic Display

A two-digit numeric display on the front of the controller indicates system status. The table below provides the operating mode codes. A full listing of diagnostic codes can be found in “Section 14: Troubleshooting” on page 56.

Table 16: Operational Display Code Summary

Display Code	Description
00	Normal Operation
01	Waiting for Start or program input
02	Normal Operation Floating Blanking Active
03	Normal Operation ECS/Blanking Active
04	Normal Operation Floating Blanking and ECS/Blanking Active

External Device Monitoring (EDM)/Machine Primary Control Element (MPCE) Monitoring

EDM/MPCE monitoring is an important safety function. It monitors the XUS-LM system interface to the guarded machine and checks to ensure that the control elements are responding correctly to the light curtain and to detect any inconsistency between the two machine EDMs/MPCEs. This is necessary to detect a malfunction within the interface which prevents a stop signal from reaching the machine controller.

Connections for EDM/MPCE monitoring are made at the controller on terminals 10 and 11 (see “Section 12: Connecting to the Machine Control Circuit” on page 50). On power-up, the XUS-LM system looks for an EDM/MPCE closed condition. If this is found, it will enter a state consistent with the selected operating mode. When the XUS-LM system enables its safety outputs, it monitors the EDM/MPCE for a closed-to-open transition. This transition must occur within 300 ms or the XUS-LM system considers the EDM/MPCE to be in an alarm state. The XUS-LM system will then enter an alarm state. Additionally, if the EDM/MPCE connectors are incorrectly wired, the XUS-LM system will enter an alarm state.

Upon entering a machine stop state, the EDM/MPCE input must close within 300 ms of the safety output switching, or the system enters an alarm state. The ability to disable EDM/MPCE monitoring is provided using the configuration switches located in the controller.

NOTE: For proper operation of the XUS-LM system when EDM/MPCE is not active, place a jumper between terminals EDM/MPCE and EDM/MPCE RTN.

Activating and Deactivating EDM/MPCE Monitoring

EDM/MPCE monitoring is activated by setting position 3 of Switch Banks A and B located under the controller cover. Refer to Table 17. **Any mismatch between the settings of Switch Banks A and B will result in an alarm condition.**

⚠ DANGER

HAZARDOUS VOLTAGE

- Disconnect power before removing the controller cover.
- Replace the cover before re-applying power.

Failure to follow this instruction will result in death or serious injury.

Table 17: EDM/MPCE Switch Settings

	Switch Bank A	Switch B
EDM/MPCE Monitoring	**3**	**3**
Active	Open	Open
Not Active (default setting)	Closed	Closed

NOTE: Replace the controller cover and retention screws after changing the system configuration. See "Access to DIP Switches" on page 23 for details.

Blocked Beam Indicators

The XUS-LM system has a visible, red blocked beam indicator adjacent to each infrared beam on the receiver. The blocked beam indicators light when the infrared beam fails to meet the conditions necessary for the XUS-LM system to remain in the machine run state. Blocked beam indicators are not safety critical components. A beam indicator failure will not cause an alarm condition and the XUS-LM system will continue to operate.

Status Indicator Lights

The following status indicator lights are on both the receiver and the controller.

Safety Output Interlock Status

When the XUS-LM system is in the machine run state, the green indicator LEDs on the receiver and controller illuminate, indicating that the safety outputs are ON.

Safety Output Status

When the XUS-LM system enters an interlock state, the yellow interlock and red LEDs on the receiver and controller are continuously illuminated.

Alarm Status

When the XUS-LM system enters an alarm state, the yellow LEDs on the receiver and controller flash periodically. Additionally, a code indicating the type of fault is displayed on the two-digit diagnostic display located on the controller. Error codes are defined in "Section 14: Troubleshooting" on page 56.

ECS/Blanking and Floating Blanking Status

When ECS/Blanking and/or Floating Blanking is active, the amber LEDs on the receiver and controller are illuminated.

English

SECTION 9: OUTPUTS

Safety Outputs

⚠ WARNING

IMPROPER GROUNDING

- This product is designed for use on a 24 V⎓, negative ground (protective earth) electrical system only.
- Never connect the XUS-LM light curtain to a positive ground (protective earth) system.
- With a positive ground (protective earth) wiring scheme, certain simultaneous shorts of both safety outputs may not be detected and the guarded machine may not stop, resulting in severe operator injury.

Failure to follow this instruction can result in death or serious injury.

The XUS-LM system receiver supplies two independent, PNP-type safety outputs to provide run/stop signals to the guarded machine. In the machine run state, the safety outputs are electrically conducting and source 650 mA of current at 24 V⎓. In the machine stop state, the outputs are not electrically conducting.

Non-Safety Auxiliary Output

Two non-safety auxiliary outputs are provided. Non-safety auxiliary output AUX1 OUT is NPN and sinks up to 100 mA to system ground when in the On condition. Non-safety auxiliary output AUX2 OUT is PNP and sources 500 mA at 24 V⎓ when in the On condition. Connection for AUX1 OUT is made at terminal 21. Connection for AUX2 OUT is made at terminal 22.

Non-Safety Auxiliary Output Operating Modes

The non-safety auxiliary outputs can be set to enter an “on” condition either when:

- The safety outputs are in the machine run state, or
- The XUS-LM system enters an alarm state.

The non-safety auxiliary output operating mode is selected by setting position 7 of Switch Banks A and B located under the controller cover. Refer to Table 18. **Any mismatch between the settings of Switch Banks A and B will result in an alarm conditions.**

⚠ DANGER

HAZARDOUS VOLTAGE

- Disconnect power before removing the controller cover.
- Replace the cover before re-applying power.

Failure to follow this instruction will result in death or serious injury.

Table 18: Non-Safety Auxiliary Output Operating Mode Switch Settings

	Switch Bank A	Switch B
Non-safety Auxiliary Output Operating Mode	**7**	**7**
Non-Safety Auxiliary Outputs on in RUN state	Open	Open
Non-Safety Alarm Outputs on in FAULT state	Closed	Closed

NOTE: Replace the controller cover and retention screws after changing the system configuration. See “Access to DIP Switches” on page 23 for details.

SECTION 10: SAFE MOUNTING DISTANCE

NOTE: All quotations and statements from Occupational Safety & Health Administration (OSHA) and American National Standards Institute (ANSI) apply to the USA only.

⚠WARNING

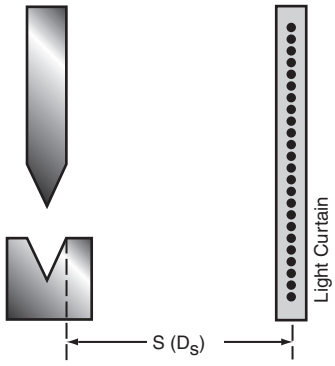
IMPROPER SETUP

Never install an XUS-LM system without regard to the safety distance. If the XUS-LM system is mounted too close to the point of operation hazard, the machine may not stop in time to prevent an operator injury.

Failure to follow this instruction can result in death or serious injury.

The XUS-LM system must be mounted far enough from the machine danger zone so that the machine will stop before a hand or other body part reaches the hazardous area. This distance is called the safety distance. It is a calculated number based on a formula. See Figure 14 for an illustration of the safety distance.

Regardless of the calculated distance, an XUS-LM system should never be mounted closer to point of operation hazard than specified. This is required by Table 0-10 in OSHA 1910.217 and EN 999.



S (D_S) is the minimum safe distance between the light curtain sensing field and the point of operation hazard (pinch point).

Figure 14: Safe Mounting Distance

English

European Safe Distance Formula

The minimum safe distance between the light curtain and the danger zone is based on European standard EN 999. This section discusses **perpendicular approach** to the danger zone, illustrated in Figure 15.

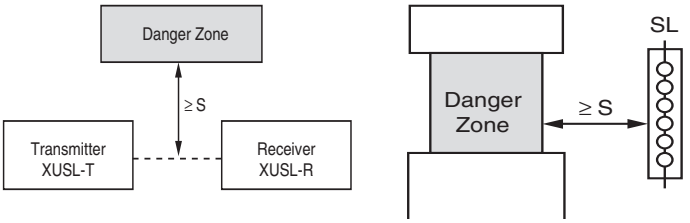


Figure 15: Perpendicular Approach to Danger Zone

For perpendicular approach to the danger zone, use the following guidelines for calculating minimum safe distance. If there is a C type standard for the machine that is to be protected, use the distance specified by this standard. Otherwise, use the following general formula defined by European standard EN 999 for calculating the safe distance:

$$S = K (t_1 + t_2) + C$$

Where:

S = (mm) the minimum safe distance between the danger zone and the axis of the light curtain.

$\mathbf{t_1}$ = (s) the response time of the light curtain (in seconds). The time t_1 is given on the nameplate of the apparatus.

$\mathbf{t_2}$ = (s) the time needed to stop the dangerous movements of the machine (in seconds).

K = (mm/s) the theoretical speed of approach of the body or body part.

C = (mm) additional safety distance = 8(d – 14 mm)

d = detection capacity

d (mm)	C (mm)
14	0
30	128

Using the general formula and parameters “K” and “C” that correspond to the light curtain, calculate the minimum safe distance “S”.

- If “S” is calculated at 500 mm (19.68 in.), this value should be retained. ***Note: S must be at least 100 mm (3.94 in.).***
- If “S” is calculated as a value greater than 500 mm (19.68 in.), recalculate “S” with the following alternate formula:

$$\text{For mm: } S = 1600 (t_1 + t_2) + C$$
$$\text{For in.: } S = 63 (t_1 + t_2) + C$$

Table 19: Calculation Examples

Minimum Distance	First Calculation	Second Calculation S > 500 mm (19.7 in.)
S = 100 mm S = 3.94 in.	For mm: $S = 2000 (t_1 + t_2) + C$ For in.: $S = 79 (t_1 + t_2) + C$	For mm: $S = 1600 (t_1 + t_2) + C$ For in.: $S = 63 (t_1 + t_2) + C$

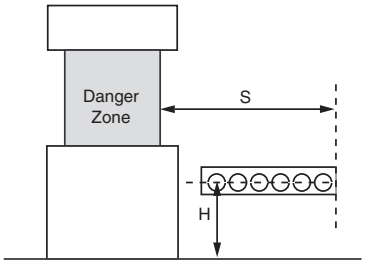
⚠WARNING

IMPROPER SET UP

If the distance "S" calculated is such that an operator can stand between the barrier and the danger zone, additional protection is required, such as a physical guard or barrier comprising several parts. Consult all applicable standards.

Failure to follow this instruction can result in death or serious injury.

When the direction of approach is **parallel** to the detection area, the minimum safe distance "S" between the dangerous zone and the beam furthest away from the dangerous zone depends on the height "H" at which the light curtain is installed. This safety distance "S" must be calculated using the formulas shown in Figure 16.



For mm: $S \geq 1600 (t_1 + t_2) + 850$
For in.: $S \geq 63 (t_1 + t_2) + 33.5$

if 875 mm < H ≤1000 mm
if 34.45 in. < H ≤39.37 in.

or

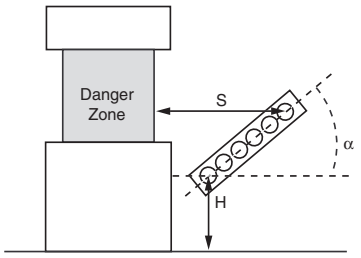
For mm: $S \geq 1600 (t_1 + t_2) + (1200 - 0.4\ H)$
For in.: $S \geq 63 (t_1 + t_2) + (47.2 - 0.4\ H)$

if 0 mm < H ≤875 mm
if 0 in. < H ≤34.45 in.

The maximum height allowed "H" is 1000 mm (39.37 in.). Once the height "H" is above 300 mm (11.81 in.) additional protective devices must be used.

Figure 16: Parallel Approach to Danger Zone

When the operator's direction of approach and the detection area form an **angle**, α, as illustrated in Figure 17, the formulas used to calculate the safe distance "S" depend on this angle.



- When the angle, α, is greater than 30°, the formulas given for the perpendicular direction of approach to the detection area must be used.
- When the angle, α, is less than or equal to 30°, the formulas given for the parallel direction of approach to the detection area must be used.

Figure 17: Angular Approach to the Danger Zone

English

US Safe Distance Formulas: ANSI B11.1

The basic formulas for calculating minimum safety distances for light curtains mounted vertically are listed below. These formulas apply to ALL light curtains, including perimeter and point of operation light curtains. ANSI B11.1 is listed first, OSHA 29 CFR 1910.217 is listed next.

The ANSI B11.1 formula applies specifically to mechanical power presses, but it is typically used on other applications as well.

$D_s = K \times (T_s + T_c + T_r + T_{bm}) + D_{pf}$

D_s = Minimum safe distance between the light curtain sensing area to the nearest point of operation potential hazard.

K = Hand speed constant of 63 inches per second. This is the standard minimum accepted value for both ANSI and OSHA. ANSI recognizes that this constant may not be optimal, and that the user should consider all factors before deciding on the value of the K factor to use in the formula.

T_s = Stop time of the machine (press), as measured from the final control element. It is measured at the maximum velocity of the press, usually at 90° of press rotation on the downstroke.

T_c = Response time of the control circuit to activate the braking system.

Note: Ts and Tc are usually measured as one value by a stop time measurement device.

T_r = The response time of the XUS-LM control, in seconds. This response time is less than 21 ms for all models.

T_{bm}= Additional time allowed for the brake monitor to compensate for wear and variations in the stopping time. Brake monitors will stop the machine (press) when the stop time of the machinery exceeds a pre-set limit.

Note: If a brake monitor is not installed on the machine, a factor must be added to the measured stop time to include brake wear. Generally, brake monitors add approximately 20% to 25% additional stop time. To determine the actual factor to be used, contact the machine manufacturer.

D_{pf} Depth penetration factor, to provide for the possibility that fingers or hands will penetrate through the sensing field before detection occurs. This value is determined by the Penetration Depth Factor Chart from ANSI B11.1 (see Figure 18 below). Alternately, the following ANSI formula can be used: $D_{pf} = 3.4 (S–0.276)$, where S = minimum object sensitivity.

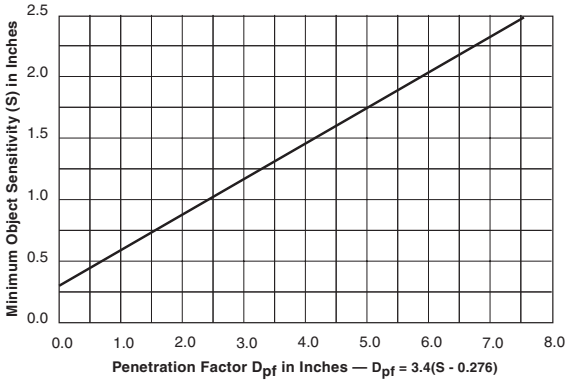


Figure 18: Depth Penetration Factor

US Safe Distance Formulas: OSHA CFR 1910.217 (c)(3)(iii)(e)

This formula applies specifically to the guarding of mechanical power presses, but it is typically used on other applications as well.

D_s = 63 in. per second x T_s

Where:

D_s = Minimum safety distance (inches)

63 in. per second = hand speed constant

T_s = Stopping time of the press measured at approximately 90° position of the crankshaft rotation (seconds). Stop time of the machine (press), as measured from the final control element. It is measured to determine worst case time and maximum velocity of the press. Usually at 90° of press rotation on the downstroke.

In addition to the formula above, we recommend that OSHA 1910.217 Table O-10 be followed. Per OSHA, the table below shows the maximum width of openings allowed for a guard based on the distance from the guard (light curtain) to the point of operation hazard. The maximum width of opening in the table below corresponds to the minimum object sensitivity for a light curtain.

Table 20: OSHA 1910.217 Table O-10

Distance of Opening from Point of Operation Hazard (in.)	Maximum Width of Opening (in.)
1/2 to1-1/2	1/4
1-1/2 to 2-1/2	3/8
2-1/2 to 3-1/2	1/2
3-1/2 to 5-1/2	5/8
5-1/2 to 6-1/2	3/4
6-1/2 to 7-1/2	7/8
7-1/2 to 12-1/2	1-1/4
12-1/2 to 15-1/2	1-1/2
15-1/2 to 17-1/2	1-7/8
17-1/2 to 31-1/2	2-1/8

NOTE: If the guarded machine is not equipped with a stop time performance monitor, a percentage increase factor should be applied to the stop time of the machine to allow for braking system wear. Contact your machine manufacturer for information.

D_{pf} Depth penetration factor, to provide for the possibility that fingers or hands will penetrate through the sensing field before detection occurs. This value is determined by the Penetration Depth Factor Chart from ANSI B11.1 (see Figure 18 on page 42). Alternately, the following ANSI formula can be used: D_{pf} = 3.4 (S-0.276), where S = minimum object sensitivity.

SECTION 11: INSTALLATION

⚠DANGER

HAZARDOUS VOLTAGE

Turn off all power before working on this equipment.

Failure to follow this instruction will result in death or serious injury.

⚠WARNING

IMPROPER SETUP OR APPLICATION

- Read this information completely before starting the installation procedure.
- An XUS-LM system should only be installed, checked, and maintained by a qualified person as defined in “Employer Responsibilities” on page 19.
- It is important that the user be familiar with the installation requirements, safe mounting distance, controls, and features before using the XUS-LM system.

Failure to follow this instruction can result in death or serious injury.

Reflective Surface Interference

A reflective surface adjacent to the detection zone can deflect the optical beam and may cause an obstruction in the zone not to be detected. The reflective surface may be part of the machine, mechanical guard, or workpiece. Therefore, a minimum distance (d) must exist between the reflective object and the center line of the XUS-LM detection zone. The Test Procedure on page 70 must be used to test for this condition.

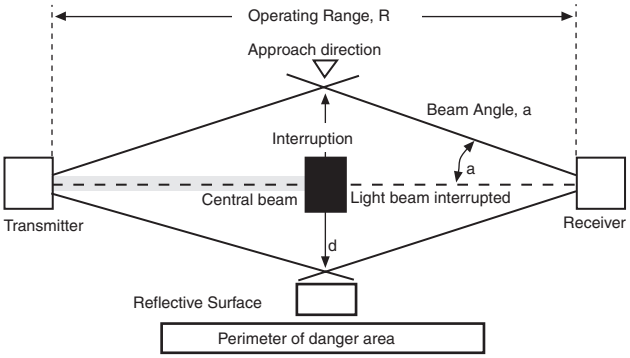


Figure 19: Correct Mounting Example with Proper Alignment

In Figure 19, the interruption is clearly detected. The reflective object is outside of the beam angle.

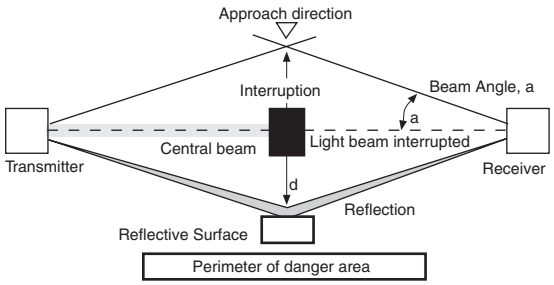


Figure 20: Unsafe Mounting Example

In Figure 20, the interruption is not detected because of the reflection. The reflective object is inside the beam angle.

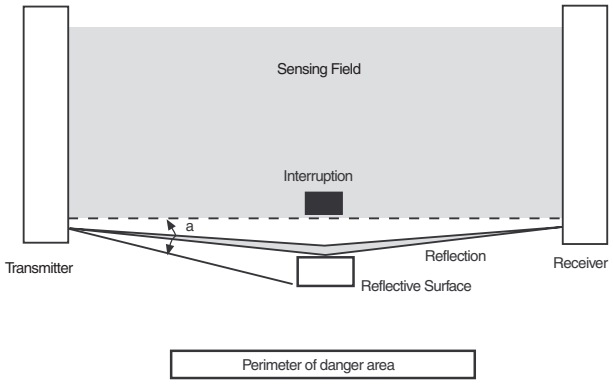


Figure 21: Unsafe Mounting Example

In Figure 21, the interruption is not detected because of the reflection. Reflective surface interference may also appear above and below the sensing field.

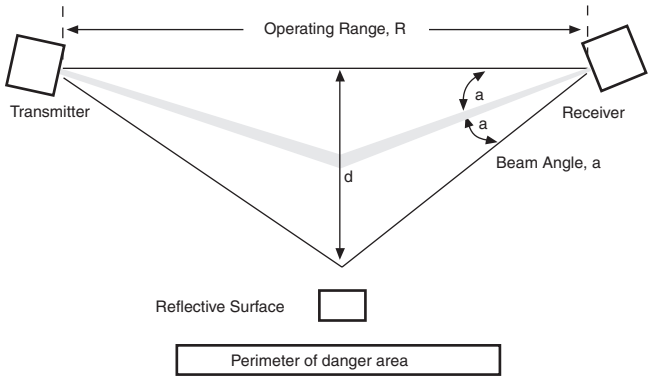


Figure 22: Worst Case Alignment Example

The example in Figure 22 shows the minimum distance from the reflective surface, d, to one side of the beam center line.

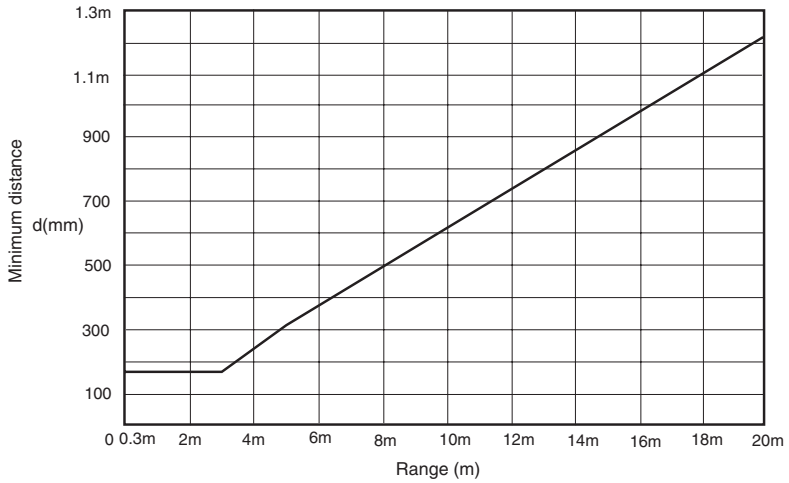


Figure 23: Minimum Distance From a Reflective Surface as a Function of Range

General Considerations

Additional Guarding

Areas of access to the point of hazardous operation not guarded by the XUS-LM system must be protected by suitable means such as a fixed barrier guard, an interlocked guard, or a safety mat. See Figure 24.

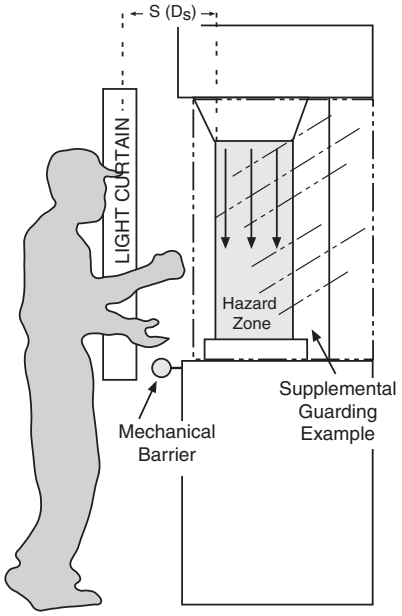


Figure 24: Correct Light Curtain Installation Example

Installation of Multiple Systems

When two or more XUS-LM systems are mounted in close proximity and in alignment with each other, precautions should be taken to avoid one curtain interfering with another. This can be corrected by mounting the transmitters and receivers back-to-back or stacked. See Figure 25.

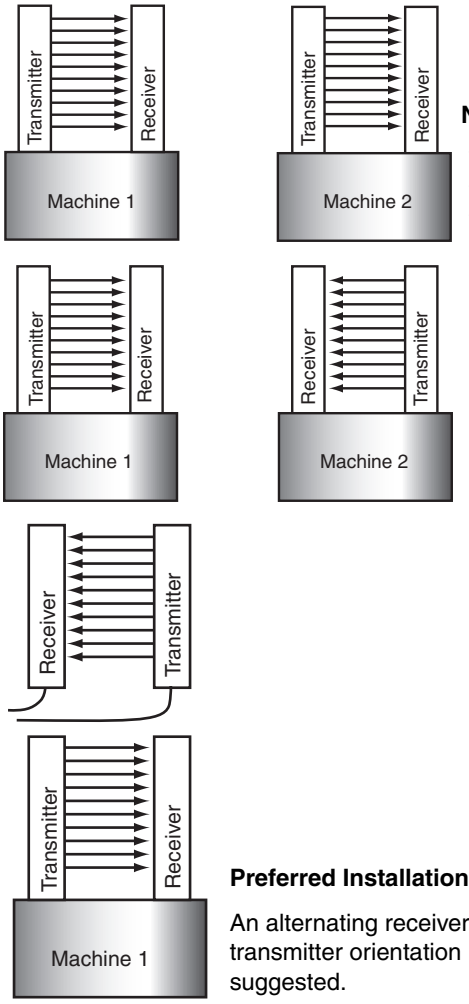


Figure 25: Multiple Light Curtain Installation Configurations

English

Detection Zone

The XUS-LM system detection zone is delineated by the inside edge of the transmitter and receiver endcaps. The area outside these marks is not protected. Position the XUS-LM system so that it is only possible to access the danger point through the detection zone.

Marking Minimum Object Resolution

Serial number labels on the transmitter and receiver indicate three possible minimum object resolutions. During installation, use a permanent marker to obscure the object resolutions not set. This will depend on whether no Floating Blanking, 1-beam, or 2-beam Floating Blanking is set. See “Using ECS/Blanking with Floating Blanking” on page 32.

Alignment

Physical alignment of the transmitter and receiver units is easiest when the XUS-LM system is in the automatic start operating mode with ECS/Blanking inactive. The units should be in the same plane and at equal height.

If the device is receiving power and all beam indicators are off, the transmitter and receiver are properly aligned. To ensure that the alignment position is stable, verify that a small deviation of the receiver (or the transmitter) around the alignment position does not cause any beam indicator to come on.

Cable Assemblies

Receiver cable connections are color coded red and transmitter cable connections are black. Details for the pinout connections of the factory-supplied connector are in Table 22 on page 51.

Input Power Requirements/Connections

The XUS-LM system operates directly from 24 $V_{\overline{\overline{\ldots}}}$ ±10%. Power to the XUS-LM system must come from a dedicated power supply which meets the requirements of IEC 60204-1 and IEC 61496-1. **The XUS-LM system internally generates voltages for its own use. No other devices should be connected to these voltages.**

Special Requirements for Perimeter Guarding

In perimeter guarding applications, the XUS-LM system detection zone is placed around the outside perimeter of a guarded machine or robot. This placement leaves space for personnel to stand between the detection zone and the hazardous machine.

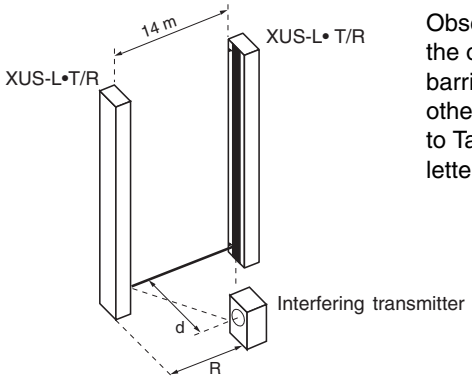
In this case, the guarded machine must only be restarted using a switch located outside and with a full view of the area of hazardous motion. Operation of the XUS-LM system in the start/restart interlock operating mode is suitable for perimeter guarding.

Presence Sensing Device Initiation/ESPE Used for Reinitiation of Machine Operation (IEC61496)

Using the light curtain to initiate a machine after an object is removed from the sensing area is called Presence Sensing Device Initiation (PSDI). Use of PSDI places additional requirements on the guarding and safety controls. It can restrict advanced light curtain features such as Floating Blanking and ECS/Blanking. Contact Schneider Electric for further information. Good sources of reference for PSDI include: ANSI RIA 15.06-1999, OSHA 1910.217(h), and ANSI B11.2-1995.

Other Infrared Transmitters

When using the light curtains in an environment containing other infrared transmitters, observe the recommendations in Figure 26 (per IEC 61496-2).



Observe the distance “d” between the optical axes of the XUSL barrier and the optical axes of other infrared transmitters. Refer to Table 21 for the values of the lettered callouts.

Figure 26: Use with Other Infrared Transmitters

Table 21: Distances Illustrated in Figure 26

Distance “R” (m/in.)	Min. Distance “d” (mm/in.)
0.5/19.68	270/10.63
0.75/29.52	260/10.24
1.5/59.05	260/10.24
3.0/118.11	250/9.84
5.0/196.85	420/16.54
10.0/393.70	840/33.07

The XUS-LM light curtains are insensitive to flashing lights, rotating flashing lights, welding sparks, and flashes.

English

SECTION 12: CONNECTING TO THE MACHINE CONTROL CIRCUIT

⚠WARNING

IMPROPER GROUNDING

- This product is designed for use on a 24 V⎓, negative ground (protective earth) electrical system only.
- Never connect the XUS-LM light curtain to a positive ground (protective earth) system.
- With a positive ground (protective earth) wiring scheme, certain simultaneous shorts of both safety outputs may not be detected and the guarded machine may not stop, resulting in severe operator injury.

Failure to follow this instruction can result in death or serious injury.

⚠WARNING

IMPROPER CONTROL

- Never use only a single safety output to control the machine.
- Should this single output fail, the machine may not stop.
- The machine must be connected using both safety outputs.

Failure to follow this instruction can result in death or serious injury.

Connecting to a Safety Monitoring Device

The wiring from the XUS-LM system to the machine control circuit must be control reliable as described in ANSI B11.19-1990 and on page 20 of this manual. Solid state outputs should be connected only to a control-reliable, safety-rated PLC, or to a control-reliable, safety-rated machine system.

Note that all safety inputs are directed to the monitoring device which also performs the EDM/MPCE monitoring function.

Connecting the Transmitter and Receiver to the Controller

Cable Connections

Receiver cable connectors are color-coded red and transmitter cable connectors are color-coded black.

Transmitter and receiver connections are made at terminal positions 23 through 34. Insert and secure the appropriate color conductor in the numbered position. Positions 26, 27, and 28 accept identically colored conductors from both the transmitter and receiver. For ease of installation, the terminal block can be removed from the controller. See Table 22 for a color code/terminal number cross-reference.

Table 22: Color Code/Terminal Number Cross Reference

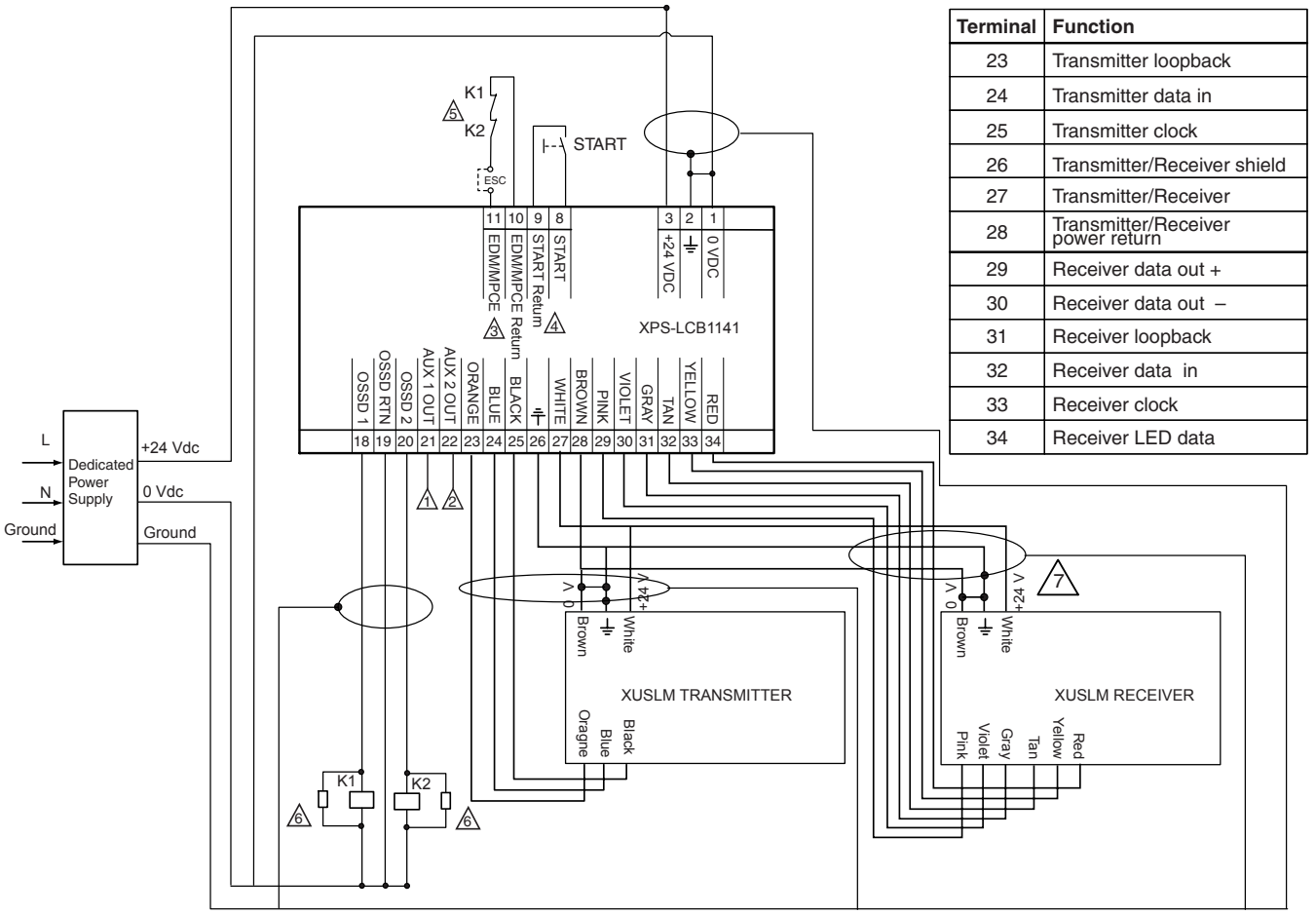
Terminal Number	Component	Conductor Color
23	Transmitter	Orange
24	Transmitter	Blue
25	Transmitter	Black
26	Transmitter and Receiver	Shield
27	Transmitter and Receiver	White
28	Transmitter and Receiver	Brown
29	Receiver	Pink
30	Receiver	Violet
31	Receiver	Gray
32	Receiver	Tan
33	Receiver	Yellow
34	Receiver	Red

English

English

Connecting Via Two Force-Guided Relays

The K1 and K2 control relays must provide force-guided relay outputs for machine control. See Figure 27 for the preferred connection method using two force-guided relays.



Terminal	Function
23	Transmitter loopback
24	Transmitter data in
25	Transmitter clock
26	Transmitter/Receiver shield
27	Transmitter/Receiver
28	Transmitter/Receiver power return
29	Receiver data out +
30	Receiver data out –
31	Receiver loopback
32	Receiver data in
33	Receiver clock
34	Receiver LED data

1. Auxiliary Output 1: NPN, 100 mA max., 30 Vdc max.
2. Auxiliary Output 2: PNP, 500 mA max., Vsupply -2V
3. For the purpose of bench testing prior to installation, the user may select EDM/MPCE OFF. In this case, the EDM/MPCE input must be connected to EDM/MPCE RETURN.
4. If remote START is not used, connect START output to START RETURN.
5. EDM/MPCE monitoring must be used when force-guided relays are used as the Final Switching Devices. Connect the EDM/MPCE output to EDM/MPCE RETURN through the NC contacts.
6. The EDM/MPCE coils must be suppressed with the arc suppressor provided in the documentation kit.
7. Install a wire between the 0 V input and Ground terminals on transmitter and receiver.

Figure 27: Connecting Via Two Force-Guided Relays

SECTION 13: CHECKOUT AND TEST PROCEDURES

Checkout Procedure

Once the XUS-LM system has been configured, mounted, aligned, and properly connected to the machine control system, the initial checkout procedures detailed in Appendix A on page 69 must be performed by qualified personnel. A copy of the checkout results should be kept with the machine records.

⚠WARNING

IMPROPER MAINTENANCE

- The tests outlined in the Test Procedure in Appendix B (page 70) must be performed at installation, according to the employer's regular inspection program and after any maintenance, tooling change, set-up, adjustment, or modification to the XUS-LM system or the guarded machine.
- Where a guarded machine is used by multiple operators or shifts, it is suggested that the test procedure be performed at each shift or operation change.
- Testing ensures that the light curtain and the machine control system work properly to stop the machine.

Failure to follow this instruction can result in death or serious injury.

Test Procedure

The Test Procedure must be performed by qualified personnel. To test the XUS-LM system with ECS/Blanking and Floating Blanking disabled, use the factory-supplied test object. For applications where ECS/Blanking or Floating Blanking are enabled, see Tables 13 and 14 on page 33 to determine the proper size test object.

When using an XUS-LM system set for Automatic Start Mode operation in conjunction with an XPS relay module, it is necessary to verify that the XPS outputs can properly change state by causing an intentional beam break at least once every change of shift or 24 hours of operation.

English

Using the Test Object

When using the test object, guide it through the detection zone as shown in Figure 28. Pay particular attention to areas which may be affected by ECS/Blanking. If Floating Blanking is active, use a properly-sized test object.

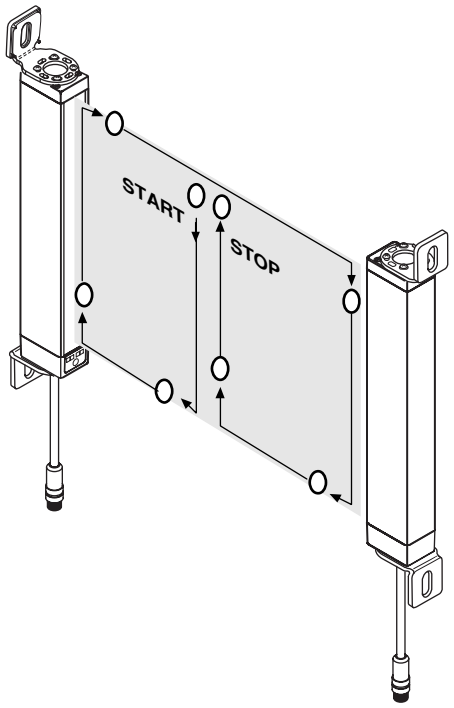


Figure 28: Test Object Pattern

Test Considerations When Using ECS/Blanking or Floating Blanking

⚠WARNING

LOSS OF SENSITIVITY

- Using ECS/Blanking with Floating Blanking is an advanced feature. All situations which may occur to the XUS-LM system detection zone must be carefully considered.
- Improper use of ECS/Blanking and/or Floating Blanking will make the XUS-LM system less sensitive to objects in the detection zone.
- ECS/Blanking may require a hard barrier guard (see “Additional Guarding” on page 46).
- The XUS-LM system may be less sensitive to objects in the detection zone. ECS/Blanking or Floating Blanking may require an increase in the safety distance.
- Read the following section carefully.

Failure to follow this instruction can result in death or serious injury.

When ECS/Blanking and/or Floating Blanking are active, the user must verify that the detection zone is being used as intended, including the size and location of the selected/blanked beams.

Check for the following conditions:

1. That unauthorized modification of the detection zone is not possible. The controller should be installed in an enclosure with supervisor-controlled access.
2. That the area selected by ECS/Blanking is completely blocked by an obstruction; or that those areas not blocked by an obstruction are protected by supplemental guarding.

If either one of these conditions cannot be met, the safe mounting distance of the XUS-LM system should be modified in accordance with the safe mounting distance formulas presented in “Section 10: Safe Mounting Distance” on page 39.

Using a proper size test object and the method described in “Using the Test Object” on page 54, check those areas which have not been programmed by ECS/Blanking. Be sure that they have not been accidentally selected as well.

SECTION 14: TROUBLESHOOTING

The controller contains a two-digit diagnostic display, which presents numeric codes indicating both normal operation and system fault status. The display codes are described in Tables 23–27.

Table 23: Operational Codes

Code Displayed	System Status	Corrective Action
88	Power-up indication	None required
00	Normal operation: no floating blanking or Exact Channel Select/Blanking	None required
01	Normal operation: waiting for start signal	Press and release the start switch
02	Normal operation: floating blanking active	None required
03	Normal operation: Exact Channel Select/Blanking active	None required
04	Normal operation: floating blanking and Exact Channel Select/Blanking active	None required

Table 24: DIP Switch Fault Codes

Code Displayed	System Status	Corrective Action
20	General DIP switch fault	1. Check the setting of operating mode DIP switches 1 and 2. 2. Check the setting of floating blanking DIP switches 5 and 6.
21	Invalid DIP switch setting	Ensure that the settings of DIP switches 1 through 7 are valid and identically set between switch banks A and B.
22	DIP switch settings changed during operation	Press and release the start button or cycle power.
23	Invalid channel select or EDM/MPCE DIP switch settings	Ensure that the channel select and EDM/MPCE DIP switches settings are valid.

Table 25: Safety Output (OSSD) Faults

Code Displayed	System Status	Possible Cause/Corrective Action
30	General safety output (OSSD) fault	1. OSSD 1 is shorted to OSSD 2. Check the wiring. Wire according to manual. 2. OSSD 1 or OSSD 2 is shorted to power. Check the wiring. Wire according to manual. 3. OSSD 1 or OSSD 2 is shorted to ground. Check wiring. Wire according to manual.

Table 26: EDM/MPCE Faults

Code Displayed	System Status	Corrective Action
40	General EDM/MPCE fault	Possible incorrectly wired EDM/MPCE circuit. Check and wire according to manual.
41	EDM/MPCE opens before safety output (OSSD) activation	Ensure that the EDM/MPCE circuit is closed before OSSD activation.
43	EDM/MPCE opens when power is applied	Ensure that the EDM/MPCE circuit is closed when power is applied.

Table 27: Controller Faults

Code Displayed	System Status	Corrective Action
50	Internal controller fault	Replace the controller.
51	Receiver fault	1. Check the receiver-to-controller wiring connections. Correct errors. 2. Check the receiver cable for cuts. Ensure that it is properly connected to the quick-disconnect fitting. Replace or properly connect the cable as required. 3. If none of the above, return the receiver to Schneider Electric for repair.
52	Transmitter fault	1. Check the transmitter-to-controller wiring connections. Correct errors. 2. Check the transmitter cable for cuts. Ensure that it is properly connected to the quick-disconnect fitting. Replace or properly connect the cable as required. 3. If none of the above, return transmitter to Schneider Electric for repair.
53	Transmitter and receiver length mismatch or transmitter and receiver not connected	1. Ensure that the transmitter and receiver are identical in protected height. 2. Ensure that the transmitter and receiver are properly connected to the controller and that their cables are not damaged.
59	24 V⎓ power supply fault	Check the voltage supplied to the unit. Ensure that it is 24 V⎓ ± 10%.
70	Ground Fault	Check the ground connections on the controller, the transmitter, and the receiver.

English

SECTION 15: CLEANING

Accumulation of oil, dirt, and grease on the front filter of the XUS-LM transmitter and receiver can effect the system operation. Clean filters with a mild detergent or glass cleaner. Use a clean, soft, lint-free cloth. Painted XUS-LM surfaces may be cleaned with a mild de-greasing cleaner or detergent.

SECTION 16: SPECIFICATIONS AND ADDITIONAL INFORMATION

Table 28: Technical Specifications

		Controller Models	
		XUSLM•6••••• 14 mm (0.55 in.)	**XUSLM•5•••••** 30 mm (1.18 in.)
Conformity/Approvals			
Conforming to standards	IEC 61496-1-2 for TYPE 4 ESPE, ANSI/RIA R15.06, ANSI B11:19-1990, OSHA 1910.217(C), OSHA 1910.212 The ANSI and OSHA standards apply only to the USA.		
Other approvals	CE, TUV, UL, CSA		
Environment			
Ambient air temperature	C F	For operating: 0 to + 55 °C, for storage: -25 to +75 °C For operating: 32 to +131 °F, for storage:-13 to +167 °F	
Relative humidity	%	95% maximum, non-condensing	
Degree of protection		Transmitter and receiver: IP65 Controller: IP20	
Resistance to shock & vibration		According to EN61496-1, Shock: 10 g, impulse 16 ms, Vibration: 5 to 60 Hz maximum on all 3 axes	
Materials		Transmitter and receiver housing: Polyester powder painted aluminum (RED color: RAL3000) End caps: Anodized aluminum Front face: PMMA Controller: ABS thermoplastic (35 mm DIN rail mount)	
Optical Characteristics			
Minimum Object Resolution (MOS) (Use of ECS/Blanking will increase this value)	mm (in.)	14 mm (0.55 in.) no floating blanking 25 mm (0.98 in.) 1-beam floating blanking 36 mm (1.41 in.) 2-beam floating blanking Etc. (See pages 32–33.)	30 mm (1.18 in.) no floating blanking 52 mm (2.05 in.) 1-beam floating blanking 74 mm (2.91 in.) 2-beam floating blanking) Etc. (See pages 32–33.)
Nominal range	m (ft.)	0.3 to 4.5 m (1 to 15 ft.)	0.3 to 14 m (1 to 46 ft.) or 0.3 to 7 m (1 to 23 ft.)
Effective aperture angle		+2.5° maximum, transmitter and receiver at operating range > 3 m (9.8 ft.).	
Light source		GaAlAs Light Emitting Diode, 850 nm	
Resistance to light		Per IEC 61496-2	
Electrical Characteristics			
Response time	ms	Shown in Table 29 on page 59.	
Power supply	V	24 V⎓ +/-10%, 2.25 A. The power supply must meet the requirements of IEC 61496-1 and IEC 60204-1.	
Max. current consumption (no load)	A	0.4 A (10 watts)	
Controller current	A	0.45 A	
Resistance to interference		Level 3 according to IEC 61496-1	
Controller input power		1.8 A with the maximum load. The power supply must meet requirements of IEC 60204-1 and IEC 61496-1. (ABL7RP2403 or equivalent).	
Safety outputs (OSSD)		2 solid state PNP (NO) outputs, 625 mA @ 24 V⎓ (short circuit protection). See Notes 1 and 2 below.	
Alarm outputs		1 NPN output 100 mA @ 24 V ⎓ or 1 PNP output 500 mA @ 24 V⎓. See Note 1 below.	
EDM/MPCE monitor		50 mA @ 24 V⎓ steady state	
Signals		Transmitter (power): 1 LED; Receiver: 4 LEDs (Stop, Run, Interlock, Floating Blanking or ECS/Blanking). Controller: 4 LEDs, plus two-digit diagnostic display	
Connections		Transmitter: 5-pin male M12 connector Receiver: 8-pin male M12 connector	
Cable lengths		Extension cables are available separately in lengths of 3 m (9.8 ft.),10 m (32.8 ft.), and 30 m (98.4 ft.). Maximum cable length of 30 meters (98.4 ft.) is dependent on load current and power supply.	
Cable gauge		Receiver and transmitter cables: 22 AWG (0.34 mm^2)	
Cable resistance		Receiver and transmitter cables: 0.1686 Ω per ft. (0.56 Ω per m)	
Tightening torque (per IEC60999-1)		Control screw terminals: 0.3 N•m (2.66 lb-in) recommended	
		Mounting bracket screws: 0.9 N•m (8 lb-in)	

NOTE 1: The total current required by two solid state outputs and the non-safety auxiliary output should not exceed 1.1 A.

NOTE 2: 24 V⎓ is nominal. Dropout voltage is 2 V.

Specifications are subject to change without notice.

XUS-LM Response Times

Table 29: Response Time by Resolution and Protected Height

XUSLM•6••••• (14 mm)			XUSLM•5••••• (30 mm)		
Protected Height mm (in.)	Number of Beams	Response Time (ms)	Protected Height mm (in.)	Number of Beams	Response Time (ms)
159 (6.25)	14	7.3	159 (6.25)	7	6.6
309 (12.16)	28	8.8	309 (12.16)	14	7.3
459 (18.07)	42	10.2	459 (18.07)	21	8.1
609 (23.97)	56	11.7	609 (23.97)	28	8.8
759 (29.88)	70	13.1	759 (29.88)	35	9.5
909 (35.78)	84	14.6	909 (35.78)	42	10.2
1059 (41.69)	98	16.0	1059 (41.69)	49	11.0
1209 (47.59)	112	17.5	1209 (47.59)	56	11.7
1359 (53.50)	126	19.0	1359 (53.50)	63	12.4
1509 (59.40)	140	20.4	1509 (59.40)	70	13.1
1659 (65.31)	154	21.9	1659 (65.31)	77	13.9
1809 (71.22)	168	23.3	1809 (71.22)	84	14.6

NOTE: The response time here is the response time for the light curtain and the XPSLCB1141 module. You must add the appropriate response time for the safety relay wired to the OSSD module output.

English

English

Dimensions

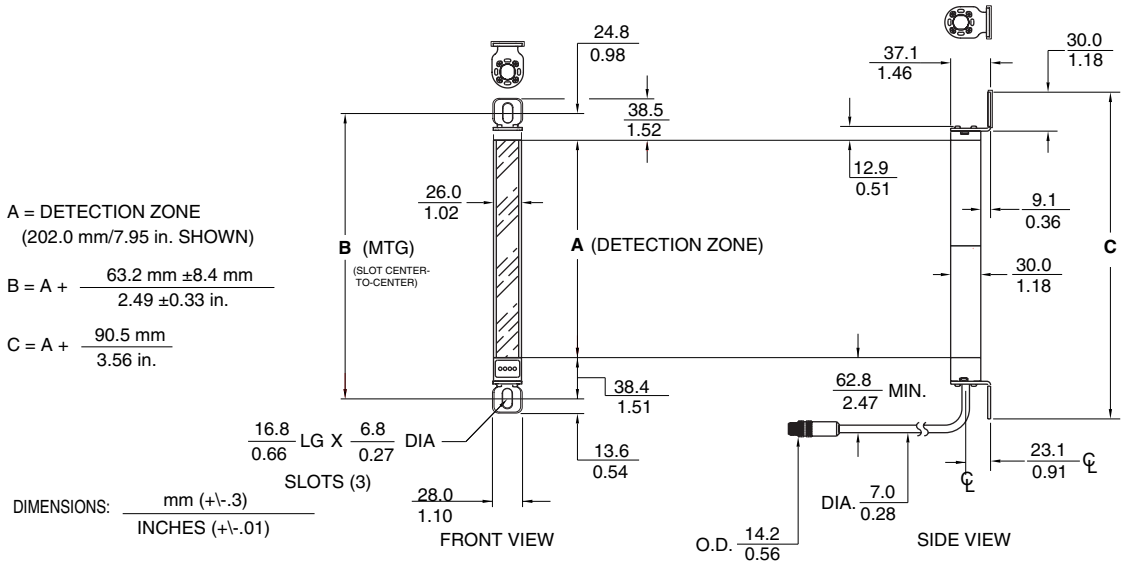


Figure 29: Dimensions (See Table 30 for Dimensions A, B, and C)

Table 30: XUS-LM Transmitter and Receiver Lengths, Detection Zone Dimensions (mm/in.)

Protected Height	150	300	450	600	750	900
A	159.0/6.26	309.0/12.17	459.0/18.07	609.0/23.98	759.0/29.88	909.0/35.79
B	222.2/8.75	372.2/14.66	522.2/20.56	672.2/26.47	822.2/32.37	972.2/38.28
C	249.4/9.82	399.4/15.73	549.4/21.63	699.4/27.54	849.4/33.44	999.4/39.35

Protected Height	1050	1200	1350	1500	1650	1800
A	1059.0/41.69	1209.0/47.60	1359.0/53.50	1509.0/59.41	1659.0/65.3	1809.0/71.22
B	1122.2/44.18	1272.2/50.09	1422.2/55.99	1572.2/61.90	1722.2/67.80	1872.2/73.71
C	1149.4/45.25	1299.4/51.16	1449.4/57.06	1599.4/62.97	1749.4/68.87	1899.4/74.78

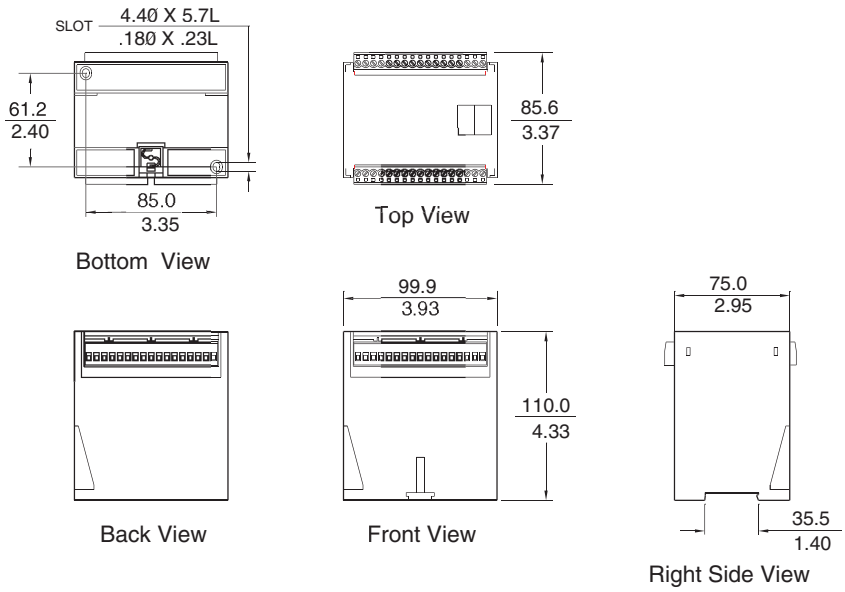


Figure 30: XPSLCB1141 DIN Rail Box Dimensions

Warranty

Consult your local sales representative for conditions of sale.

Repairs

Schneider Electric offers product repair service at the factory. If you need repairs made to any Schneider Electric light curtain product, contact our Customer Service Department.

Documentation Criteria

This publication has been carefully checked for accuracy and is believed to be fully consistent with the products it describes. However, Schneider Electric does not assume liability for the contents of this publication, the examples used within, or the use of any product described herein. Schneider Electric reserves the right to make changes to products and/or documentation without further notification.

English

SECTION 17: SPARE PARTS

Transmitters and Receivers

Spare transmitters and receivers are available through your local Schneider Electric distributor. Refer to Tables 31–33 for model numbers.

Table 31: XUSLM•6 (up to 4.5 m) Spare Transmitters and Receivers

Protected Height (mm/in.)	Transmitter Model No.	Receiver Model No.
159/6.26	XUSLMN6E0150T	XUSLMN6W0150R
309/12.17	XUSLMN6E0300T	XUSLMN6W0300R
459/18.07	XUSLMN6E0450T	XUSLMN6W0450R
609/23.98	XUSLMN6E0600T	XUSLMN6W0600R
759/29.88	XUSLMN6E0750T	XUSLMN6W0750R
909/35.79	XUSLMN6E0900T	XUSLMN6W0900R
1059/41.69	XUSLMN6E1050T	XUSLMN6W1050R
1209/47.60	XUSLMN6E1200T	XUSLMN6W1200R
1359/53.50	XUSLMN6E1350T	XUSLMN6W1350R
1509/59.41	XUSLMN6E1500T	XUSLMN6W1500R
1659/65.31	XUSLMN6E1650T	XUSLMN6W1650R
1809/71.22	XUSLMN6E1800T	XUSLMN6W1800R

Table 32: XUSLM•5 (up to 7 m) Spare Transmitters and Receivers

Protected Height (mm/in.)	Transmitter Model No.	Receiver Model No.
159/6.26	XUSLMP5E0150T	XUSLMP5W0150R
309/12.17	XUSLMP5E0300T	XUSLMP5W0300R
459/18.07	XUSLMP5E0450T	XUSLMP5W0450R
609/23.98	XUSLMP5E0600T	XUSLMP5W0600R
759/29.88	XUSLMP5E0750T	XUSLMP5W0750R
909/35.79	XUSLMP5E0900T	XUSLMP5W0900R
1059/41.69	XUSLMP5E1050T	XUSLMP5W1050R
1209/47.60	XUSLMP5E1200T	XUSLMP5W1200R
1359/53.50	XUSLMP5E1350T	XUSLMP5W1350R
1509/59.41	XUSLMP5E1500T	XUSLMP5W1500R
1659/65.31	XUSLMP5E1650T	XUSLMP5W1650R
1809/71.22	XUSLMP5E1800T	XUSLMP5W1800R

Table 33: XUSLM•5 (up to 14 m) Spare Transmitters and Receivers

Protected Height (mm/in.)	Transmitter Model No.	Receiver Model No.
159/6.26	XUSLMU5E0150T	XUSLMU5W0150R
309/12.17	XUSLMU5E0300T	XUSLMU5W0300R
459/18.07	XUSLMU5E0450T	XUSLMU5W0450R
609/23.98	XUSLMU5E0600T	XUSLMU5W0600R
759/29.88	XUSLMU5E0750T	XUSLMU5W0750R
909/35.79	XUSLMU5E0900T	XUSLMU5W0900R
1059/41.69	XUSLMU5E1050T	XUSLMU5W1050R
1209/47.60	XUSLMU5E1200T	XUSLMU5W1200R
1359/53.50	XUSLMU5E1350T	XUSLMU5W1350R
1509/59.41	XUSLMU5E1500T	XUSLMU5W1500R
1659/65.31	XUSLMU5E1650T	XUSLMU5W1650R
1809/71.22	XUSLMU5E1800T	XUSLMU5W1800R

Cable

Table 34: Cable Part Numbers

Cable Length (m/ft.)	Transmitter Part No.	Receiver Part No.
3.0/9.8	XSZMCT03	XSZMCR03
10.0/32.8	XSZMCT10	XSZMCR10
30.0/98.5	XSZMCT30	XSZMCR30

Additional Spare Parts

Table 35: Additional Spare Parts

Description	Part No.
Mounting Brackets w/ Hardware	XUSLZ214
Screws for Cover (50)	XPSLCBZ225
Arc Suppression Kit	XUSLZ500
Microprocessor Control Box	XPSLCB1141
Mounting Bracket for Shock Mount Kit	XUSLZ216

English

SECTION 18: ACCESSORIES

Shock Mount Kit

This kit is used to isolate mirrors from possible sources of vibration. It can also be used to shock-mount controller, power supplies, transmitters, and receivers. Eight shock mounts are included. You need to purchase three mounting bracket pairs (XUSLZ216, see Table 35 on page 63) for each transmitter and for each receiver.

Part Number	Description
XSZSMK	XSZSMK and XSZSMK1 shock mounts secured with 10-32 studs
XSZSMK1	
XSZSMK2	XSZSMK2 shock mount secured with 1/4-20 studs

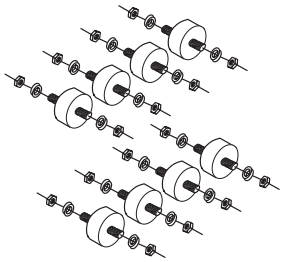


Figure 31: Shock Mount Kit

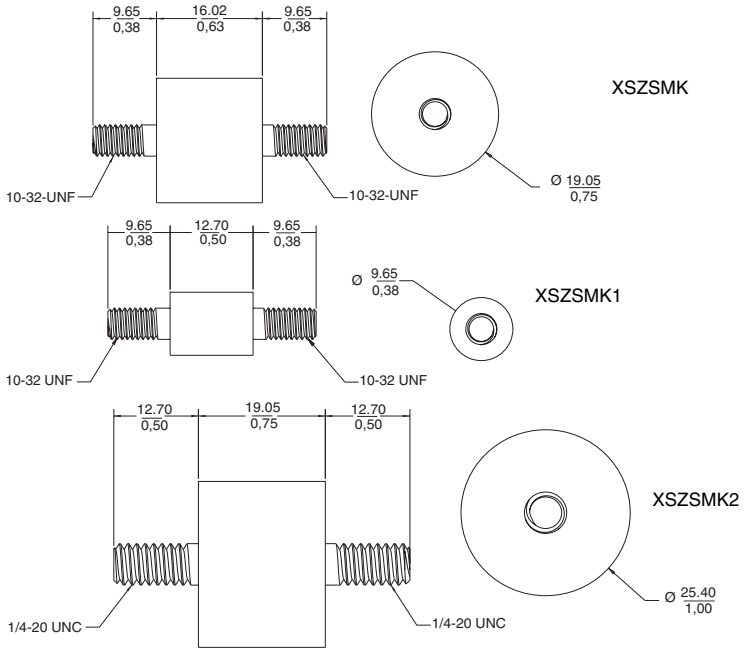


Figure 32: Shock Mount Kit Dimensions (mm/in)

Table 36: Recommended Mounting Methods

Shock Mount Kit	Compression Mount					Shear Mount				
	Max. Load		Torque (K)		Natural Freq. (Hz)	Max. Load		Torque (K)		Natural Freq. (Hz)
	lb	kg	lb-in	N•m		lb	kg	lb-in	N•m	
XSZSMK	18.0	8.16	222.5	25.16	11.0	3.0	1.36	27.7	3.13	9.5
XSZSMK1	4.8	2.177	96.1	10.86	14.0	2.5	1.13	20.7	2.34	9.0
XSZSMK2	55.0	24.94	949.7	107.39	13.0	23.0	10.43	132.2	14.94	7.5

Table 37: Weight Classes

	Weight Class			
Product (Lengths in mm)	**1**	**2**	**3**	**4**
XUSLM Lengths 150–600	X			
XUSLM, Lengths 750–1800		X		
XUSZM, Lengths 152–457		X		
XUSZM, Lengths 508–711			X	
XUSZM, Lengths 762–1016				X
XUSZM, Lengths >1016	**Use of shock mount kits is not recommended**			
XUSZA, Length 102	X			
XUSZA, Length 152–1067		X		
XUSZA, Length 1219–1626			X	
XUSZA, Length 1829 –2134				X

English

Table 38: Shock Applications [1]

Mounting Method	Weight Class 1		Weight Class 2		Weight Class 3		Weight Class 4	
Shear Mounted	XSZSMK	Using two mounts per head	XSZSMK	Using two or four mounts per head	XSZSMK	Using four mounts per head	XSZSMK	Using four mounts per head
	XSZSMK1		XSZSMK1		XSZSMK1		XSZSMK1	
					XSZSMK2	Using two or four mounts per head	XSZSMK2	Using two or four mounts per head
Compression Mounted	Not Recommended				XSZSMK	Using two mounts per head	XSZSMK	Using two mounts per head
			XSZSMK1	Using two mounts per head	XSZSMK1	Using two or four mounts per head	XSZSMK1	Using four mounts per head

[1] Low frequency, high amplitude applications, such as punch presses, where strong shock can be present.

Table 39: Vibration Applications [2]

Mounting Method	Weight Class 1		Weight Class 2		Weight Class 3		Weight Class 4	
Shear Mounted	XSZSMK	Using two or four mounts per head	XSZSMK	Using two or four mounts per head	XSZSMK	Using two or four mounts per head	XSZSMK	Using four mounts per head
	XSZSMK1		XSZSMK1		XSZSMK1	Using four mounts per head	XSZSMK1	
			XSZSMK2	Using two mounts per head	XSZSMK2	Using two or four mounts per head	XSZSMK2	Using two or four mounts per head
Compression Mounted			XSZSMK	Using two mounts per head	XSZSMK	Using two or four mounts per head	XSZSMK	Using two mounts per head
	XSZSMK1	Using two mounts per head	XSZSMK1	Using two or four mounts per head	XSZSMK1	Using four mounts per head	XSZSMK1	Using four mounts per head

[2] High frequency, low amplitude applications, such as offset printing machines, where constant vibration can be present.

Mirrors
Mounting Recommendations

Mirrors must be firmly mounted and protected against shocks. Observe safety distances throughout the protected zone, including the distances to possible reflective surfaces.

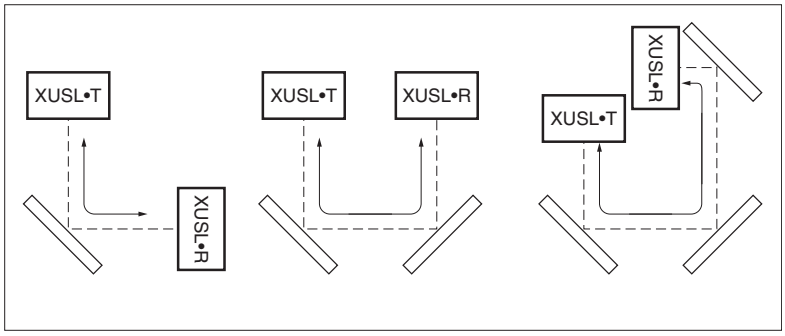


Figure 33: Mirror Configurations

The total nominal range between the transmitter and the receiver will be reduced according to the number of mirrors.

Table 40: Recommended Maximum Range for Glass Mirrors

No. of Mirrors	XUSLMN6••••	XUSLMP5••••	XUSLMU5••••
1	3.9 m (12.79 ft.)	6.1 m (20.01 ft.)	12.3 m (40.35 ft.)
2	3.4 m (11.15 ft.)	5.3 m (17.38 ft.)	10.7 m (35.10 ft.)
3	3.0 m (9.84 ft.)	4.7 m (15.41 ft.)	9.5 m (31.16 ft.)
4	2.7 m (8.85 ft.)	4.2 m (13.77 ft.)	8.4 m (27.55 ft.)

Table 41: Recommended Maximum Range for Stainless Steel Mirrors

No. of Mirrors	XUSLMN6••••	XUSLMP5••••	XUSLMU5••••
1	3.6 m (11.81 ft.)	5.7 m (18.70 ft.)	11.4 m (37.40 ft.)
2	3.0 m (9.84 ft.)	4.6 m (15.09 ft.)	9.3 m (30.51 ft.)
3	2.4 m (7.87 ft.)	3.8 m (12.46 ft.)	7.7 m (25.26 ft.)
4	2.0 m (6.56 ft.)	3.1 m (10.17 ft.)	6.3 m (20.66 ft.)

Mirror Dimensions

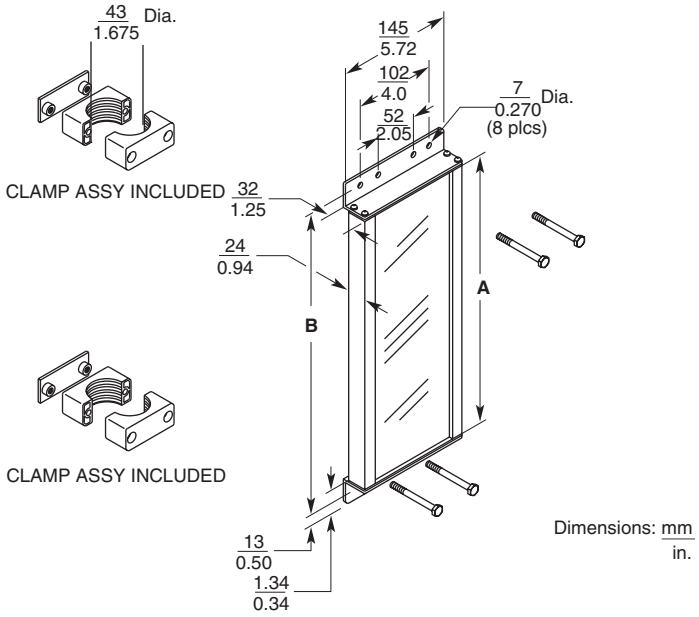


Figure 34: Mirror Dimensions (See Table 42 for Dimensions A and B)

Table 42: Mirror Dimensions A and B

Part Number		Dimension A (mm/in.)	Dimension B (mm/in.)
Glass	**Stainless Steel**		
XUSZM0152	XUSZA0152	191/7.5	233/9.18
XUSZM0305	XUSZA0305	343/13.5	386/15.18
XUSZM0457	XUSZA0457	495/19.5	538/21.18
XUSZM0508	XUSZA0508	546/21.5	589/23.18
XUSZM0610	XUSZA0610	749/29.5	792/31.18
XUSZM0762	XUSZA0762	800/31.5	843/33.18
XUSZM0813	XUSZA0813	851/33.5	894/35.18
XUSZM0914	XUSZA0914	953/37.5	995/39.18
XUSZM1016	XUSZA1016	1054/41.5	1097/43.18
XUSZM1067	XUSZA1067	1105/43.5	1148/45.18
XUSZM1219	XUSZA1219	1257/49.5	1300/51.18
XUSZM1321	XUSZA1321	1359/53.5	1402/55.18
XUSZM1372	XUSZA1372	1410/55.5	1452/57.18
XUSZM1422	XUSZA1422	1461/57.5	1503/59.18
XUSZM1524	XUSZA1524	1562/61.5	1605/63.18
XUSZM1626	XUSZA1626	1664/65.5	1706/67.18
XUSZM1830	XUSZA1830	1867/73.5	1910/75.18
XUSZM2134	XUSZA2134	2172/85.5	2214/87.18

English

SECTION 19: GLOSSARY

ANSI: American National Standards Institute. Administrator and coordinator of the US private sector standardization system.

Channel: a pair of beams between an XUS-LM transmitter and receiver.

C Type Standard: C type standards call for additional distance in minimum safe distance calculations based on the detection capability of the safety device.

Detection Zone: The zone within which a specified test piece will be detected by the XUS-LM system.

ECS/B: Exact Channel Select/ Blanking. Disables a selected, fixed area of the detection zone.

EDM/MPCE: A means by which the electro-sensitive protective equipment (ESPE) monitors the state of control devices which are external to the ESPE. The electrically powered element directly controls the normal operation of a machine in such a way that it is the last (in time) to function when machine operation is to be initiated or arrested.

FB: Floating Blanking. One or two channels disabled at any location in the detection zone.

Minimum Object Sensitivity (MOS): The largest allowable size of an interruption in the sensing field.

OFF State: The state in which the output circuit is interrupted and does not permit current to flow.

ON State: The state in which the output circuit is complete and permits the flow of current.

OSHA: Occupational Safety & Health Administration. A U.S. government agency.

Output Safety Switching Device (OSSD): The component of the safety light curtain connected to the machine control system which, when the light curtain detection zone is interrupted, responds by going to the OFF state. Also known as a safety output.

Test Object: An opaque cylindrical object used to verify the detection capability of the XUS-LM system.

APPENDIX A: CHECKOUT PROCEDURE

The Checkout Procedure in Table 43 must be performed by qualified personnel during the initial installation and at least once every three months thereafter or more frequently depending on machine usage and company guidelines.

Make a copy of the checkout procedure form and use the copy as the checkout log to be stored with the machine records. Use caution when working around hazardous voltages which may be present during this procedure.

Machine Identification:_____

Date:_____

Table 43: Checkout Procedure

Item	Condition	Comments
1. Verify that the guarded machine is compatible with the type of machine which may be used with the XUS-LM system. See “Section 2: Important Safety Warnings” on page 19 for further information.	❑ Pass ❑ Fail	
2. Verify that the mounting distance of the XUS-LM system is equal to or greater than the minimum safe distance from the danger point. See “Section 10: Safe Mounting Distance” on page 39 for more information.	❑ Pass ❑ Fail	
3. Determine that all access to the danger point not protected by an XUS-LM system is guarded by other means, such as gates, fencing, wire, or other approved methods. Verify that all additional guarding devices are installed and operating properly.	❑ Pass ❑ Fail	
4. Make sure the operator is not able to stand between the XUS-LM system detection zone and the machine danger point. Verify that the light curtain can only be reset from a position outside and within view of the hazardous machine area.	❑ Pass ❑ Fail	
5. Inspect the electrical connections between the guarded machine control system and the XUS-LM system. Verify that they are properly connected to the machine such that a stop signal from the XUS-LM system results in an immediate halt of the machine's cycle. See “Section 12: Connecting to the Machine Control Circuit” on page 50.	❑ Pass ❑ Fail	
6. If the EDM/MPCE monitoring feature is not used, proceed to step 7. To test the EDM/MPCE feature, verify that the feature has been enabled. Turn the machine power on. Cycle the machine. Place a temporary jumper wire between the EDM/MPCE connections. The XUS-LM system should enter an alarm condition. Remove the temporary jumper. Press and release the Start button.	❑ Pass ❑ Fail	
7. Record the test results in the machine log. Then perform the Test Procedures on page 70.		❑ Recorded results

Comments_____
_____
_____
_____
_____

Technician Signature:_____

APPENDIX B: TEST PROCEDURES

The tests described in Table 44 must be performed by qualified personnel during initial XUS-LM system installation, according to the employer's regular inspection program, and after any maintenance, adjustment or modification to the XUS-LM system or the guarded machine.

Testing ensures that the light curtain, safety system, and the machine control system work together to properly stop the machine. Failure to test properly could result in serious injury to personnel. To test the XUS-LM system, use the correct size test object.

Table 44: Test Procedures

Item	Condition	Comments
1. Disable the machine to be guarded. Turn power on to the XUS-LM system.	❑ Pass ❑ Fail	
2. Visually inspect the machine to ensure that access to the danger point is only through the XUS-LM detecting zone. If not, additional guarding, including mechanical barriers, may be required. Verify that all additional guarding devices and barriers are installed and operating properly.	❑ Pass ❑ Fail	
3. Verify that the mounting distance of the XUS-LM system is equal to or greater than the calculated minimum safe distance from the danger point. See "Section 10: Safe Mounting Distance" on page 39 for further information. Ensure that the operator is not able to stand between the XUS-LM detection zone and the danger point.	❑ Pass ❑ Fail	
4. Check for signs of external damage to the XUS-LM system, the machine, and the electrical cables and wiring. If damage is found, lockout the machine in an off condition and report to the supervisor.	❑ Pass ❑ Fail	
5. Interrupt the XUS-LM system detection zone with the proper size test object. Move the test object inside the perimeter (along the top, sides and bottom) of the detection zone and up and down through the center. At least one individual beam indicator must be lit while the test object is anywhere in the detection zone. If in automatic start mode, verify that the red machine start light is lit. If in start/restart interlock mode, verify that the red machine stop and yellow interlock lights are on. Press and release the Start button before proceeding to step 6.	❑ Pass ❑ Fail	
6. Start the machine. While the machine is in motion, interrupt the detection zone with the test object. The machine should stop immediately. Never insert the test object into the dangerous parts of the machine. With the machine at rest, interrupt the detection zone with the test object. Verify that the machine will not start with the test object in the detection zone.	❑ Pass ❑ Fail	
7. Verify that the braking system is working properly. If the machine does not stop fast enough, adjust the braking system or increase the distance from the detection zone to the danger point.	❑ Pass ❑ Fail	
8. If the safety devices or the machine fail any of these tests, do not run the machine. Immediately tag or lockout the machine to prevent its use and notify the supervisor.		

Comments:_____
_____
_____
_____
_____

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