



4700 Series

Installation and Operating Manual

for MC4700, MCF4700, MCJ4700, MS4700 & MSF4700 Series



Scientific Technologies Inc.
Optical Sensor Division
Manufacturing and Sales Office
6550 Dumbarton Circle
Fremont CA 94555 USA

1 / 888 / 510-4357

Tel: 510/608-3400
Fax: 510/744-1442
www.sti.com

NOTE:

This manual provides information for MC4700, MCF4700, MCJ4700, MS4700 and the MSF4700 transmitters and receivers, for use with both the LCM metal enclosure as well as the DIN box controller. Where information is common the term “4700 system” is used. Where information is specific to a certain version the exact model number (example: safe mounting distance calculation) is provided. The specifications and detailed information of the MCF4700, MCJ4700, MS4700 and the MSF4700 information are located at the back of the manual.



4700 Series Safety Light Curtain

Table of Contents

Section 1—Important Safety Warnings	page 9
Section 2—Significant Features	page 10
2.1—Standard Features	page 10
2.2—Optional Features	page 10
Section 3—System Access, Components and Indicators	page 11
3.1—Access to Configuration Switches	page 11
3.1.1—LCM DIN Controller	page 11
3.1.2—LCM Metal Chassis Controller	page 12
3.2—Location of the components and indicators	page 13
Section 4—System Operation	page 16
4.1—Operating States	page 16
4.1.1—Machine Run	page 16
4.1.2—Machine Stop	page 16
4.1.3—Interlock	page 16
4.1.4—Alarm	page 16
4.2—Operating Modes	page 16
4.2.1—Automatic Start	page 16
4.2.2—Start Interlock	page 17
4.2.3—Start/Restart Interlock	page 17
4.3—Operating Mode Selection	page 18
4.4—Start Switch Type Selection	page 18
Section 5—Detection Options	page 18
5.1—Exact Channel Select (ECS)	page 19
5.2—Multi Channel Select (MCS)	page 19
5.3—Floating Blanking	page 21
5.4—Using Exact Channel Select with Floating Blanking	page 21
5.4.1—The Effect of Exact Channel Select and Floating Blanking on Minimum Object Resolution	page 21
5.5—Activating and Programming Exact Channel Select	page 23

5.6—MCS Programing	page 23
5.7—Activating Floating Blanking	page 24
5.8—Additional Guarding When Using Exact Channel Select	page 24
Section 6—Diagnostic and Test Features	page 25
6.1.—Diagnostic Display	page 25
6.2—Individual Beam Indicators	page 25
6.3—Machine Primary Control Element (MPCE) Monitoring	page 25
6.3.1—Activating and Deactivating MPCE Monitoring	page 26
6.3.2—Activating and Deactivating MPCE Monitoring on the Metal Chassis Controller- Relay Output Version	page 26
6.4.—Status Indicator Lights	page 26
6.4.1—Safety Output status	page 26
6.4.2—Interlock Status	page 26
6.4.3—Alarm Status	page 26
6.4.4—Exact Channel Select and Floating Blanking Status	page 26
Section 7—Outputs	page 27
7.1—Safety Outputs	page 27
7.1.1—Din Controller and Metal Chassis Solid State Version	page 27
7.2.2—metal chassis Controller - Relay Output Version	page 27
7.2.—Auxiliary Outputs	page 27
7.2.1—DIN Controller and Metal Chassis Solid State Version	page 27
7.2.2—metal chassis Controller - Relay Output Version	page 27
7.2.3—Auxiliary Output Operating Modes	page 27
Section 8—Safe Mounting Distance	page 28
8.1—US Safe Distance Formulas	page 28
8.2—European Safety Distance Formulas	page 29
8.2.1—Safety Distance Formula for Systems with a Minimum Object Resolution of 40 mm or Less	page 29
8.2.2—Safety Distance Formula for Systems with a Minimum Object Resolution Greater Than 40 mm	page 30
8.2.3—Factors Affecting The Safety Distance Formula	page 30



Section 9—Installation page 31

 9.1—*Reflective Surface Interference* page 31

 9.2.—*Connecting Transmitter and Receiver to Controller* page 33

 9.2.1—*Cable Assemblies* page 33

 9.2.2—*Cable Connections* page 33

 9.3—*General Considerations* page 34

 9.3.1—*Additional Guarding* page 34

 9.3.2—*Installation of Multiple Systems* page 35

 9.3.3—*Detection Zone* page 36

 9.3.4—*Marking Minimum Object Resolution* page 36

 9.3.5—*Alignment* page 36

 9.3.6—*Input Power Requirements/Connections* page 36

 9.3.7—*Special Requirements for Perimeter Guarding* page 36

 9.3.8—*Presence Sensing Device Initiation* page 36

Section 10—Connecting To The Machine Control Circuit page 37

 10.1—*Din Controller* page 37

 10.1.1—*Connecting to a Safety Monitoring Device* page 38

 10.1.2—*Connecting Via an RM-1 Module* page 39

 10.1.3—*Connecting Via Two Force-Guided Relays* page 40

 10.2—*Metal Chassis Controllers* page 41

 10.2.1—*Connecting Via Two Normally Open Relay Safety Outputs* page 41

 10.2.2—*Connecting Via One Normally Open One Normally Closed Safety Relay Outputs*
 page 42

 10.2.3—*Connecting Solid State Safety Outputs to Two Force-Guided Relays* . . . page 43

 10.2.4—*Connecting Via a Safety Monitoring Device* page 44

Section 11—Checkout and Test Procedures page 45

 11.1—*Checkout Procedure* page 45

 11.2—*Test Procedure* page 45

 11.3—*Using the Test Object* page 45

11.4— <i>Test Considerations When Using Exact Channel Select or Floating Blanking</i> . . .	page 46
Section 12—<i>Troubleshooting</i>	page 46
Section 13—<i>Cleaning</i>	page 48
Section 14—<i>Specifications and Additional Information</i>	page 49
14.1— <i>System Specifications</i>	page 49
14.2— <i>MicroSafe MC4700 Series Dimensions</i>	page 49
14.2.1— <i>MC4700 Series Dimensions</i>	page 54
14.2.2— <i>MC4700 Spare Parts</i>	page 55
14.3— <i>MicroSafe Flexible MCF4700 Series</i>	page 54
14.3.1— <i>MCF4700 Series Dimensions</i>	page 54
14.3.2— <i>MCF4700 Spare Parts</i>	page 59
14.4— <i>MicroSafe Jointed MCJ4700 Series</i>	page 64
14.4.1— <i>MCJ4700 Segment Dimensions</i>	page 64
14.4.2— <i>90° Jointed MicroSafe MCJ4700 Dimensions</i>	page 55
14.4.3— <i>Sensor Assembly Instructions</i>	page 55
14.4.4— <i>Installation</i>	page 55
14.4.5— <i>Minimum Object Resolution at Joints</i>	page 55
14.4.6— <i>MCJ4700 Spare Parts</i>	page 55
14.5— <i>MiniSafe MS4700 Series</i>	page 70
14.5.1— <i>MS4700 Dimensions</i>	page 70
14.5.2— <i>MS4700 Spare Parts</i>	page 72
14.6— <i>MiniSafe Flexible MsF4700 Series</i>	page 76
14.6.1— <i>MSF4700 Series Dimensions</i>	page 77
14.6.2— <i>MSF4700 Spare Parts</i>	page 78
14.7— <i>DIN and LCM NEMA Controllers</i>	page 83
Section 15—<i>Glossary</i>	page 88
15.1— <i>Glossary Definitions</i>	page 88
Section 16—<i>Others</i>	page 99
16.1— <i>Warranty</i>	page 99
16.2— <i>Patents</i>	page 99
16.3— <i>Trademarks</i>	page 99
16.4— <i>Repairs</i>	page 99



16.5—*Documentation Criteria* page 99

Appendix A—*Checkout Procedure* page 89

 A.1—*Checkout Procedure Log* page 89

Appendix B—*Test Procedure* page 90

 B.1—*Test Procedure Log* page 90

Appendix C—*DeviceNet Operating Instructions* page 91

 C.1—*Introduction* page 91

 C.2—*Features* page 91

 C.2.1—*System identification* page 91

 C.2.2—*System status* page 91

 C.2.3—*System Settings* page 91

 C.2.4—*Diagnostic Information* page 92

 C.3—*Basic DeviceNet Network Connections* page 94

 C.4—*LCM-2XX series internal D-Net Wire Colors and Pin Outs* page 94

 C.4.1—*Screw Connectors for LCM-2XX series D-Net interface module* page 94

 C.5—*DeviceNet Configuration Switches* page 96

 C.5.1—*Switch Function Selection Description* page 97

 C.6 *Quick Disconnect Option* page 98

Table of Figures

Figure 3-1—Accessing the Configuration Switches on the LCM DIN Controller	page 11
Figure 3-2—Accessing the Configuration Switches on the LCM-Metal Chassis Controller .	page 12
Figure 3-3—4700 Transmitter and Receiver	page 13
Figure 3-4—DIN Controller Components	page 14
Figure 3-5—Metal Chassis Controller Components	page 15
Figure 4-1—Functional Flow Diagram	page 17
Figure 5-1—Connection Recommendations for LCM Metal Enclosure	page 20
Figure 5-2—Connection Recommendations for LCM DIN Box	page 20
Figure 5-3—Adding Hard guarding to Light Curtain when Using Channel Select	page 23
Figure 8-1—Safe Mounting Distance	page 28
Figure 9-1—Correct Mounting Example with Proper Alignment	page 31
Figure 9-2—Unsafe Mounting Example	page 31
Figure 9-3—Unsafe Mounting Example	page 32
Figure 9-4—Worst Case Alignment Example	page 32
Figure 9-5—Minimum Distance from a Reflective Surface as a Function of Range	page 32
Figure 9-6—Correct Light Curtain Installation Examples	page 34
Figure 9-7—Multiple Light Curtain Installation Configurations	page 35
Figure 9-8—Mounting Orientation	page 35
Figure 10-1—Connecting to a Safety Monitoring Device	page 38
Figure 10-2—Connecting via an RM-1 Module	page 39
Figure 10-3—Connecting Via Two Force-guided Relays	page 40
Figure 10-4—Connecting with Two Normally Open Safety Outputs	page 41
Figure 10-5—Connecting with One Normally Open One Normally Closed Safety Outputs	page 42
Figure 10-6—Connecting with Two Force Guided Relay Outputs	page 43
Figure 10-7—Connecting with Safety Monitoring Device	page 44
Figure 11-1—Test Object Pattern	page 45
Figure 14-1—MC4700 Series Dimensional Drawing	page 54
Figure 14-2—MicroSafe Flexible MCF4700 Dimensions	page 57
Figure 14-3—MicroSafe Jointed MCJ4700 Dimensions	page 64
Figure 14-4—90° Jointed MicroSafe MCJ4700 Dimensions	page 65
Figure 14-5—Assembly Instructions Steps	page 66
Figure 14-6—MS4700 Mechanical Drawing	page 70



Figure 14-7—*MiniSafe Flexible MSF4700 Dimensions* page 76

Figure 14-8—*DIN Controller Dimension Drawing* page 83

Figure 14-9—*LCM Nema Metal Chassis Controller Dimension Drawing* page 84

Figure 15-1—*DeviceNet Install Location* page 98

Figure 15-2—*DevieNet Wiring with Optional M12 Connector* page 98

Figure C-1—*Basic DeviceNet configuration* page 94

Figure C-2—*Pin Outs for Internal Screw Connectors used internally in the LCM-2XX* page 95

Figure C-3—*Pin Outs for Micro_Style Connectors* page 95

Figure C-4—*Pin Outs for Phoenix-style connectors used in the STI MC4700, LCM-2 interface*
. page 96

Figure C-5—*LCM-2 Power/DeviceNet board* page 96

Table of Tables

Table 3-1—*System Component Identification for the 4700 Transmitter and Receiver* page 13

Table 3-2—*System Component Identification for the LCM-1, LCM-2 and LCM-3 Controllers*
. page 14

Table 4-1—*Operating Mode Switch Settings* page 18

Table 5-1—*System Response to Exact Channel Select* page 19

Table 5-3—*System Response to Floating Blanking* page 21

Table 5-4—*Icon Key for Tables 5-1 and 5-2* page 21

Table 5-5—*Sample S and D_{pf} Factors for 12 mm Resolution Systems* page 22

Table 5-6—*Sample S and D_{pf} Factors for 14 mm resolution Systems* page 22

Table 5-7—*Sample S and D_{pf} Factors for 20mm resolution Systems* page 22

Table 5-8—*Sample S and D_{pf} Factors for 30 mm resolution Systems* page 23

Table 5-9—*Switch Settings, Exact Channel Select and Floating Blanking* page 24

Table 6-1—*Operational Display Code Summary* page 25

Table 6-2—*MPCE Switch Settings* page 26

Table 7-1—*Auxiliary Output Operating Mode Switch Settings* page 28

Table 9-1—*Color Code/Terminal Number Cross Reference for DIN Controllers* page 33

Table 9-2—*Color Code/Terminal Number Cross Reference Metal Chassis Controllers* page 33

Table 12-1—*Operational Codes* page 46

Table 12-2—*DIP Switch Fault Codes* page 47

Table 12-3— <i>Safety Output (OSSD) Faults</i>	page 47
Table 12-4— <i>MPCE Faults</i>	page 47
Table 12-5— <i>Controller Faults</i>	page 48
Table 14-1— <i>Response Time for 12 mm MC4700 and MS4700</i>	page 51
Table 14-2— <i>Response Time for 14 mm and 20 mm MC4700 and MS4700</i>	page 51
Table 14-3— <i>Response Times for 30 mm MC4700 and MS4700 systems</i>	page 52
Table 14-4— <i>12mm transmitter and Receiver Lengths</i>	page 54
Table 14-5— <i>14mm, 20 mm and 30 mm Transmitter and Receiver Lengths</i>	page 54
Table 14-6— <i>MC4700-12 Spare Transmitter and Receiver Model Number</i>	page 55
Table 14-7— <i>MC4700-14 Spare Transmitter and Receiver Model Number</i>	page 55
Table 14-8— <i>MC4700-20 Spare Transmitter and Receiver Model Number</i>	page 56
Table 14-9— <i>MC4700-30 Spare Transmitter and Receiver Model Number</i>	page 56
Table 14-10— <i>MCF4700-12 Dimensions First & Middle Segment</i>	page 58
Table 14-11— <i>MCF4700-12 Dimensions Last Segment</i>	page 58
Table 14-12— <i>MCF4700-14, MCF4700-20 and MCF4700-30 First and Middle Segment</i>	page 58
Table 14-13— <i>MCF4700-14, MCF4700-20 and MCF4700-30 Last Segment</i>	page 59
Table 14-14— <i>Transmitter and Receiver Segments</i>	page 59
Table 14-15— <i>MCJ470-12 Dimensions</i>	page 67
Table 14-16— <i>MCJ4700 Joint Resolution (Resolution at the Corner)</i>	page 67
Table 14-17— <i>Transmitter and Receiver Segments</i>	page 67
Table 14-18— <i>MS4700-12 Dimensions</i>	page 70
Table 14-19— <i>MS4700-14 & MS4700-20 Dimensions</i>	page 71
Table 14-20— <i>MS4700-30 Dimensions</i>	page 71
Table 14-21— <i>Transmitter and Receiver Segments</i>	page 72
Table C-1— <i>Specifications for 4700 System Controller with DeviceNet</i>	page 92
Table C-2— <i>4700 Status Information Sent in Response to a poll command</i>	page 93
Table C-3— <i>I/O Data for Change of State</i>	page 93
Table C-4— <i>I/O Data</i>	page 93
Table C-5— <i>Configuration Switches for Device-Net</i>	page 97

1 IMPORTANT SAFETY WARNINGS

▲ WARNING! Read and understand this section prior to installing a 4700 system.

A 4700 system is a general purpose presence sensing device designed to guard personnel working around moving machinery.

Whether a specific machine application and light curtain installation complies with safety regulations depends on the proper application, installation, maintenance and operation of the light curtain. These items are the responsibility of the purchaser, installer and employer.

The employer is responsible for the selection and training of personnel to properly install, operate, and maintain the machine and its safeguarding systems. A 4700 system should only be installed, verified 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 or experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work.”* (ANSI B30.2-1983)

To use a 4700 series safety light curtain 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 a 4700 system in this type of environment.
- All applicable governmental and local rules, codes, and regulations must be satisfied. This is the employer’s responsibility.
- All safety-related machine control elements must be designed so that a alarm in the control logic or failure of the control circuit does not lead to a failure to danger.
- Additional guarding may be required for access to dangerous areas not covered by the 4700 series system.
- Perform the STI test procedure at installation and after maintenance, adjustment, repair or modification to the machine controls, tooling, dies or machine, or the 4700 series system.
- Perform only the test and repair procedures outlined in this manual.
- Follow all procedures in this manual for proper operation of the 4700 series system.

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

2 SIGNIFICANT FEATURES

2.1 STANDARD FEATURES

- Individual Beam Indicators
- External Device Monitoring (MPCE Monitoring)
- Automatic Start Mode
- Start Interlock Mode
- Start/Restart Interlock Mode
- Adjustable Mounting Brackets
- Floating Blanking
- Exact Channel Select
- Two Safety (PNP) Outputs
- Auxiliary Output
- Start Switch Input Selectable NO or NC

2.2 OPTIONAL FEATURES

- Relay Safety Outputs (Metal Chassis Controllers only)
- DeviceNet
- Multi-Channel Select (Non-CE)

3 SYSTEM ACCESS, COMPONENTS AND INDICATORS

3

3.1 ACCESS TO CONFIGURATION SWITCHES

3.1.1 LCM DIN CONTROLLER

Switches for configuring system features are located under the front cover of the controller. Access to these switches is gained by the following procedure:

1. Remove the four screws holding the cover in place (see *Figure 3-1* for location).
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 3-1* for detail. The cover is not hinged and will be completely removed.

To replace the cover:

1. Correctly position one end and push down on the opposite end to snap it in place.
2. Replace the four screws to properly retain the cover.

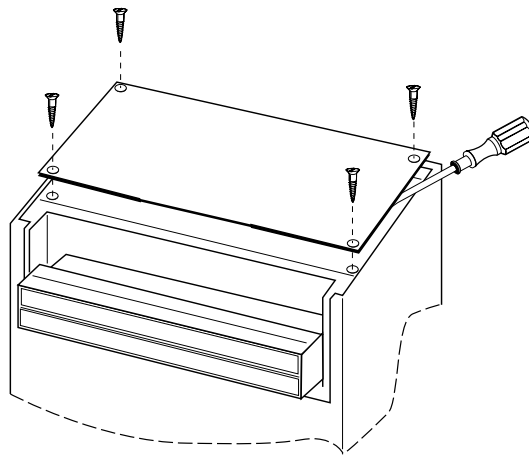


Figure 3-1 Accessing the Configuration Switches on the LCM DIN Controller

3.1.2 LCM METAL CHASSIS CONTROLLER

Switches for configuring system features are located inside the front cover of the controller. Access to these switches is gained by the unlocking the clasp on the right-hand side of the controller box.

The Clasp has provisions to accept a user-provided padlock. Only a qualified person should have possession of the key to the padlock, or to the optional Program/Start keyswitch.

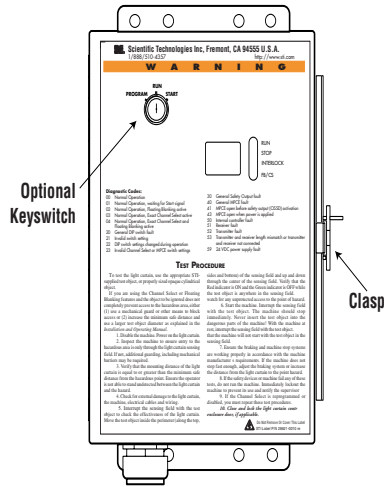


Figure 3-2 Accessing the Configuration Switches on the LCM-Metal Chassis Controller



3.2 LOCATION OF THE COMPONENTS AND INDICATORS

Refer to *Figure 3-3*, *Figure 3-4* and *Figure 3-5* for the location of the components and indicators listed below.

Table 3-1 System Component Identification for the 4700 Transmitter and Receiver

Chart #	
1	RECEIVER
2	Individual Beam Indicators (one for each beam) – Red
3	Channel Select or Floating Blanking Indicator – Amber
4	Interlock or Fault Indicator – Yellow
5	Machine Stop Indicator – Red
6	Machine Run Indicator – Green
7	TRANSMITTER
8	Detection Zone

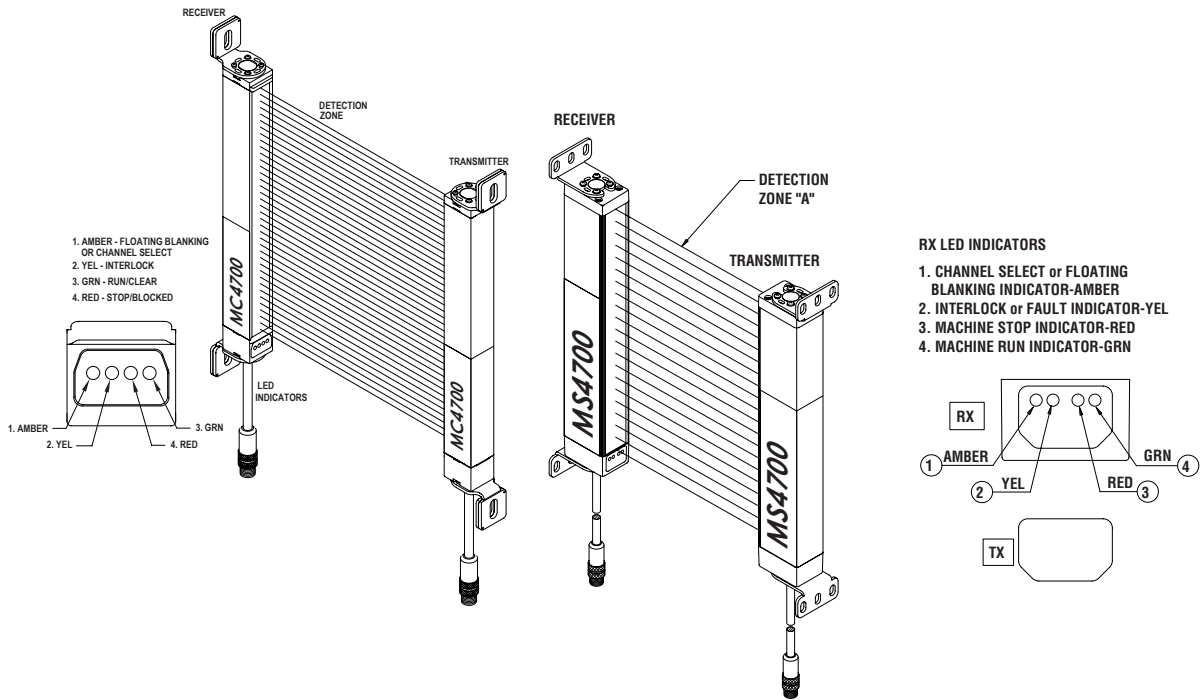


Figure 3-3 4700 Transmitter and Receiver

Table 3-2 System Component Identification for the LCM-1, LCM-2 and LCM-3 Controllers

Chart #	
4	EXact Channel Select 1 beam
5	EXact Channel Select 2 beams
6	EXact Channel Select 3 beams
7	EXact Channel Select Return
9	Channel Selector Floating Blanking Indicator - Amber
10	Interlock or Alarm Indicator - Yellow
11	Machine Stop Indicator - Red
12	Machine Run Indicator - Green
13	Diagnostic Code Display
14	Switch A
15	Program Button
16	Switch B
17	Removable Terminal Blocks for input and output connections
18	DeviceNet status indicators (optional)
19	Start Switch Type Jumper
20	Relay Board (metal chassis only)
21	Power In (metal chassis only)
22	MPCE Monitoring (metal chassis only)
23	Multi-channel Select terminals
24	Optional Keyswitch

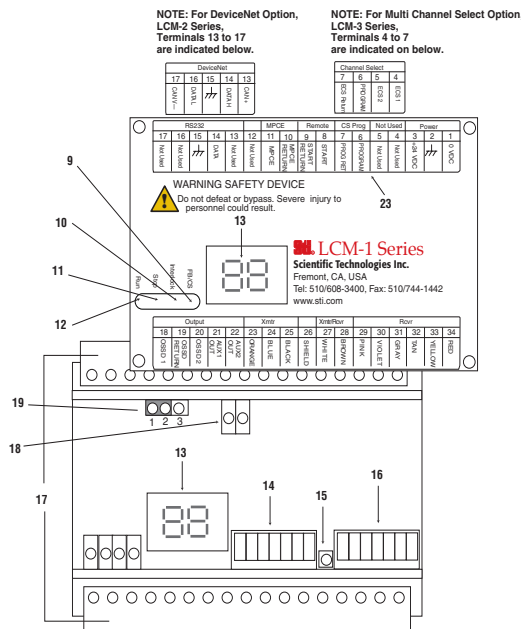


Figure 3-4 DIN Controller Components

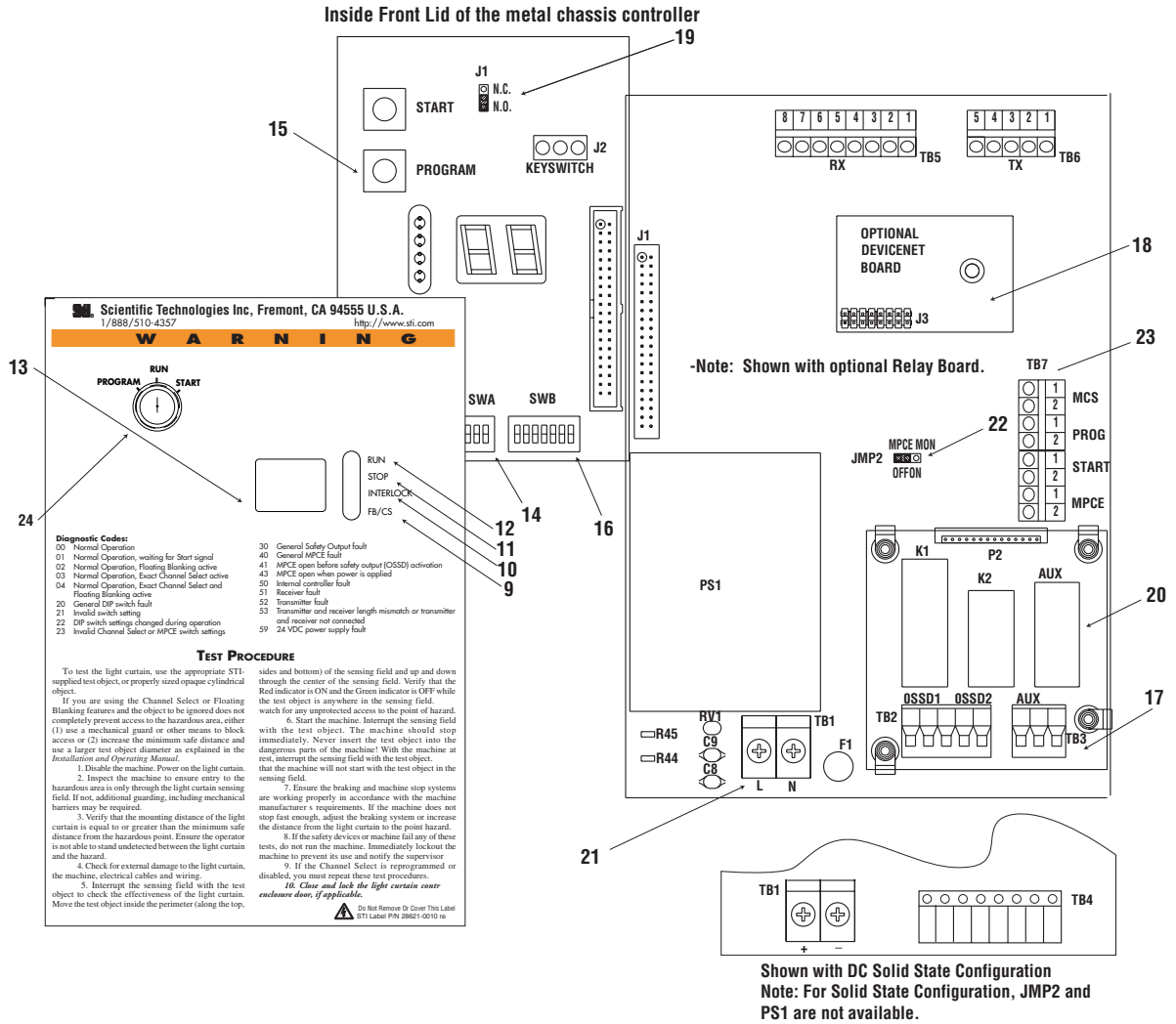


Figure 3-5 Metal Chassis Controller Components

4 SYSTEM OPERATION

4

The 4700 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.

The safety light curtain 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.

4.1 OPERATING STATES

The operating condition of a 4700 system is described in terms of states. The following operating states exist for the 4700 system.

4.1.1 MACHINE RUN

The two system safety outputs are in the ON state, the green machine run indicator is lit, and the auxiliary output is in a state consistent with its configuration. See *Section 7* on page 27. The protected machine is allowed to operate. Pressing and releasing the start button has no effect.

4.1.2 MACHINE STOP

The two system safety outputs are in the OFF state, the red machine stop indicator is lit, and the auxiliary output is in a state consistent with its configuration. See *Section 7* on page 27. The protected machine is not allowed to operate. Press and releasing the start switch has no effect.

4.1.3 INTERLOCK

The two system safety outputs are in the OFF state, the red machine stop indicator and yellow interlock indicator are lit. The auxiliary output is in a state consistent with its configuration. See *Section 7* on page 27. 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.

4.1.4 ALARM

The two system safety outputs are in the OFF state, the red machine stop indicator is lit, the yellow interlock indicator is flashing, and the auxiliary output is in the OFF state. The alarm state does not allow the protected machine to operate. The primary difference between alarm and interlock is that the 4700 system will remain in the alarm state until power is recycled or the start switch is pressed and released and the system has run a self-test.

4.2 OPERATING MODES

System operating modes determine the start-up and operating behavior of the 4700 system. Operating mode definitions rely on the operating states presented above. Operating mode selection is performed via configuration switches under the front cover of the controller.

NOTE! *If internal faults are detected by the 4700 system during power-up or operation, it will enter the alarm state with its safety outputs in the OFF state.*

4.2.1 AUTOMATIC START

The 4700 system will power-up with its safety outputs OFF, and perform system initialization and self tests. The 4700 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 4700 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 4700 system will automatically change from machine stop to machine run.

4.2.2 START INTERLOCK

The 4700 system will power-up with its safety outputs OFF and perform system initialization and self-tests. If no obstructions are detected in the protected zone, (or an exact channel select pattern satisfied), the 4700 system enters the interlock state. To enter the machine run state, the detection zone must be clear (or an exact channel select pattern satisfied), and then the operator must press and release the start switch. In the machine run state, when an object is sensed entering the detection zone the 4700 system will change from machine run to machine stop. Once the detection zone is clear, the 4700 system will automatically change from machine stop to machine run.

4.2.3 START/RESTART INTERLOCK

The 4700 system will power-up with its safety outputs OFF, and, if no faults are detected, enter the interlock state. To enter the machine run state, the detection zone must be clear (or an exact channel select pattern satisfied), and then the operator must press and release the start switch. In the machine run state, when an object is sensed entering the detection zone the 4700 will change from machine run to interlock. The 4700 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 switch. If any obstruction is present in the detection zone when the start switch is pressed and released, the 4700 will remain in the interlock state.

NOTE! The definitions above mention a start switch. See Section 10–“Connecting to the Machine Control Circuit” for wiring of the start switch.

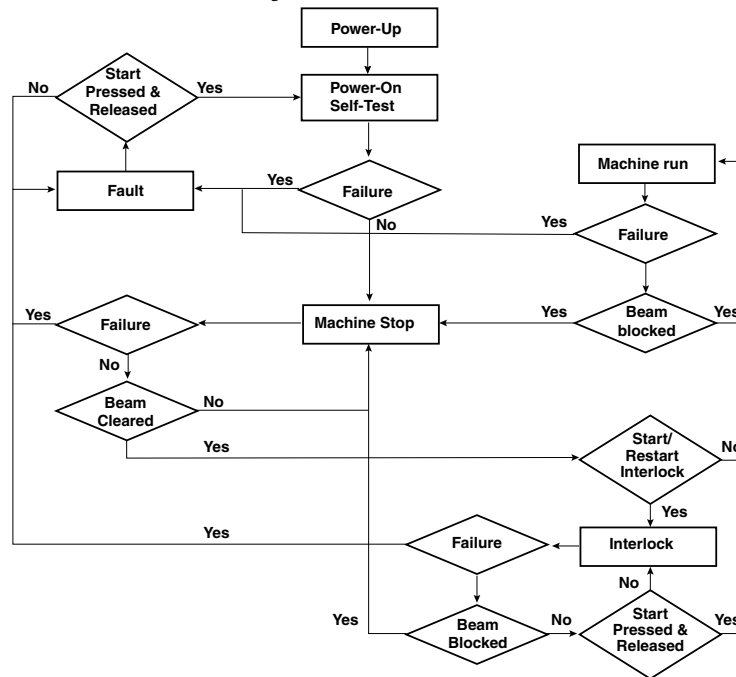


Figure 4-1 Functional Flow Diagram

4.3 OPERATING MODE SELECTION

Operating mode is selected by setting positions 1 and 2 of Switches A and B, located under the controller cover. Refer to *Table 4-1*. Any mismatch between the settings of Switch 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.

⚠ Warning! Disconnect power before accessing the controller assembly.

Table 4-1 Operating Mode Switch Settings

OPERATING MODE	SWITCH A		SWITCH B	
	1	2	1	2
Automatic Start (default setting)	CLOSED/ON	CLOSED/ON	CLOSED/ON	CLOSED/ON
Start interlock	OPEN/OFF	CLOSED/ON	OPEN/OFF	CLOSED/ON
Start/Restart interlock	OPEN/OFF	OPEN/OFF	OPEN/OFF	OPEN/OFF
Not Allowed	CLOSED/ON	OPEN/OFF	CLOSED/ON	OPEN/OFF

4.4 START SWITCH TYPE SELECTION

The type of Start switch (Normally Open or Normally Closed) used by the 4700 system is selectable by a jumper located under the controller cover. Refer to Figure 3-4—*DIN Controller Components* and Figure 3-5—*Metal Chassis Controller Components*. 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: If there is a mismatch between the type of Start selected and used, (i.e. jumper between Pins 1 and 2 and Normally Open Start Switch used) the switch must be pressed and released twice before the system will enter a Run state.

5 DETECTION OPTIONS

5

⚠ Warning! Use of Exact Channel Select and/or Floating Blanking will make the 4700 system less sensitive to objects in the detection zone. Improper use of either can result in severe injury to personnel. Exact Channel Select may require a hard barrier guard (see Section 5.8—Additional Guarding When Using Exact Channel Select), Exact Channel Select or Floating Blanking requires an increase in the safety distance. Read the following section 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 Channel Selected 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 Channel Select programming may be inadvertently deselected. Use the STI Test Procedure to verify the correct configuration.

- Floating Blanking increases the minimum safety distance therefore test object size will increase.



- After programming or activating Channel Select 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 STI Test Procedure.

5.1 EXACT CHANNEL SELECT (ECS)

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

ECS requires that any portion of the detection zone which is blocked remain blocked. If the obstruction is removed the 4700 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 5-1, “System Response to Exact Channel Select” for a diagram of 4700 system response during operation with ECS active.

Table 5-1 System Response to Exact Channel Select

Channel Select Status	Exact Channel Select Inactive	Exact Channel Select Inactive	Exact Channel Select Active	Exact Channel Select Active	Exact Channel Select Active
Channel 1	○	○	○	⊗	○
Channel 2	○	○	⊗	⊗	⊗
Channel 3	○	⊗	⊗	⊗	△
Channel 4	○	○	⊗	⊗	⊗
Channel 5...	○	○	○	○	○
System Response	machine run	machine stop	machine run	machine stop	machine stop

5.2 MULTI CHANNEL SELECT (MCS)

MCS stores up to four patterns of selected beams. Just as the ECS disables selected, fixed areas of the detection zone by masking off specific, fixed beam locations, the MCS can be programmed to store four different patterns. MCS is helpful when a machine requires multiple setups where stationary objects such as tooling, fixtures, or material frequently obstruct a portion of the detection zone. Access and programming is performed using a PLC or switch inputs. The suggested logic patterns for identification of the stored program are in Table 5-2 on page 20. Refer to drawings *Figure 5-1* and *Figure 5-2* for connection recommendations.

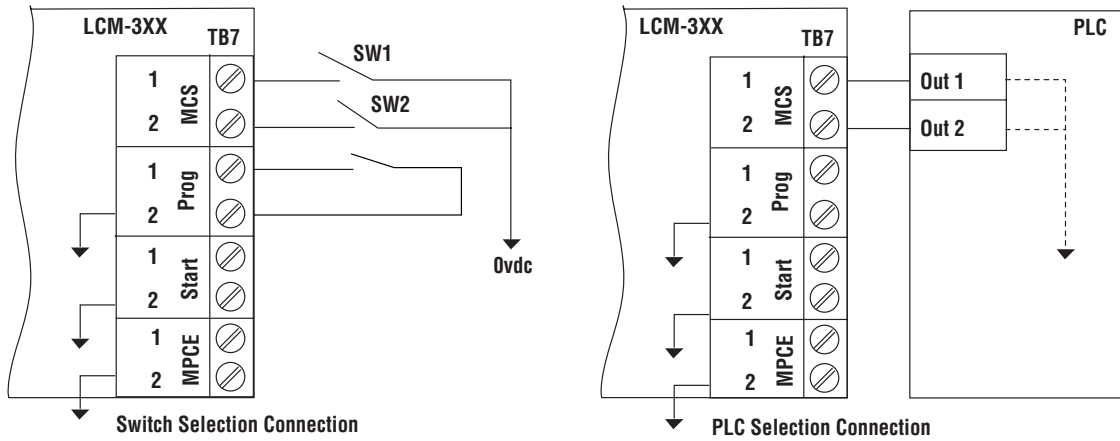


Figure 5-1 Connection Recommendations for LCM Metal Enclosure

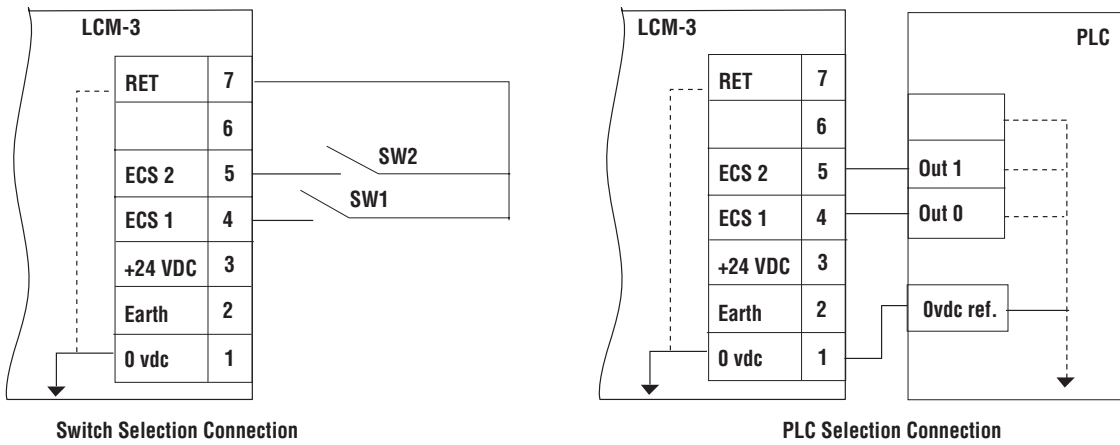


Figure 5-2 Connection Recommendations for LCM DIN Box

Switch	Switch 2	Switch 1
Pattern 1	0	0
Pattern 2	0	1
Pattern 3	1	0
Pattern 4	1	1

Note: 0 = Open, 1 = Closed.

Table 5-2 Switches for Multi Channel Select

5.3 FLOATING BLANKING

Up to two channels can be disabled at any location in the detection zone without the 4700 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 5-3* for a diagram of 4700 system response during operation with Floating Blanking active.

Table 5-3 System Response to Floating Blanking

	Floating Blanking Inactive	1 Channel Floating Blanking Active	1 Channel Floating Blanking Active	1 Channel Floating Blanking Active	1 Channel Floating Blanking Active	2 Channel Floating Blanking Active	2 Channel Floating Blanking Active	2 Channel Floating Blanking Active	2 Channel Floating Blanking Active	2 Channel Floating Blanking Active	2 Channel Floating Blanking Active	2 Channel Floating Blanking Active
Channel 1	○	○	○	○	○	○	○	○	○	○	○	⊗
Channel 2	○	○	○	⊗	⊗	○	○	⊗	⊗	⊗	⊗	○
Channel 3	⊗	○	⊗	⊗	○	○	⊗	⊗	○	⊗	○	⊗
Channel 4	○	○	○	○	⊗	○	○	○	⊗	⊗	⊗	○
Channel 5...	○	○	○	○	○	○	○	○	○	○	⊗	⊗
System Response	1 Exception machine stop	0 Exceptions machine run	1 Exception machine run	2 Exceptions machine stop	2 Exceptions machine stop	0 Exceptions machine run	1 Exception machine run	2 Exceptions machine run	2 Exceptions machine run	3 Exceptions machine stop	3 Exceptions machine stop	3 Exceptions machine stop

Table 5-4 Icon Key for Tables 5-1 and 5-2

Symbol	Description
○	Optical channel is not blocked.
⊗	Optical channel is blocked.
△	Optical channel is selected by Exact Channel Select.
⊗	Optical channel is selected by Exact Channel Select and is blocked.

5.4 USING EXACT CHANNEL SELECT WITH FLOATING BLANKING

⚠ Warning! Using Exact Channel Select with Floating Blanking is an advanced feature. All situations which may occur to the 4700 system detection zone must be carefully considered. The 4700 system is less sensitive to objects in the detection zone. The safety distance must be increased. Failure to do so may cause serious injury.

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

5.4.1 THE EFFECT OF EXACT CHANNEL SELECT AND FLOATING BLANKING ON MINIMUM OBJECT RESOLUTION

When Exact Channel Select and/or Floating Blanking is active, the safety distance is affected. Exact Channel Select 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.

- A 4700 system with 12 mm minimum object resolution and one channel disabled has a minimum object sensitivity of:

$$12 \text{ mm} + 6.25 \text{ mm} = 18.25 \text{ mm (0.72 inches)}.$$

- A 4700 system with 12 mm minimum object resolution and two channels disabled has a minimum object sensitivity of:

$$12 \text{ mm} + 6.25 \text{ mm} + 6.25 \text{ mm} = 24.5 \text{ mm (0.96 inches)}.$$

If the size of the object detected by the 4700 system increases, the minimum safe distance must increase. Use the minimum object sensitivity given in *Table 5-5*, *Table 5-6*, *Table 5-7* & *Table 5-8* to determine the new figure to use when computing the safety distance.

Table 5-5 Sample S and D_{pf} Factors for 12 mm Resolution Systems

Total Number of Beams Disabled by Exact Channel Select and/or Floating Blanking	Minimum Object Resolution S	Depth Penetration Factor, D _{pf} for use with ANSI Formula (D _{pf} = 3.4 (S-.276) inches)
None	12 mm (0.47 inches)	0.67 inches (16.96 mm)
1 Beam	19 mm (0.75 inches)	1.61 inches (40.93 mm)
2 Beams	26 mm (1.02 inches)	2.53 inches (64.25 mm)
3 Beams	33 mm (1.30 inches)	3.48 inches (88.43 mm)
4 Beams	40 mm (1.57 inches)	4.40 inches (111.75 mm)
5 Beams	47 mm (1.85 inches)	5.35 inches (135.93 mm)
etc...		

Table 5-6 Sample S and D_{pf} Factors for 14 mm resolution Systems

Total Number of Beams Disabled by Exact Channel Select and/or Floating Blanking	Minimum Object Resolution S	Depth Penetration Factor, D _{pf} for use with ANSI Formula (D _{pf} = 3.4 (S-.276) inches)
None	14 mm (0.55 inches)	0.9 inches (24 mm)
1 Beam	25 mm (0.98 inches)	2.4 inches (61 mm)
2 Beams	36 mm (1.42 inches)	3.9 inches (99 mm)
3 Beams	47 mm (1.85 inches)	5.4 inches (136 mm)
4 Beams	58 mm (2.28 inches)	6.8 inches (173 mm)
5 Beams	69 mm (2.72 inches)	8.3 inches (211 mm)
etc...		

Table 5-7 Sample S and D_{pf} Factors for 20mm resolution Systems

Total Number of Beams Disabled by Exact Channel Select and/or Floating Blanking	Minimum Object Resolution S	Depth Penetration Factor, D _{pf} for use with ANSI Formula (D _{pf} = 3.4 (S-.276) inches)
None	20 mm (0.79 inches)	1.75 inches (44.45 mm)
1 Beam	31 mm (1.22 inches)	3.21 inches (81.53 mm)
2 Beams	42 mm (1.65 inches)	4.60 inches (118.96 mm)
3 Beams	53 mm (2.09 inches)	6.16 inches (156.86 mm)
4 Beams	64 mm (2.52 inches)	7.63 inches (193.76 mm)
5 Beams	75 mm (2.95 inches)	9.1 inches (231.16 mm)
etc...		



Table 5-8 Sample S and D_{pf} Factors for 30 mm resolution Systems

Total Number of Beams Disabled by Exact Channel Select and/or Floating Blanking	Minimum Object Resolution S	Depth Penetration Factor, D _{pf} for use with ANSI Formula (D _{pf} = 3.4 (S-.276) inches)
None	30 mm (1.18 inches)	3.07 inches (78.0 mm)
1 Beam	52 mm (2.05 inches)	6.03 inches (153.2 mm)
2 Beams	74 mm (2.91 inches)	8.96 inches (227.6 mm)
3 Beams	96 mm (3.78 inches)	11.91 inches (302.5 mm)
4 Beams	118 mm (4.65 inches)	14.87 inches (377.7 mm)
5 Beams	140 mm (5.51 inches) ¹	17.80 inches (452.0 mm)
etc...		

Hard guarding refers to mechanical barriers such as sheet or expanded metal, etc. See Figure 5-3 *Adding Hard guarding to Light Curtain when Using Channel Select* for an example.

Floating Blanking changes the resolution (object size) of the 4700 system and will require different mounting distance.

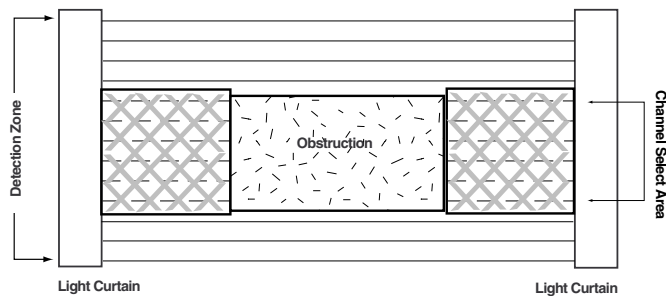


Figure 5-3 Adding Hard guarding to Light Curtain when Using Channel Select

5.5 ACTIVATING AND PROGRAMMING EXACT CHANNEL SELECT

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

Exact Channel Select is activated by setting position 4 of Switches A and B, located under the controller cover. Refer to *Figure 3-1*. Any mismatch between the settings of the switches will result in an alarm condition.

To program an ECS pattern, the 4700 system must be in the machine stop state. An ECS pattern is stored by blocking the appropriate area of the detection zone and pressing, then releasing the program button (See *Figure 3-4* and *Figure 3-5* for locations). The MCS works the same as the ECS except in addition to blocking the appropriate area of the detection zone, an four position binary switch or PLC or two SPST switches are needed to differentiate the four possible pattern.

5.6 MCS PROGRAMING

1. Ensure that power is supplied to the controller, and that the light curtain is green and showing all beams are clear. The display should read "00".

2. Set position 4 of switches A and B to the closed position and press “Start”, the display should read “03”.
3. Set the Pattern select inputs, see Table 5-2—*Switches for Multi Channel Select*.
4. Place the desired object in field (block beams) and press the “program” button, the display should read “01”.
5. Push the “start” button, and the display should read “03”. The light curtain will enter the Machine Run state.
6. To add more patterns (a total of eight possible) Set the Pattern select inputs to another program the display will read “27”, press the start button and continue to step 4. Repeat steps 4 and 5.
7. To change from one pattern to another, change the ECS inputs to the desired program and push the start button.

The 4700 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 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, the stored ECS pattern is cleared.

NOTE! *Replace controller cover after changing system configuration. See Section 3.1.1 on page 11 and Section 3.1.2 on page 12 for details.*

OPERATING MODE	SWITCH A			SWITCH B		
	4	5	6	4	5	6
Exact Channel Select Active	CLOSED /ON			CLOSED /ON		
Exact Channel Select Inactive (default setting)	OPEN /OFF			OPEN /OFF		
One-channel Floating Blanking Active		CLOSED /ON	OPEN /OFF		CLOSED /ON	OPEN /OFF
Two-channel Floating Blanking Active		OPEN /OFF	CLOSED /ON		OPEN /OFF	CLOSED /ON
Floating Blanking Inactive (default setting)		OPEN /OFF	OPEN /OFF		OPEN /OFF	OPEN /OFF
Not Allowed – alarm Condition		CLOSED /ON	CLOSED /ON		CLOSED /ON	CLOSED /ON

Table 5-9 Switch Settings, Exact Channel Select and Floating Blanking

5.7 ACTIVATING FLOATING BLANKING

Floating Blanking (either one- or two- beam) is activated by setting positions 5 and 6 of Switches A and B located under the controller cover. Refer to . Any mismatch between the settings of Switches will result in an alarm condition. Use of the program button is not required.

5.8 ADDITIONAL GUARDING WHEN USING EXACT CHANNEL SELECT

Exact Channel Select creates “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: (Refer to Figure 5-3 *Adding Hard guarding to Light Curtain when Using Channel Select*).

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.

6 DIAGNOSTIC AND TEST FEATURES

6

6.1. 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 12—*Troubleshooting*.

Table 6-1 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 Channel Select Active
04	Normal Operation Floating Blanking and Channel Select Active

6.2 INDIVIDUAL BEAM INDICATORS

The 4700 system has a visible, red Individual Beam Indicator (IBI), adjacent to each infrared beam. These IBI's are located on the receiver. The IBI will light when the infrared beam fails to meet the conditions necessary for the 4700 system to remain in the machine run state.

IBI's are not a safety critical component. An IBI failure will not cause an alarm condition and the 4700 system will continue to operate.

6.3 MACHINE PRIMARY CONTROL ELEMENT (MPCE) MONITORING

MPCE monitoring is an important safety function. It monitors the 4700 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 MPCE.

Connections for MPCE monitoring are made at the controller on terminals 10 and 11 for the DIN controller and on TB7 terminals 1 and 2 for the metal chassis controller. For a detailed diagram, see *Section 10—Connecting To The Machine Control Circuit*. On power-up, the 4700 system looks for an MPCE closed condition. If this is found, it will enter a state consistent with the selected operating mode. When the 4700 system enables its safety outputs, it monitors the MPCE for a closed-to-open transition. This transition must occur within 300 ms or the 4700 system considers the MPCE faulted. The 4700 system will then enter an alarm state. Additionally, if the MPCE connections are incorrectly wired, the 4700 will enter an alarm state.

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

NOTE! When MPCE is not active, place a jumper between the terminals MPCE and MPCE RTN for the DIN controller (or place a jumper between terminals 1 and 2 of TB7 for the Solid State Output Version of the metal chassis controller).

6.3.1 **ACTIVATING AND DEACTIVATING MPCE MONITORING**

(on Din Controller and Metal Chassis Solid State Version)

MPCE monitoring is activated by setting position 3 of Switches A and B located under the controller cover. Refer to *Table 6-2*. Any mismatch between the settings of Switches A and B will result in an alarm condition.

Table 6-2 MPCE Switch Settings

	SWITCH A	SWITCH B
MPCE MONITORING	3	3
Active	OPEN/OFF	OPEN/OFF
Not Active (default setting)	CLOSED/ON	CLOSED/ON

NOTE! Replace controller cover and retention screws after changing system configuration. See *Section 3.1.1* on page 11 and *Section 3.1.2* on page 12 for details.

6.3.2 **ACTIVATING AND DEACTIVATING MPCE MONITORING ON THE METAL CHASSIS CONTROLLER-RELAY OUTPUT VERSION**

MPCE monitoring is activated by setting Jumper 2 in the ON position located on the main controller board of the metal chassis controllers. Position 3 of the dipswitch does not affect the operation of Relay version controller.

6.4. STATUS INDICATOR LIGHTS

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

6.4.1 **SAFETY OUTPUT STATUS**

When the 4700 system is in the machine run state, the green indicator LEDs on the receiver and controller illuminate, indicating that the safety outputs are ON.

6.4.2 **INTERLOCK STATUS**

When the 4700 system enters an interlock state, the yellow interlock and red LEDs on the receiver and controller are continuously illuminated.

6.4.3 **ALARM STATUS**

When the 4700 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 12—Troubleshooting*.

6.4.4 **EXACT CHANNEL SELECT AND FLOATING BLANKING STATUS**

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

7 OUTPUTS

7.1 SAFETY OUTPUTS

7.1.1 DIN CONTROLLER AND METAL CHASSIS SOLID STATE VERSION

The 4700 system 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 milliamps of current at 24 VDC. In the Machine Stop state, the outputs are not electrically conducting.

⚠ WARNING! This product is designed for use on a 24 VDC, negative ground (protective earth) electrical system only. Never connect the 4700 system 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.

7.1.2 METAL CHASSIS CONTROLLER - RELAY OUTPUT VERSION

The 4700 system supplies 1 N.O. and 1 N.C/N.O. dry relay contacts, safety outputs to provide Run/Stop signals to the guarded machine. In the Run state the N.O. contacts are closed and will conduct the supplied voltage. In the Machine Stop state, the N.O. contacts are open. The N.C. contact will open in a Run state and close in a Stop state.

7.2. AUXILIARY OUTPUTS

7.2.1 DIN CONTROLLER AND METAL CHASSIS SOLID STATE VERSION

Two auxiliary outputs are provided. Auxiliary output AUX1 OUT is NPN and sinks up to 100 mA to system ground when in the on condition. Auxiliary output AUX2 OUT is PNP and sources 250 mA at 24 VDC when in the on condition.

7.2.2 METAL CHASSIS CONTROLLER - RELAY OUTPUT VERSION

N.O./N.C. auxiliary outputs are provided. These outputs are intended for light curtain Status indication. The auxiliary output is user configurable for Alarm mode and Follow mode.

7.2.3 AUXILIARY OUTPUT OPERATING MODES

The auxiliary outputs can be set to enter an ON condition either when:

- The safety outputs are in the machine run state (Follow Mode), or
- The 4700 system enters an alarm state (Alarm Mode).

The auxiliary output operating mode is selected by setting position 7 of Switches A and B located under the controller cover. Refer to *Table 7-1*. Any mismatch between the settings of the switches will result in an alarm conditions.

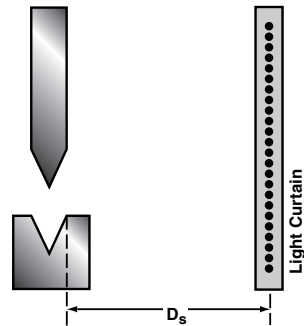
Table 7-1 Auxiliary Output Operating Mode Switch Settings

	SWITCH A	SWITCH B
Auxiliary Output Operating Mode	7	7
Auxiliary Outputs on in RUN (Follow) state	OPEN/OFF	OPEN/OFF
Auxiliary Outputs on in FAULT (Alarm) state	CLOSED/ON	CLOSED/ON

NOTE! Replace controller cover and retention screws after changing system configuration. See Section 3.1 for details.

8 SAFE MOUNTING DISTANCE

8



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

Figure 8-1 Safe Mounting Distance

⚠ WARNING! Never install a 4700 system without regard to the safety distance. If the 4700 system is mounted too close to the point of operation hazard, the machine may not stop in time to prevent an operator injury.

A 4700 system must be mounted far enough from the machine danger zone so 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 8-1—*Safe Mounting Distance* for an illustration of the safety distance.

Regardless of the calculated distance, a 4700 system should never be mounted closer to the point of operation hazard than allowed by Table 0-10 in OSHA 1910.217.

8.1 US SAFE DISTANCE FORMULAS

In the United States two formulas exist to properly determine the safety distance. STI recommends the formula provided by the American National Standards Institute (ANSI) which incorporates additional factors when compared to the formula required by OSHA.

The ANSI formula given below is for a normal approach to the light curtain.

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

Where:

D_s = minimum safety distance, in inches, between the 4700 system detection zone and the nearest point of operation hazard.

K = hand speed constant in inches per second. The ANSI standard value is 63 inches/second which assumes the operator starts a hand motion toward the point of operation from rest. According to ANSI B11.19-1990, "The value of the hand speed constant, K , has been determined by various studies and although these studies indicate speeds of 63 in./sec. to over 100 in./sec., they are not considered conclusive determinations. The user should consider all factors, including the physical ability of the operator, when determining the value of K to be used."



T_s = the stop time of the press (or machine) in seconds, measured from the final de-energized control element. Measured at maximum closing velocity.

T_c = the response time, in seconds, of the press or machine control circuit to activate the machine's brake.

NOTE! $T_s + T_c$ is usually measured together by a stop time measuring device.

T_r = the response time of the 4700 system, in seconds. This response time is given in *Table 14-1*, *Table 14-2* and *Table 14-3*.

▲ WARNING! When using a **STI RM-1 with the 4700**, add **0.008 seconds to the response times stated in Table 14-1, Table 14-2 and Table 14-3.**

T_{bm} = the additional stopping time, in seconds, allowed by the brake performance monitor before it detects stop time deterioration.

The T_{bm} factor allows consideration for brake wear, adding extra stop time allowed by the brake monitor. Therefore, T_{bm} = Brake monitor set point - ($T_s + T_c$).

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} = This is related to the minimum object sensitivity of the 4700 system. By knowing the minimum object sensitivity, S , of the 4700 system, D_{pf} is read directly from *Table 5-5*, *Table 5-6*, *Table 5-7* or *Table 5-8*.

For a 4700 system with 12 mm minimum object resolution and without Exact Channel Select or Floating Blanking active:

$$S = 0.47 \text{ inches (12 mm) and } D_{pf} = 0.67 \text{ inches (16.96 mm)}$$

For a 4700 system with 20 mm minimum object resolution and without Exact Channel Select or Floating Blanking active:

$$S = 0.79 \text{ inches (20 mm) and } D_{pf} = 1.75 \text{ inches (44.45 mm)}$$

8.2 EUROPEAN SAFETY DISTANCE FORMULAS

The following discussion is based on standard EN999 and applies to light curtains used in industrial environments.

8.2.1 SAFETY DISTANCE FORMULA FOR SYSTEMS WITH A MINIMUM OBJECT RESOLUTION OF 40 MM OR LESS

When the minimum object resolution of the system is 40 mm or less, use the following formula:

$$S = (K \times T) + C$$

where:

S = the minimum distance in millimeters, from the danger zone to the detection point, line, plane or zone.

$$K = 2000 \text{ mm/s}$$

T = the overall system stopping performance in seconds.

$$T = t_1 + t_2$$

t_1 = response time of the safety light curtain in seconds. This response time is given in *Table 14-1*, *Table 14-2* and *Table 14-3*.

t_2 = maximum stopping time of the machine in seconds.

$C = 8(d-14 \text{ mm})$, but not less than zero.

d = the minimum object detection of the 4700 in millimeters.

i.e.:

$$S = (2000 \text{ mm/s} \times T) + 8(d - 14 \text{ mm})$$

This formula applies for all minimum distances of S up to and including 500 mm. The minimum value of S shall not be less than 100 mm.

If S is found to be greater than 500 mm using the formula above, then the formula below can be used. In this case the minimum value of S shall not be less than 500 mm.

$$S = (1600 \text{ mm/s} \times T) + 8(d - 14 \text{ mm})$$

8.2.2 SAFETY DISTANCE FORMULA FOR SYSTEMS WITH A MINIMUM OBJECT RESOLUTION GREATER THAN 40 MM

When the minimum object resolution of the system is greater than 40 mm, use the following formula:

$$S = (K \times T) + C$$

where:

S = the minimum distance in millimeters, from the danger zone to the detection point, line, plane or zone.

$K = 1600 \text{ mm/s}$

T = the overall system stopping performance in seconds.

$$T = t_1 + t_2$$

t_1 = response time of the safety light curtain in seconds. This response time is given in *Table 14-1*, *Table 14-2* and *Table 14-3*.

t_2 = maximum stopping time of the machine in seconds.

$C = 850 \text{ mm}$.

i.e.:

$$S = (1600 \text{ mm/s} \times T) + 850 \text{ mm}$$

8.2.3 FACTORS AFFECTING THE SAFETY DISTANCE FORMULA

When light curtains are used for machine initiation, their minimum object resolution must be 30 mm or smaller (based on EN999, other standards may vary). In this case the formula given in 8.2.1—*Safety Distance Formula for Systems with a Minimum Object Resolution of 40 mm or Less* applies except that the minimum distance S shall be greater than 150 mm. For parallel approach the formula C becomes:

$C = 1200\text{mm} - (0.4 \times H)$, but not less than 850 mm.

H = the height of the detection zone above the floor in mm.

9 INSTALLATION

9.1 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. (See *Figure 9-2* and *Figure 9-3*.) 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 4700 system detection zone. The Test Procedure (Appendix B) **must** be used to test for this condition.

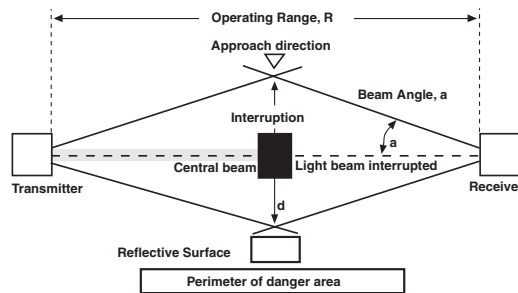


Figure 9-1 Correct Mounting Example with Proper Alignment

The interruption is clearly detected. The reflective object is outside of the beam angle

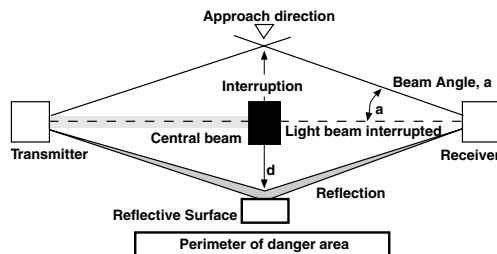


Figure 9-2 Unsafe Mounting Example

The interruption is not detected because of the reflection. The reflective object is inside the beam angle.

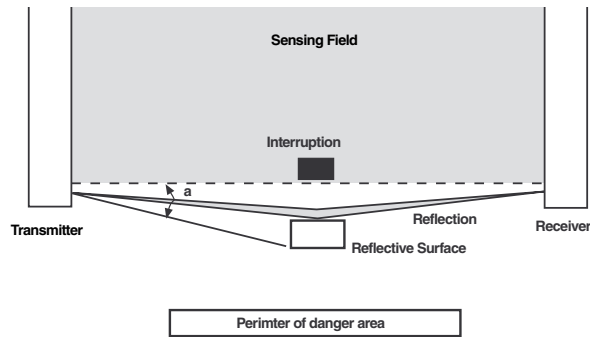


Figure 9-3 Unsafe Mounting Example

Interruption is not detected because of the reflection. Reflective surface interference may also appear above and below the sensing field.

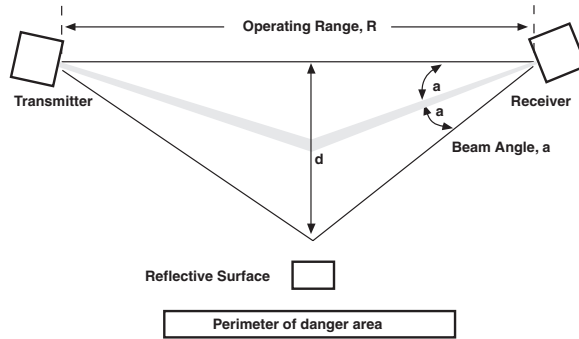


Figure 9-4 Worst Case Alignment Example

This example shows the minimum distance from the reflective surface, d , to one side of the beam center line.

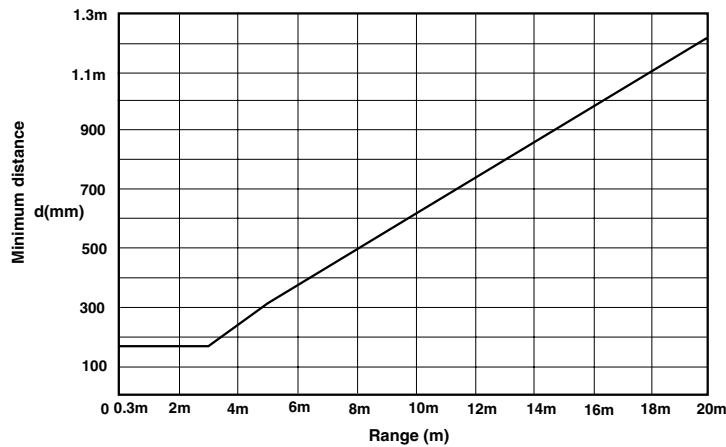


Figure 9-5 Minimum Distance from a Reflective Surface as a Function of Range



9.2. CONNECTING TRANSMITTER AND RECEIVER TO CONTROLLER

9.2.1 CABLE ASSEMBLIES

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

9.2.2 CABLE CONNECTIONS

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 the table below for a color code/terminal number cross-reference.

Table 9-1 Color Code/Terminal Number Cross Reference for DIN Controllers

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

Table 9-2 Color Code/Terminal Number Cross Reference Metal Chassis Controllers

TB5 Terminals	Component	Conductor Color
1	Receiver	White
2	Receiver	Brown
3	Receiver	Tan
4	Receiver	Yellow
5	Receiver	Red
6	Receiver	Grey
7	Receiver	Violet
8	Receiver	Pink
TB6 Terminals	Component	Conductor Color
1	Transmitter	White
2	Transmitter	Brown
3	Transmitter	Blue
4	Transmitter	Black
5	Transmitter	Orange

9.3 GENERAL CONSIDERATIONS

9.3.1 ADDITIONAL GUARDING

Areas of access to the point of hazardous operation not guarded by the 4700 system must be protected by suitable means such as a fixed barrier guard, an interlocked guard or a safety mat. See *Figure 9-6*.

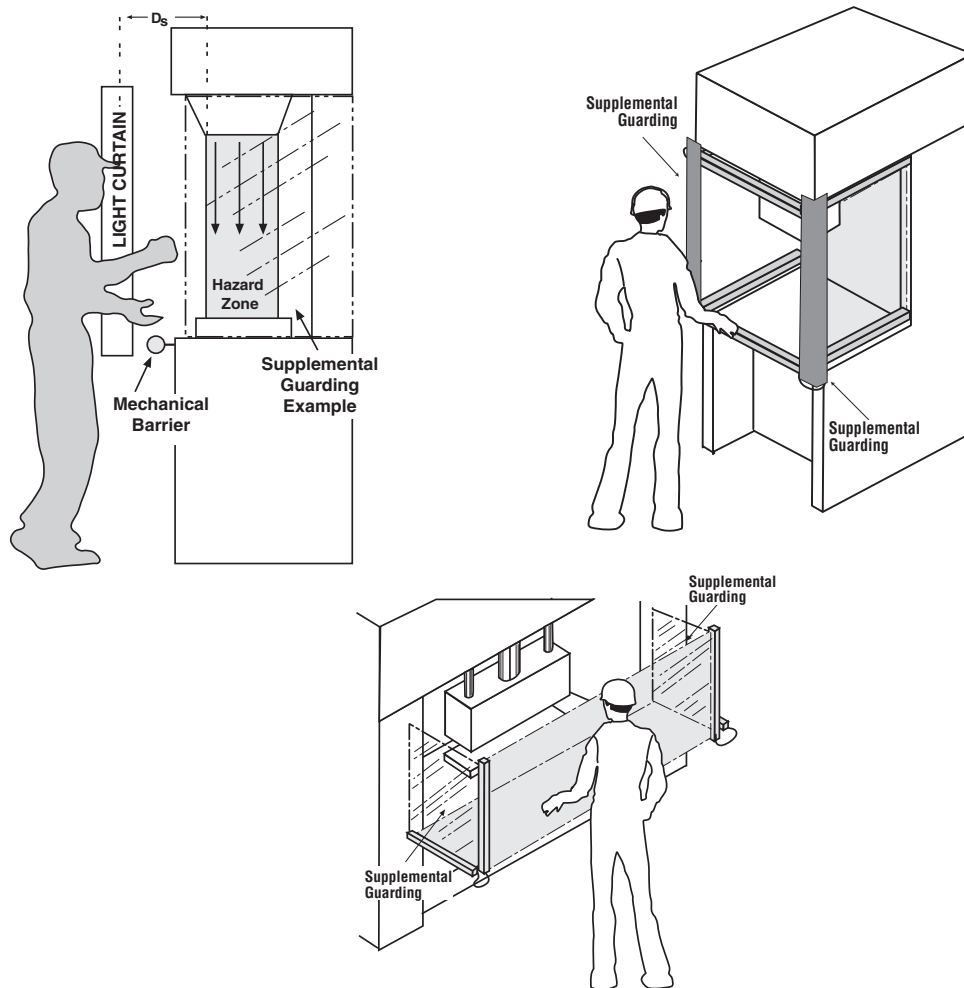


Figure 9-6 Correct Light Curtain Installation Examples



9.3.2 INSTALLATION OF MULTIPLE SYSTEMS

When two or more 4700 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 9-7* for reference.

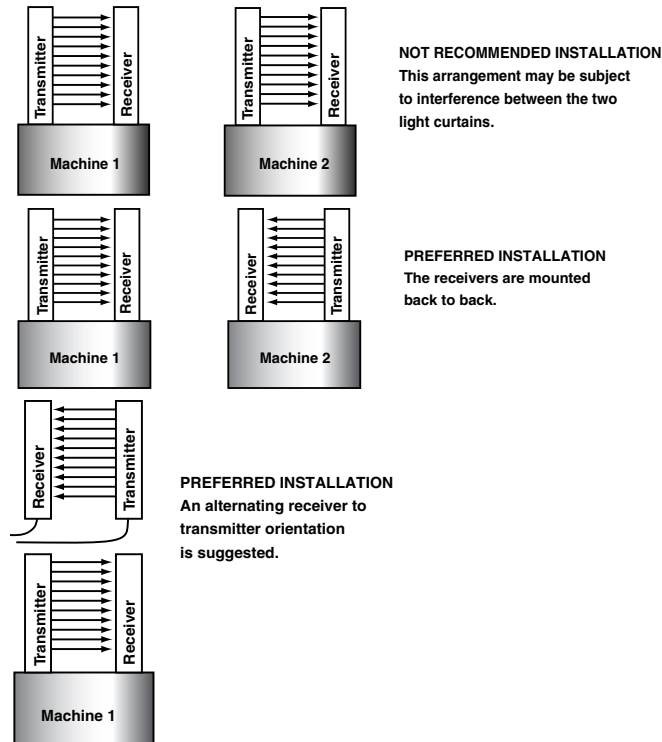
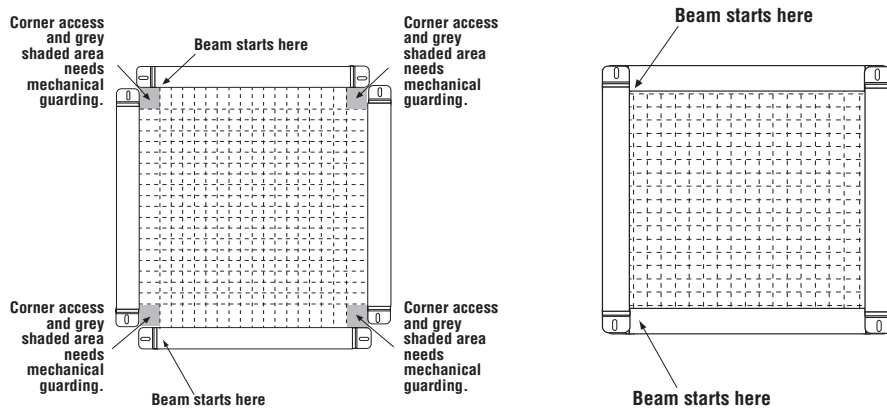


Figure 9-7 Multiple Light Curtain Installation Configurations



STI recommends overlapping the light curtains in order to have better coverage.

Figure 9-8 Mounting Orientation

9.3.3 **DETECTION ZONE**

The 4700 detection zone is delineated by the inside edge of the transmitter and receiver endcaps. The area outside these marks is not protected. Position the 4700 so that it is only possible to access the danger point through the detection zone.

9.3.4 **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 *Section 5.5* on page 23 for information.

9.3.5 **ALIGNMENT**

Physical alignment of the transmitter and receiver units is easiest when the 4700 system is in the automatic start operating mode with Exact Channel Select inactive. The units should be in the same plane and at equal height.

The Individual Beam Indicators will light when a beam is out of alignment. See Section 6.2—*Individual Beam Indicators* for details.

9.3.6 **INPUT POWER REQUIREMENTS/CONNECTIONS**

- DIN controller and DC metal chassis controller:

The 4700 system operates directly from 24 VDC \pm 20%, 2.25A*. Power to the 4700 system must come from a dedicated power supply which must meet the requirements of IEC60204-1 and IEC 61496-1, STI part number 42992 or equivalent. The 4700 system internally generates voltages for its own use. No other devices should be connected to these voltages.

*Internal consumption of power by the controller is less than 10 watts (415mA)

- AC metal chassis controller:

100 - 230 VAC @ 30 VA.

9.3.7 **SPECIAL REQUIREMENTS FOR PERIMETER GUARDING**

In perimeter guarding applications the 4700 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 4700 system in the start/restart interlock operating mode is suitable for perimeter guarding.

9.3.8 **PRESENCE SENSING DEVICE INITIATION**

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 Exact Channel Select. Contact STI for further information. Good sources of reference for PSDI include: ANSI RIA 15.06-1999, OSHA 1910.217(h), and ANSI B11.2-1995.



10 CONNECTING TO THE MACHINE CONTROL CIRCUIT

10

10.1 DIN CONTROLLER

⚠ WARNING! *This product is designed for use on a 24 VDC, negative ground (protective earth) electrical system only. Never connect the 4700 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.*

⚠ WARNING! *Never use only a single safety output to control the machine. Should this single output fail, the machine may not stop, resulting in severe operator injury. The machine must be connected using both safety outputs.*

10.1.1 CONNECTING TO A SAFETY MONITORING DEVICE

The wiring from the 4700 system to the machine control circuit must be control reliable as described in ANSI B11.19-1990. Normally PLCs are not designed to be control reliable. Safety devices, such as the 4700 system should not depend on a PLC to stop a guarded machine.

However, safety related monitoring devices are now available. See *Figure 10-1* for connection to such a device. Note that all safety inputs are directed to the monitoring device which also performs the MPCE monitoring function.

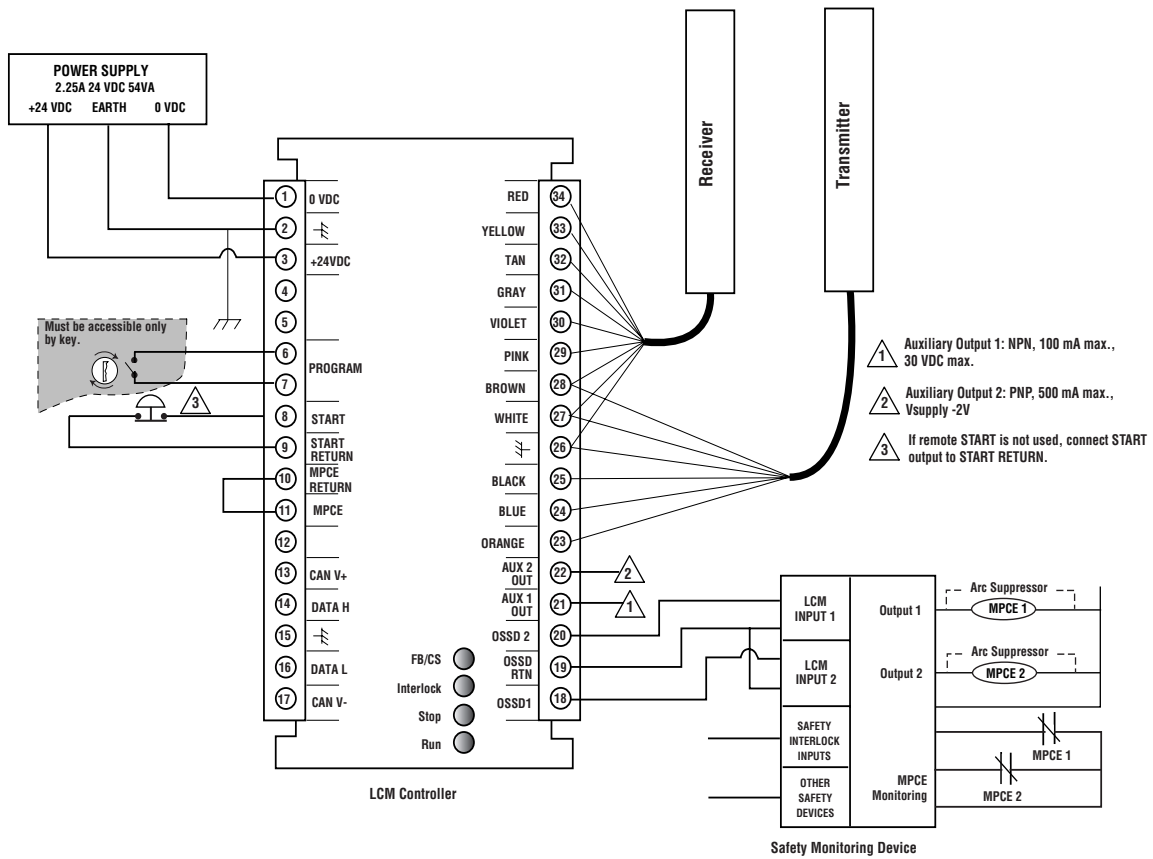


Figure 10-1 Connecting to a Safety Monitoring Device

10.1.2 CONNECTING VIA AN RM-1 MODULE

The STI RM-1 Module provides force-guided relay outputs for machine control. (OSSD) Safety outputs 1 and 2 are connected to the RM-1 and provide the power necessary to energize its relays. See *Figure 10-2* for the preferred connection method using the RM-1. The auxiliary non-safety output of the 4700 system can be used to signal light curtain status to a PLC.

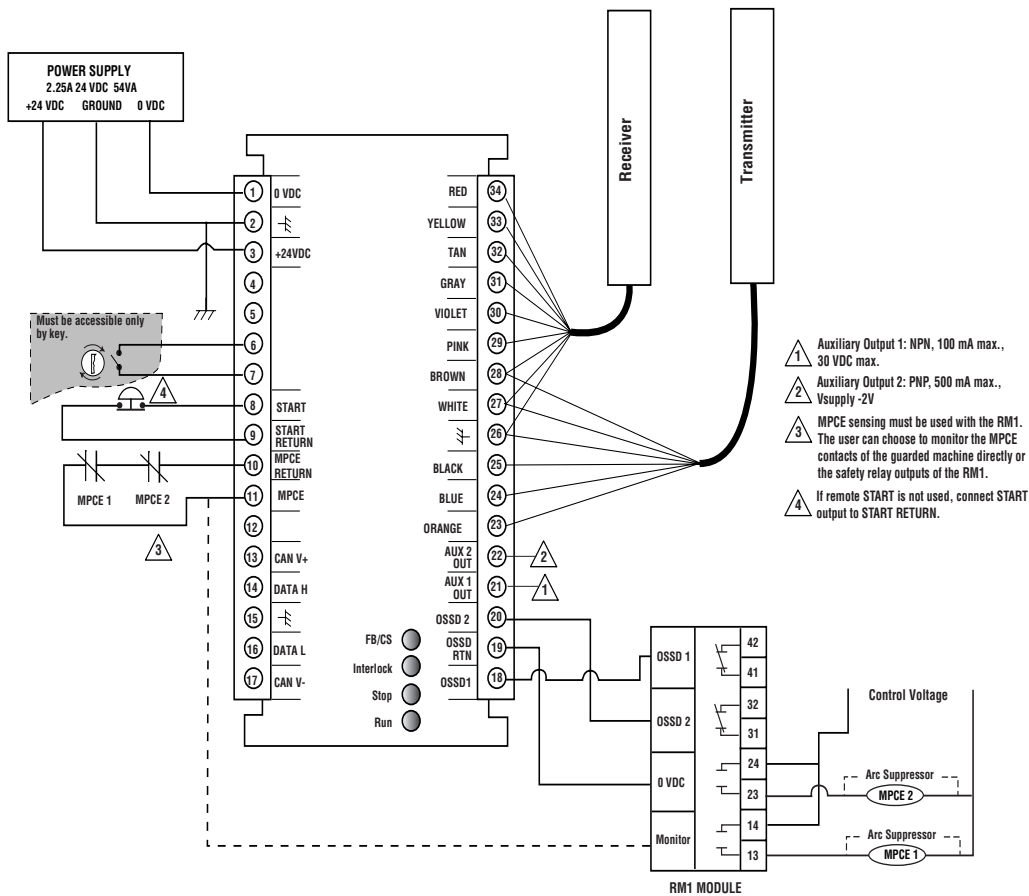


Figure 10-2 Connecting via an RM-1 Module

10.1.3 CONNECTING VIA TWO FORCE-GUIDED RELAYS

FGR series relays provide force-guided relay outputs for machine control. See *Figure 10-3* for the preferred connection method using two force-guided relays.

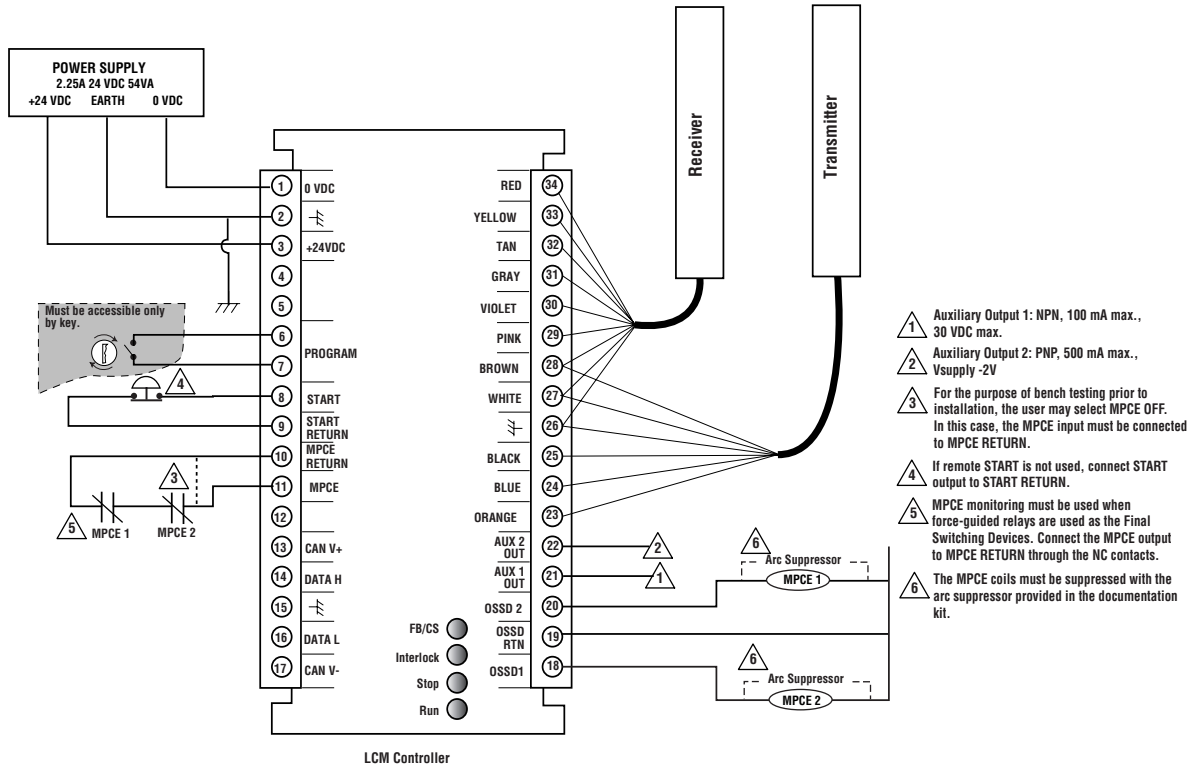


Figure 10-3 Connecting Via Two Force-guided Relays

10.2 METAL CHASSIS CONTROLLERS

10.2.1 CONNECTING VIA TWO NORMALLY OPEN RELAY SAFETY OUTPUTS

See Figure 10-4 for the preferred connection diagram for a Two Normally Open contact arrangement control circuit.

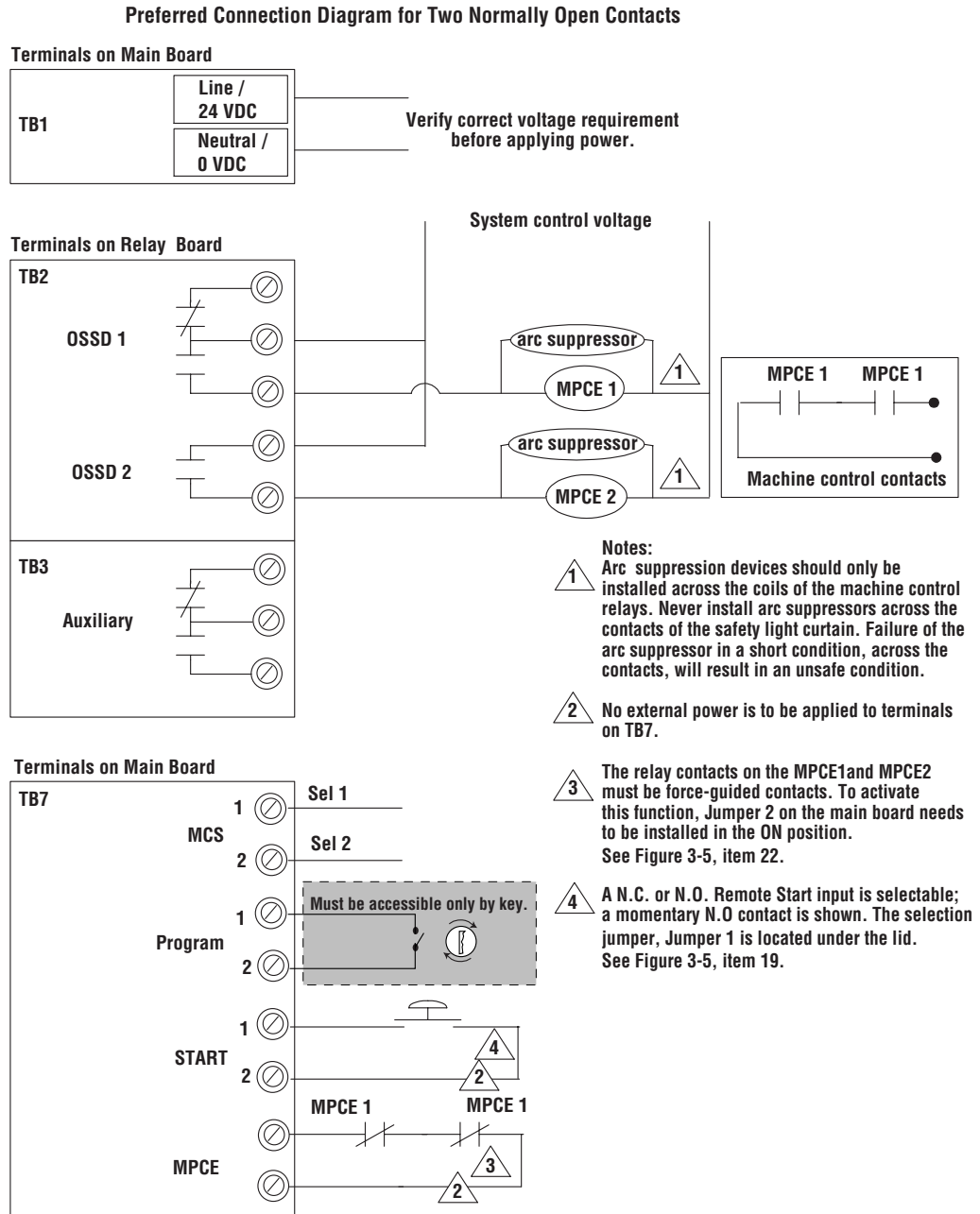


Figure 10-4 Connecting with Two Normally Open Safety Outputs

10.2.2 CONNECTING VIA ONE NORMALLY OPEN ONE NORMALLY CLOSED SAFETY RELAY OUTPUTS

See Figure 10-5 for preferred connection diagram for a One Normally Open, One Normally Closed contact arrangement control circuit.

Preferred Connection Diagram for One Normally Open, One Normally Closed Contacts

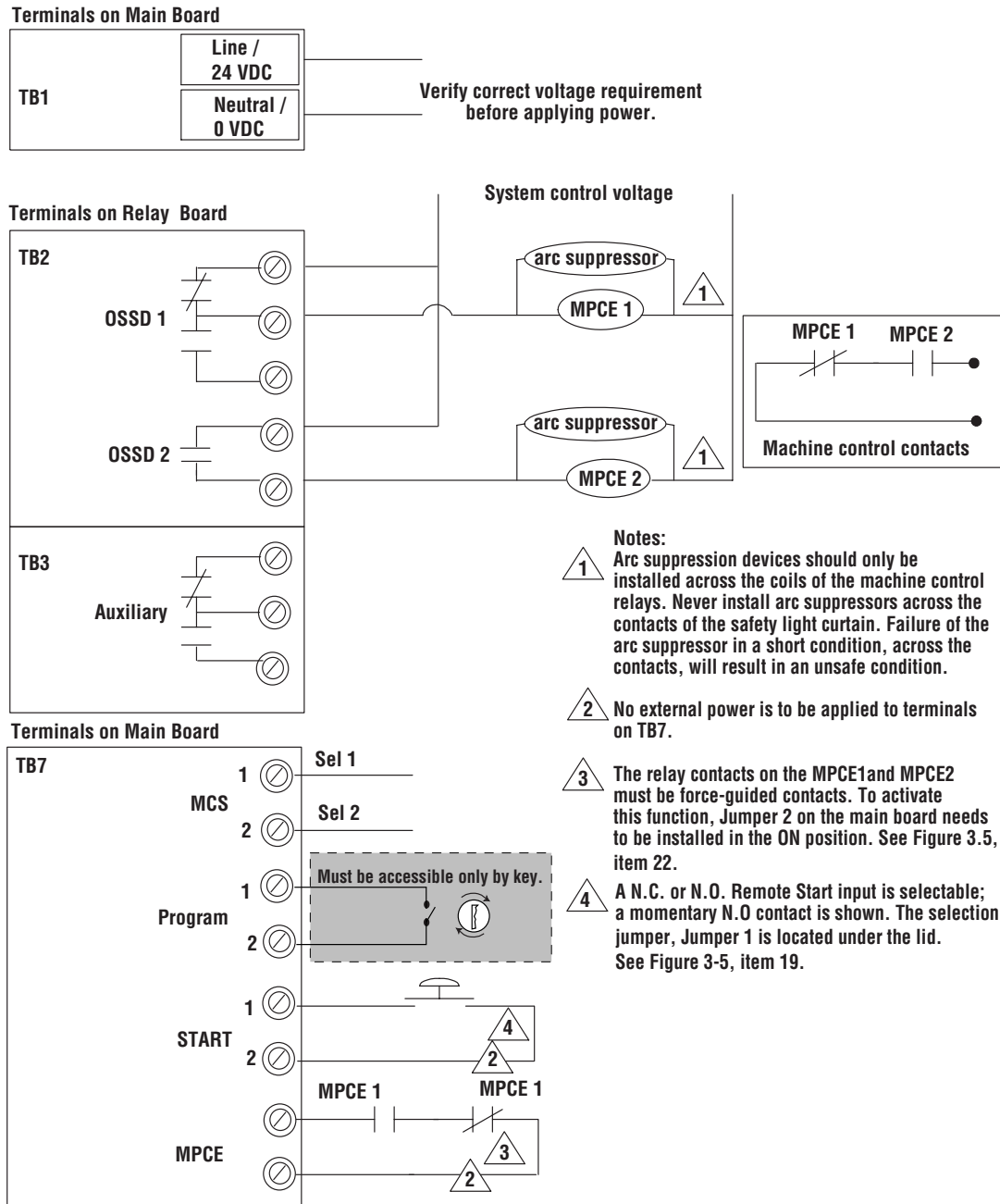


Figure 10-5 Connecting with One Normally Open One Normally Closed Safety Outputs

10.2.3 CONNECTING SOLID STATE SAFETY OUTPUTS TO TWO FORCE-GUIDED RELAYS

See Figure 10-6 for preferred connection diagram when connecting via Two FGR (force guided) relays. The FGR relays provide force-guided contacts for the machine control circuit.

Preferred Connection Diagram when Connecting Via Two Force-Guided Relays

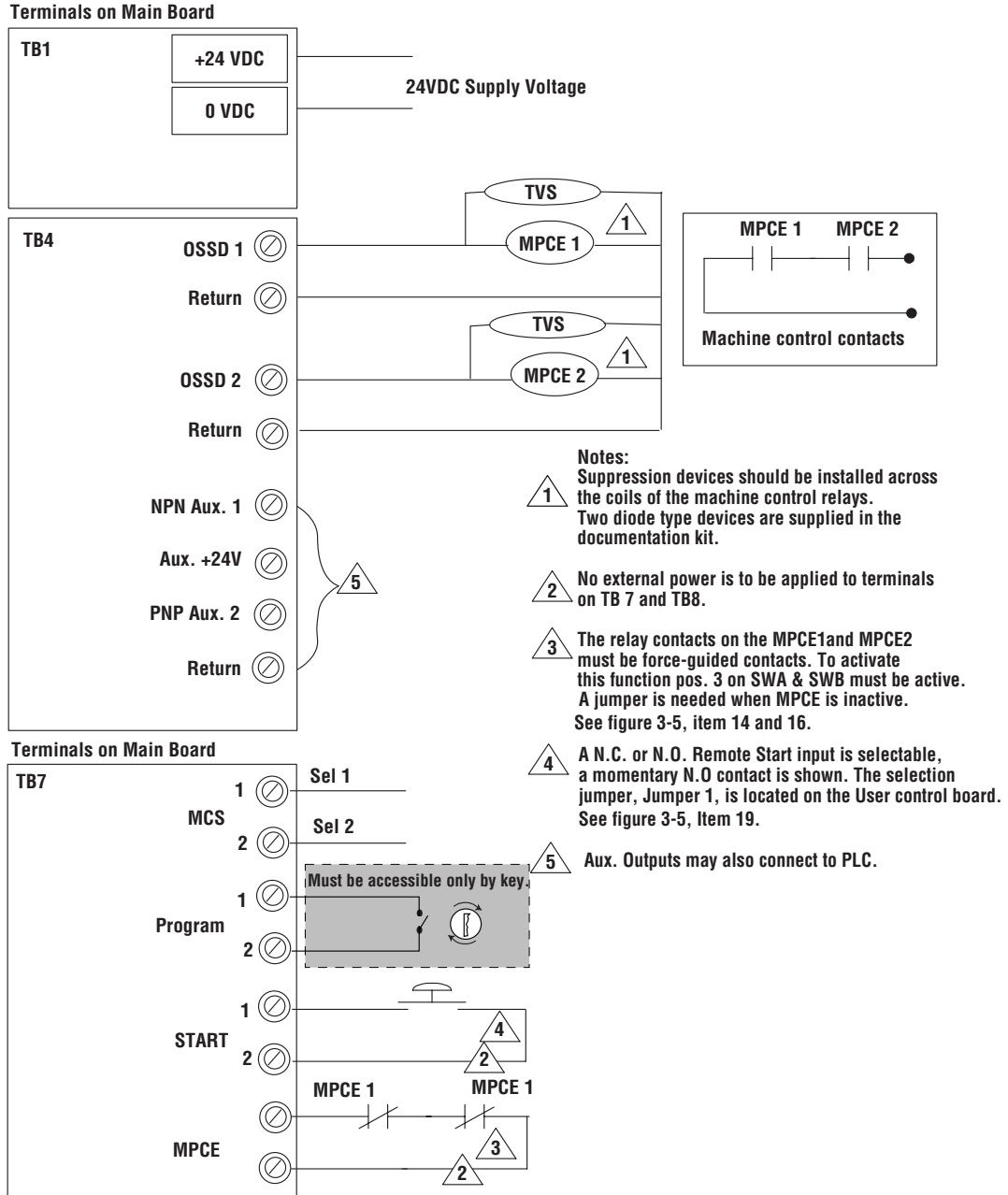


Figure 10-6 Connecting with Two Force Guided Relay Outputs

10.2.4 CONNECTING VIA A SAFETY MONITORING DEVICE

See *Figure 10-7* for preferred connection diagram when connecting via a safety monitoring device. Note that all safety devices are inputs to the Safety Monitoring Device, which performs the MPCE monitoring function.

NOTE: Normally PLCs are not control reliable, however Safety rated PLCs and monitoring devices are now available.

Preferred Connection Diagram when Connecting Via a Safety Monitoring Device

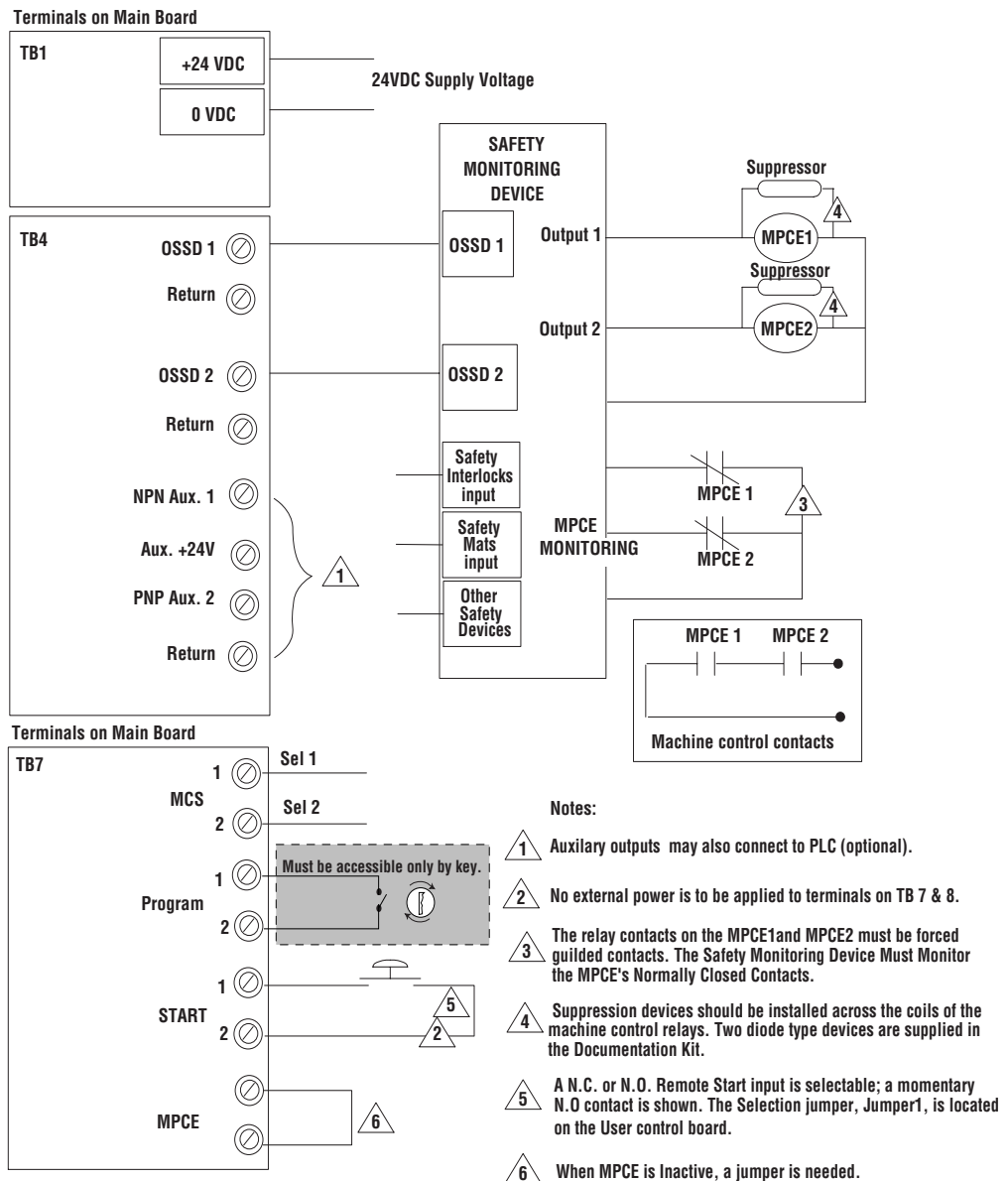


Figure 10-7 Connecting with Safety Monitoring Device

11 CHECKOUT AND TEST PROCEDURES

11

11.1 CHECKOUT PROCEDURE

Once the 4700 system has been configured, mounted, aligned and properly connected to the machine control system, the initial Checkout Procedure detailed in Appendix A **must** be performed by qualified personnel. A copy of the checkout results should be kept with the machine records.

11.2 TEST PROCEDURE

⚠ WARNING! *The tests outlined in the Test Procedure in Appendix B 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 4700 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 test properly could result in serious injury to personnel.*

The Test Procedure must be performed by qualified personnel. To test the 4700 system without Exact Channel Select and Floating Blanking disabled, use the STI-supplied test object. For applications where Exact Channel Select or Floating Blanking are enabled, see *Table 5-5, Table 5-6, Table 5-7 and Table 5-8* to determine the proper size test object.

When using a 4700 system for Automatic Start Mode operation, in conjunction with an RM-1 relay module, it is necessary to verify that the RM-1 outputs can properly change state by causing an intentional beam break at least every change of shift or 24 hours of operation.

11.3 USING THE TEST OBJECT

When using the test object, guide it through the detection zone as shown below. Pay particular attention to areas which may be affected by Exact Channel Select. If Floating Blanking is active, use a proper size test object.

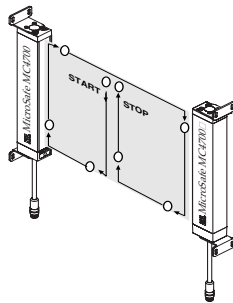


Figure 11-1 Test Object Pattern

11.4 TEST CONSIDERATIONS WHEN USING EXACT CHANNEL SELECT OR FLOATING BLANKING

⚠ Warning! Use of Exact channel Select and/or Floating Blanking will make the 4700 system less sensitive to objects in the detection zone. Improper use of either can result in severe injury to personnel. Exact Channel Select may require a hard barrier guard (see section 5.8), Floating Blanking requires an increase in the safety distance. Read section 5 carefully.

When Exact Channel Select 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 condition:

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 Exact Channel Select is:
 - a. Completely blocked by an obstruction; or
 - b. that those areas not blocked by an obstruction are protected by supplemental guarding.

If neither of these conditions can be met, the safe mounting distance of the 4700 system should be modified in accordance with the safe mounting distance formulas presented in Section 8—*Safe Mounting Distance*.

3. Using a proper size test object and the method described in Section 11.3—*Using the Test Object*, check those areas which have not been programmed by Exact Channel Select. Be sure that they have not been accidentally selected as well.

12 TROUBLESHOOTING

12

The controller contains a two-digit diagnostic display, which presents numeric codes indicating both normal operation and system fault status. The operational codes are described in the table below.

Table 12-1 Operational Codes

Code Displayed	System Status	Corrective Action
88	Power-up indication.	None required.
00	Normal operation; no floating blanking or exact channel select.	None required.
01	Normal operation; waiting for start signal.	Press and release start switch.
02	Normal operation; floating blanking active.	None required.
03	Normal operation; exact channel select active.	None required.
04	Normal operation; floating blanking and exact channel select active.	None required.



Table 12-2 DIP Switch Fault Codes

Code Displayed	System Status	Corrective Action
20	Incorrect operating mode or floating blanking switch setting.	1. Check setting of operating mode switches 1 and 2. 2. Check setting of floating blanking switches 5 and 6.
21	Invalid switch setting.	1. Check to see that settings of switch positions 1 through 7 are valid and identically set between switches A and B.
22	DIP switch settings changed during operation.	1. Press and release start switch or cycle power.
23	Invalid switch settings.	1. Check channel select and MPCE switches for valid settings.

Table 12-3 Safety Output (OSSD) Faults

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

Table 12-4 MPCE Faults

Code Displayed	System Status	Corrective Action
40	General MPCE fault.	1. Possible incorrectly wired MPCE circuit. Check and wire according to manual.
41	MPCE Open before safety output (OSSD) activation.	1. Check to confirm that MPCE circuit is closed before OSSD activation.
43	MPCE open when power is applied.	1. Check to confirm that MPCE circuit is closed when power is applied.

Table 12-5 Controller Faults

Code Displayed	System Status	Corrective Action
50	Internal controller fault.	1. Return controller to STI for repair.
51	Receiver fault.	1. Check receiver to controller wiring connections. Correct errors. 2. Check receiver cable for cuts, and proper connection to quick-disconnect fitting. Replace or properly connect cable as required. 3. If none of the above, return receiver to STI for repair.
52	Transmitter fault.	1. Check transmitter to controller wiring connections. Correct errors. 2. Check transmitter cable for cuts, and proper connection to quick-disconnect fitting. Replace or properly connect cable as required. 3. If none of the above, return transmitter to STI for repair.
53	Transmitter and receiver length mismatch or transmitter and receiver not connected.	1. Check to determine that transmitter and receiver are identical in protected height. 2. Check to determine that transmitter and receiver are properly connected to controller and that their cables are not damaged.
59	24 VDC power supply fault.	1. Check voltage supplied to unit. Correct so that it is 24 VDC \pm 20%.
70	Grounding/Shielding Fault	1. Check the controller is properly grounded. 2. Check to see that the transmitter and receiver shield is connected properly. 3. Check for cross-talk from other I.R. light source.

13 CLEANING

13

Accumulation of oil, dirt and grease on the front filter of the 4700 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 4700 surfaces may be cleaned with a mild de-greasing cleaner or detergent.



14 SPECIFICATIONS AND ADDITIONAL INFORMATION

14

14.1 SYSTEM SPECIFICATIONS

Protective Height:

- 12 mm minimum object resolution: 100 to 1200 mm in 100 mm increments
- 14 and 20 mm minimum object resolution: 150 to 1800 mm in 75 mm increments
- 30 mm minimum object resolution: 150 to 1800 mm in 150 mm increments.

Operating Range:

MC4700	SR	LR
12 mm	0.2 to 3 m (0.7 to 10 ft.)	0.2 to 5 m (0.7 to 16.5 ft.)
14 mm	0.3 to 5 m (1 to 16.5 ft.)	Not Available
20 mm	0.3 to 7 m (1 to 23 ft.)	0.3 to 12 m (1 to 39 ft.)
30 mm	0.3 to 7 m (1 to 23 ft.)	0.3 to 12 m (1 to 39 ft.)
MCF4700	SR	LR
12 mm	0.2 to 3 m (0.7 to 10 ft.)	Not Available
14 mm	0.3 to 3 m (1 to 10 ft.)	Not Available
20 mm	0.3 to 7 m (1 to 23 ft.)	Not Available
30 mm	0.3 to 7 m (1 to 23 ft.)	Not Available
MCJ4700	SR	LR
12 mm	0.2 to 3 m (0.7 to 10 ft.)	Not Available
14 mm	0.3 to 5 m (1 to 16.5 ft.)	Not Available
20 mm	0.3 to 7 m (1 to 23 ft.)	Not Available
30 mm	0.3 to 7 m (1 to 23 ft.)	Not Available
MS4700	SR	LR
12 mm	0.2 to 3 m (0.7 to 10 ft.)	0.2 to 5 m (0.7 to 16.5 ft.)
14 mm	0.3 to 5 m (1 to 16.5 ft.)	Not Available
20 mm	0.3 to 7 m (1 to 23 ft.)	0.3 to 12 m (1 to 39 ft.)
30 mm	0.3 to 7 m (1 to 23 ft.)	0.3 to 12 m (1 to 39 ft.)
MSF4700	SR	LR
12 mm	0.2 to 3 m (0.7 to 10 ft.)	Not Available
14 mm	0.3 to 3 m (1 to 10 ft.)	Not Available
20 mm	0.3 to 7 m (1 to 23 ft.)	Not Available
30 mm	0.3 to 7 m (1 to 23 ft.)	Not Available

Minimum Object Resolution:

- 12 mm minimum object resolution systems:
 - With no Floating Blanking: 12.0 mm (0.47 inches)¹
 - With 1-beam Floating Blanking: 19 mm (0.75 inches)¹
 - With 2-beam Floating Blanking: 26 mm (1.02 inches)¹
- 14 mm minimum object resolution systems:
 - With no Floating Blanking: 14.0 mm (0.55 inches)¹
 - With 1-beam Floating Blanking: 25 mm (0.98 inches)¹
 - With 2-beam Floating Blanking: 36 mm (1.42 inches)¹
- 20 mm minimum object resolution systems:
 - With no Floating Blanking: 20.0 mm (0.79 inches)¹
 - With 1-beam Floating Blanking: 31 mm (1.22 inches)¹
 - With 2-beam Floating Blanking: 42 mm (1.65 inches)¹
- 30 mm minimum object resolution systems:
 - With no Floating Blanking: 30.0 mm (1.18 inches)¹
 - With 1-beam Floating Blanking: 52 mm (2.05 inches)¹
 - With 2-beam Floating Blanking: 74 mm (2.91 inches)¹

¹ Use of Exact Channel will increase this value

MCJ4700 Joint Resolution (Resolution at the corner)

	Floating Blanking OFF	Floating Blanking 1 Channel	Floating Blanking 2 Channels
MCJ-12	25 mm	31 mm	37 mm
MCJ-20	29 mm	40 mm	50 mm
MCJ-30	32 mm	52 mm	73 mm

Safety Output: Din & Solid State Output version of Metal Chassis Controllers: Two PNP each output sourcing 625 mA @ 24 VDC.

Relay version of metal chassis controller only: 1 N.O. and 1 N.C. /N.O. rated for 6A at 230 VAC.

Auxiliary (non-safety) Output:

Din & Solid State Output version of Metal Chassis Controllers: One NPN output sinking 100 mA @ 24 VDC. One PNP sourcing 250 mA @ 24 VDC.

Relay version of metal chassis controller only: 1 N.O./N.C. rated at 3A @ 230 VAC.

MPCE: 50mA @ 24 VDC

Maximum Response Time: <See Table 14-1, Table 14-2 or Table 14-3 for details of response time by protected height.

Power Input:

Din & Solid State Output version of Metal Chassis Controllers: 24 VDC \pm 20%, 2A* , . Power supply must meet the requirements of IEC 60204-1 and IEC 61496-1. STI part number 42992 or equivalent.



Relay version of metal chassis controller only: 100 - 230 VAC @ 30 VA

*Internal consumption of power by the controller is less than 10 watts (415mA).

Light Source: GaAlAs Light Emitting Diode, 850 nm

Cable Length: Up to 30 m between the controller and the transmitter and receiver assemblies. The DIN system operates with shielded cables on the OSSD and AUX outputs with lengths up to 75 m.

Construction:

— Transmitter and receiver are polyester powder painted aluminum.

Temperature: 0 to 55° C (32 to 131° F)

Relative Humidity: 95% maximum, non-condensing

Enclosure Rating:

— Transmitter and receiver: IP65

— Controller: IP20 for DIN mount and IP65 for Metal Chassis

Indicator Lights:

— Receiver: Machine Run, Machine Stop, Interlock/Fault, Channel Select/Floating Blanking, Individual Beam

— Controller: Machine Run, Machine Stop, Interlock/Fault, Channel Select/Floating Blanking; plus two-digit diagnostic display and bus status LED for DeviceNet option.

Specifications subject to change without notice.

Response Time:

- MC4700 and MS4700

Table 14-1 Response Time for 12 mm MC4700 and MS4700

Response Times for 12 mm systems				
Protected Height Designator	No. of Beams	Response Times – mS		
		Solid State	Mechanical Relay	
			N.O.	N.C.
100	16	7.5	17.5	27.5
200	32	9.2	19.2	29.2
300	48	10.9	20.9	30.9
400	64	12.5	22.5	32.5
500	80	14.2	24.2	34.2
600	96	15.8	25.8	35.8
700	112	17.5	27.5	37.5
800	128	19.2	29.2	39.2
900	144	20.8	30.8	40.8
1000	160	22.5	32.5	42.5
1100	176	24.1	34.1	44.1
1200	192	25.8	35.8	45.8
1300	208	27.5	37.5	47.5
1400	224	29.1	39.1	49.1
1500	240	30.8	40.8	50.8
1600	256	32.4	42.4	52.4

Note: MC4700-12 is only available up to 1200 mm protective heights.

Table 14-2 Response Time for 14 mm and 20 mm MC4700 and MS4700

Response Times for 14 mm and 20 mm systems				
Protected Height Designator	No. of Beams	Response Times – mS		
		Solid State	Mechanical Relay	
			N.O	N.C.
150	14	7.3	17.3	27.3
225	21	8.1	18.1	28.1
300	28	8.8	18.8	28.8
375	35	9.5	19.5	29.5
450	42	10.2	20.2	30.2
525	49	11.0	21.0	31.0
600	56	11.7	21.7	31.7
675	63	12.4	22.4	32.4
750	70	13.1	23.1	33.1
825	77	13.9	23.9	33.9
900	84	14.6	24.6	34.6
975	91	15.3	25.3	35.3
1050	98	16.0	26.0	36.0
1125	105	16.8	26.8	36.8
1200	112	17.5	27.5	37.5
1275	119	18.2	28.2	38.2
1350	126	19.0	29.0	39.0
1425	133	19.7	29.7	39.7
1500	140	20.4	30.4	40.4
1575	147	21.1	31.1	41.1
1650	154	21.9	31.9	41.9
1725	161	22.6	32.6	42.6
1800	168	23.3	33.3	43.3

Formula is: Response Time (ms) = 5.881 + (Nbeams x 0.103763)

Same extensions for relay controllers applies.

Table 14-3 Response Times for 30 mm MC4700 and MS4700 systems

Response Times for 30 mm systems				
Protected Height Designator	No. of Beams	Response Times – mS		
		Solid State	Mechanical Relay	
			N.O	N.C.
150	7	6.6	16.6	26.6
300	14	7.3	17.3	27.3
450	21	8.1	18.1	28.1
600	28	8.8	18.8	28.8
750	35	9.5	19.5	29.5
900	42	10.2	20.2	30.2
1050	49	11.0	21.0	31.0
1200	56	11.7	21.7	31.7
1350	63	12.4	22.4	32.4
1500	70	13.1	23.1	33.1
1650	77	13.9	23.9	33.9
1800	84	14.6	24.6	34.6

Note: Add 8 ms to the "Solid State" response time when using RM-1; Use the response time in Mechanical Relay table when using the RM-X .



- Response Time for MCF4700, MCJ4700 and MSF4700

The MCF and MCJ can have up to four segments. It is possible for each segment to have a different minimum object resolution.

Step 1: Determine the number of beams in each segment using *Table 14-1*, *Table 14-2* and *Table 14-3*.**

Step 2: Use the formula below to determine response time:

(Total number of beams x 0.0924) + 5.21 msec = response time in msec.

**The total number of beams in a system cannot exceed 192.

MCF4700 example:

MCF47-12200-301800-20300

The unit has three segments, a 12 mm resolution of 200 mm length, a 30 mm resolution of 1800 length and a 20 mm resolution of 300 mm length.

Table 14-1 show 32 beams for the 12 mm segment, *Table 14-3* show 84 beams for the 30 mm segment and *Table 14-2* shows 28 beams for the 20 mm segment. The total number of beams is:

$$32 + 84 + 28 = 144.$$

From the formula:

$$(144 \text{ beams} \times 0.0924) + 5.21 \text{ ms} = 18.5 \text{ ms}.$$

14.2 MICROSAFE MC4700 SERIES DIMENSIONS

14.2.1 MC4700 SERIES DIMENSIONS

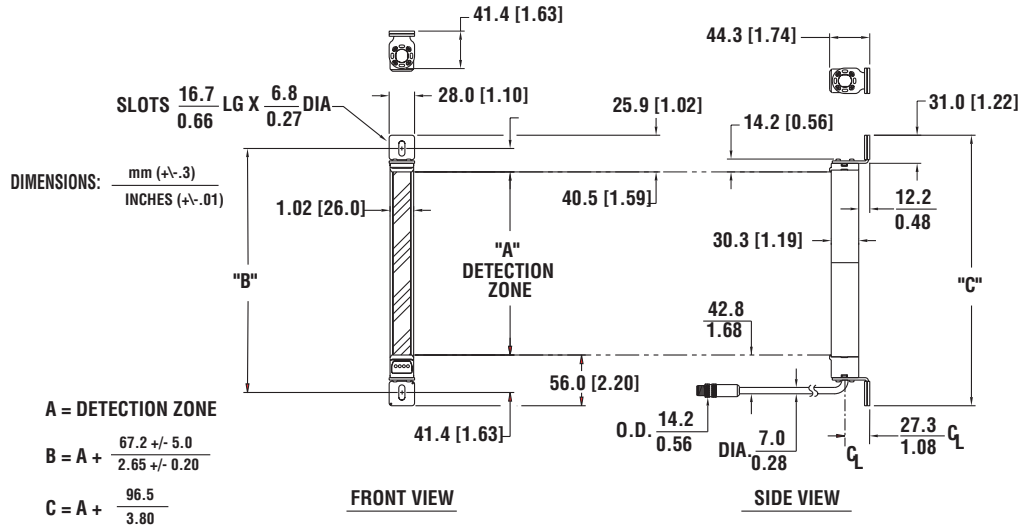


Figure 14-1 MC4700 Series Dimensional Drawing

Table 14-4 12mm transmitter and Receiver Lengths

	100	200	300	400	500	600
A	102/4.0	202/8.0	302/11.9	402/15.8	502/19.8	602/23.7
B	169/6.7	269/10.6	369/14.5	469/18.5	569/22.4	669/26.3
C	198/7.8	298/11.7	398/15.7	498/19.6	598/23.5	698/27.5

	700	800	900	1000	1100	1200
A	702/27.6	802/31.6	902/35.5	1002/39.5	1102/43.4	1202/47.3
B	769/30.3	869/34.2	969/38.1	1069/42.1	1169/46.0	1269/50.0
C	798/31.4	898/35.4	998/39.3	1098/43.2	1198/47.2	1298/51.1

Table 14-5 14mm, 20 mm and 30 mm Transmitter and Receiver Lengths

	155	235*	305	385*	455	535*	605	685*
A	159/6.3	235/9.3	309/12.2	385/15.2	459/18.1	535/21.1	609/24.0	685/27.0
B	226/8.9	302/11.9	376/14.8	452/17.8	526/20.7	602/23.7	676/26.6	752/29.6
C	255/10.0	331/13.0	405/15.9	481/18.9	555/21.9	631/24.8	705/27.8	781/30.7

	755	835*	905	985*	1055	1135*	1205	1285*
A	759/29.9	835/32.9	909/35.8	985/38.9	1059/41.7	1135/44.7	1209/47.6	1285/50.6
B	826/32.5	902/35.5	976/38.4	1052/41.4	1126/44.3	1202/47.3	1276/50.2	1352/53.2
C	855/33.6	931/36.7	1005/39.6	1081/42.6	1155/45.5	1231/48.5	1305/51.4	1381/54.4

	1355	1435*	1505	1585*	1655	1735*	1805
A	1359/53.5	1435/56.5	1509/59.4	1585/62.4	1659/65.3	1735/68.3	1809/71.2
B	1426/56.1	1502/59.1	1576/62.0	1652/65.0	1726/68.0	1802/70.9	1876/73.9
C	1455/57.3	1531/60.3	1605/63.2	1681/66.2	1755/69.1	1831/72.1	1905/75.0

*For 14mm and 20mm systems only.

14.2.2 MC4700 SPARE PARTS

Spare transmitters and receivers are available through your local STI distributor. Information on model numbers is provided below:

Table 14-6 MC4700-12 Spare Transmitter and Receiver Model Number

Protected Height (mm/inches)	*Transmitter Model Number	Receiver Model Number
102/4.0	MC47__-12-100-X	MC47-12-100-R
202/8.0	MC47__-12-200-X	MC47-12-200-R
302/11.9	MC47__-12-300-X	MC47-12-300-R
402/15.8	MC47__-12-400-X	MC47-12-400-R
502/19.8	MC47__-12-500-X	MC47-12-500-R
602/23.7	MC47__-12-600-X	MC47-12-600-R
702/27.6	MC47__-12-700-X	MC47-12-700-R
802/31.6	MC47__-12-800-X	MC47-12-800-R
902/35.5	MC47__-12-900-X	MC47-12-900-R
1002/39.5	MC47__-12-1000-X	MC47-12-1000-R
1102/43.4	MC47__-12-1100-X	MC47-12-1100-R
1202/47.3	MC47__-12-1200-X	MC47-12-1200-R

*Select [SR] or [LR].

Table 14-7 MC4700-14 Spare Transmitter and Receiver Model Number

Protected Height (mm/inches)	Transmitter Model Number	Receiver Model Number
159/6.3	MC47SR-14-150-X	MC47-14-150-R
235/9.3	MC47SR-14-225-X	MC47-14-225-R
309/12.2	MC47SR-14-300-X	MC47-14-300-R
385/15.2	MC47SR-14-375-X	MC47-14-375-R
459/18.1	MC47SR-14-450-X	MC47-14-450-R
535/21.1	MC47SR-14-525-X	MC47-14-525-R
609/24.0	MC47SR-14-600-X	MC47-14-600-R
685/27.0	MC47SR-14-675-X	MC47-14-675-R
759/29.9	MC47SR-14-750-X	MC47-14-750-R
835/32.9	MC47SR-14-825-X	MC47-14-825-R
909/35.8	MC47SR-14-900-X	MC47-14-900-R
985/38.9	MC47SR-14-975-X	MC47-14-975-R
1059/41.7	MC47SR-14-1050-X	MC47-14-1050-R
1135/44.7	MC47SR-14-1125-X	MC47-14-1125-R
1209/47.6	MC47SR-14-1200-X	MC47-14-1200-R
1285/50.6	MC47SR-14-1275-X	MC47-14-1275-R
1359/53.5	MC47SR-14-1350-X	MC47-14-1350-R
1435/56.5	MC47SR-14-1425-X	MC47-14-1425-R
1509/59.4	MC47SR-14-1500-X	MC47-14-1500-R
1585/62.4	MC47SR-14-1575-X	MC47-14-1575-R
1659/65.3	MC47SR-14-1650-X	MC47-14-1650-R
1735/68.3	MC47SR-14-1725-X	MC47-14-1725-R
1809/71.2	MC47SR-14-1800-X	MC47-14-1800-R

Table 14-8 MC4700-20 Spare Transmitter and Receiver Model Number

Protected Height (mm/inches)	*Transmitter Model Number	Receiver Model Number
159/6.3	MC47__-20-150-X	MC47-20-150-R
235/9.3	MC47__-20-225-X	MC47-20-225-R
309/12.2	MC47__-20-300-X	MC47-20-300-R
385/15.2	MC47__-20-375-X	MC47-20-375-R
459/18.1	MC47__-20-450-X	MC47-20-450-R
535/21.1	MC47__-20-525-X	MC47-20-525-R
609/24.0	MC47__-20-600-X	MC47-20-600-R
685/27.0	MC47__-20-675-X	MC47-20-675-R
759/29.9	MC47__-20-750-X	MC47-20-750-R
835/32.9	MC47__-20-825-X	MC47-20-825-R
909/35.8	MC47__-20-900-X	MC47-20-900-R
985/38.9	MC47__-20-975-X	MC47-20-975-R
1059/41.7	MC47__-20-1050-X	MC47-20-1050-R
1135/44.7	MC47__-20-1125-X	MC47-20-1125-R
1209/47.6	MC47__-20-1200-X	MC47-20-1200-R
1285/50.6	MC47__-20-1275-X	MC47-20-1275-R
1359/53.5	MC47__-20-1350-X	MC47-20-1350-R
1435/56.5	MC47__-20-1425-X	MC47-20-1425-R
1509/59.4	MC47__-20-1500-X	MC47-20-1500-R
1585/62.4	MC47__-20-1575-X	MC47-20-1575-R
1659/65.3	MC47__-20-1650-X	MC47-20-1650-R
1735/68.3	MC47__-20-1725-X	MC47-20-1725-R
1809/71.2	MC47__-20-1800-X	MC47-20-1800-R

* Select [SR] or [LR]

Table 14-9 MC4700-30 Spare Transmitter and Receiver Model Number

Protected Height (mm/inches)	*Transmitter Model Number	Receiver Model Number
159/6.3	MC47__-30-150-X	MC47-30-150-R
309/12.2	MC47__-30-300-X	MC47-30-300-R
459/18.1	MC47__-30-450-X	MC47-30-450-R
609/24.0	MC47__-30-600-X	MC47-30-600-R
759/29.9	MC47__-30-750-X	MC47-30-750-R
909/35.8	MC47__-30-900-X	MC47-30-900-R
1059/41.7	MC47__-30-1050-X	MC47-30-1050-R
1209/47.6	MC47__-30-1200-X	MC47-30-1200-R
1359/53.5	MC47__-30-1350-X	MC47-30-1350-R
1509/59.4	MC47__-30-1500-X	MC47-30-1500-R
1659/65.3	MC47__-30-1650-X	MC47-30-1650-R
1809/71.2	MC47__-30-1800-X	MC47-30-1800-R

* Select [SR] or [LR]

14.3 MICROSAFE FLEXIBLE MCF4700 SERIES

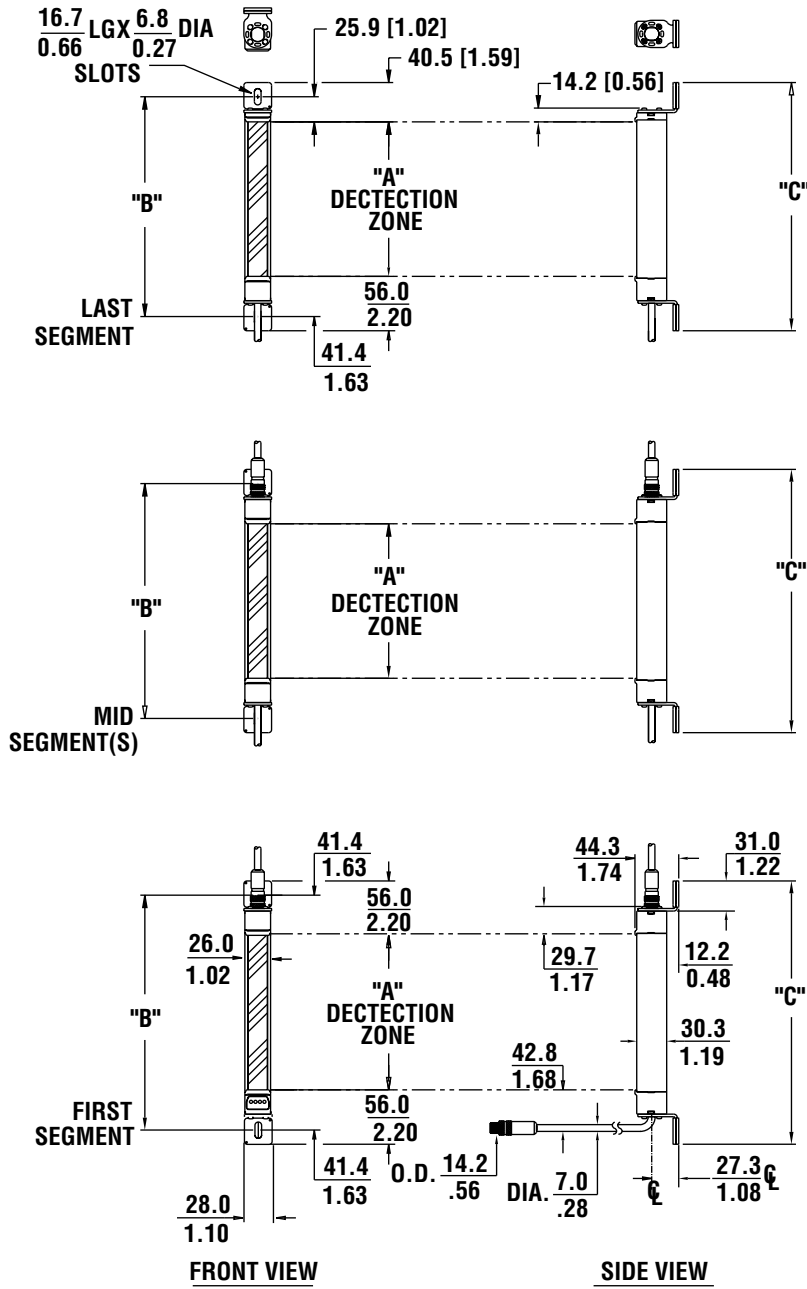


Figure 14-2 MicroSafe Flexible MCF4700 Dimensions

14.3.1 MCF4700 SERIES DIMENSIONS

Table 14-10 MCF4700-12 Dimensions First & Middle Segment

A mm/in.	B mm/in.	C mm/in.
102/4.0	185/7.3	214/8.4
202/8.0	285/11.2	314/12.4
302/11.9	385/15.2	414/16.3
402/15.8	485/19.1	514/20.2
502/19.8	585/23.0	614/24.2
602/23.7	685/27.0	714/28.1
702/27.6	785/30.9	814/32.0
802/31.6	885/34.8	914/36.0
902/35.5	985/38.8	1014/39.9
1002/39.5	1085/42.7	1114/43.9
1102/43.4	1185/46.7	1214/47.8

Table 14-11 MCF4700-12 Dimensions Last Segment

A mm/in.	B mm/in.	C mm/in.
102/4.0	169/6.7	198/7.8
202/8.0	269/10.6	298/11.7
302/11.9	369/14.5	398/15.7
402/15.8	469/18.5	498/19.6
502/19.8	569/22.4	598/23.5
602/23.7	669/26.3	698/27.5
702/27.6	769/30.3	798/31.4
802/31.6	869/34.2	898/35.4
902/35.5	969/38.1	998/39.3
1002/39.5	1069/42.1	1098/47.2
1102/43.4	1169/46.0	1198/47.2

Table 14-12 MCF4700-14, MCF4700-20 and MCF4700-30 First and Middle Segment

A mm/in.	B mm/in.	C mm/in.
159/6.3	242/9.5	271/10.7
*235/9.3	318/12.5	347/13.7
309/12.2	392/15.4	421/16.6
*385/15.2	468/18.4	497/19.6
459/18.1	542/21.3	571/22.5
*535/21.1	618/24.3	647/25.5
609/24.0	692/27.2	721/28.4
*685/27.0	768/30.2	797/31.4
759/29.9	842/33.1	871/34.3
*835/32.9	918/36.1	947/37.3
909/35.8	992/39.1	1021/40.2
*985/38.9	1068/42.0	1097/43.2
1059/41.7	1142/45.0	1171/46.1
*1135/44.7	1218/48.0	1247/49.1
1209/47.6	1292/50.9	1321/52.0
*1285/50.6	1368/53.9	1397/55.0



1359/53.5	1442/56.8	1471/57.9
*1435/56.5	1518/59.8	1547/60.9
1509/59.4	1592/62.7	1621/63.8
*1585/62.4	1668/65.7	1697/66.8
1659/65.3	1742/68.6	1771/69.7
*1735/68.3	1818/71.6	1847/72.7
1809/71.2	1892/74.5	1921/75.6
	* Not available in 30 mm resolution	

Table 14-13 MCF4700-14, MCF4700-20 and MCF4700-30 Last Segment

A mm/in.	B mm/in.	C mm/in.
159/6.3	226/8.9	255/10.0
*235/9.3	302/11.9	331/13.0
309/12.2	376/14.8	405/15.9
*385/15.2	452/17.8	481/18.9
459/18.1	526/20.7	555/21.9
*535/21.1	602/23.7	631/24.8
609/24.0	676/26.6	705/27.8
*685/27.0	752/29.6	781/30.7
759/39.9	826/32.5	855/33.7
*835/32.9	902/35.5	931/36.7
909/35.8	976/38.4	1005/39.6
*985/38.9	1052/41.4	1081/42.6
1059/41.7	1126/44.3	1155/45.5
*1135/44.7	1202/47.3	1231/48.5
1209/47.6	1276/50.2	1305/51.4
*1285/50.6	1352/53.2	1381/54.4
1359/53.5	1426/56.1	1455/57.3
*1435/56.5	1502/59.1	1531/60.3
1509/59.4	1576/62.0	1605/63.2
*1585/62.4	1652/65.0	1681/66.2
1659/65.3	1726/68.0	1755/69.1
*1735/68.3	1802/70.9	1831/72.1
1809/71.2	1876/73.9	1905/75.0
	* Not available in 30 mm resolution	

14.3.2 MCF4700 SPARE PARTS

Table 14-14 Transmitter and Receiver Segments

MCF4700-12 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model Number	Description
MCF47-12-100-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 102 mm (4.0 in.)
MCF47-12-200-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 202 mm (8.0 in.)
MCF47-12-300-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 302 mm (11.9 in.)
MCF47-12-400-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 402 mm (15.8 in.)
MCF47-12-500-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 502 mm (19.8 in.)
MCF47-12-600-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 602 mm (23.7 in.)
MCF47-12-700-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 702 mm (27.6 in.)

MCF4700-12 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
MCF47-12-800-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 802 mm (31.6 in.)
MCF47-12-900-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 902 mm (35.5 in.)
MCF47-12-1000-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 1002 mm (39.5 in.)
MCF47-12-1100-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 1102 mm (43.4 in.)
MCF47-12-1200-(X1, X2, or X3)	MicroSafe Flexible MCF4700-12 Transmitter, 1202 mm (47.3 in.)

MCF4700-12 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MCF47-12-100-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 102 mm (4.0 in.)
MCF47-12-200-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 202 mm (8.0 in.)
MCF47-12-300-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 302 mm (11.9 in.)
MCF47-12-400-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 402 mm (15.8 in.)
MCF47-12-500-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 502 mm (19.8 in.)
MCF47-12-600-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 602 mm (23.7 in.)
MCF47-12-700-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 702 mm (27.6 in.)
MCF47-12-800-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 802 mm (31.6 in.)
MCF47-12-900-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 902 mm (35.5 in.)
MCF47-12-1000-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 1002 mm (39.5 in.)
MCF47-12-1100-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 1102 mm (43.4 in.)
MCF47-12-1200-(R1, R2, or R3)	MicroSafe Flexible MCF4700-12 Receiver, 1202 mm (47.3 in.)

MCF4700-14 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model	NumberDescription
MCF47-14-075-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 78 mm (3.1 in.) Mid and Last Segments Only
MCF47-14-150-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 159 mm (6.3 in.)
MCF47-14-225-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 235 mm (9.3 in.)
MCF47-14-300-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 309 mm (12.1 in.)
MCF47-14-375-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 385 mm (15.1 in.)
MCF47-14-450-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 459 mm (18.1 in.)
MCF47-14-525-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 535 mm (21.1 in.)
MCF47-14-600-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 609 mm (24.0 in.)
MCF47-14-675-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 685 mm (27.0 in.)
MCF47-14-750-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 759 mm (29.9 in.)
MCF47-14-825-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 835 mm (32.9 in.)
MCF47-14-900-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 909 mm (35.8 in.)
MCF47-14-975-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 985 mm (38.8 in.)
MCF47-14-1050-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1059 mm (41.7 in.)
MCF47-14-1125-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1135 mm (44.7 in.)
MCF47-14-1200-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1209 mm (47.60 in.)
MCF47-14-1275-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1285 mm (50.6 in.)
MCF47-14-1350-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1359 mm (53.3 in.)
MCF47-14-1425-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1435 mm (56.5 in.)
MCF47-14-1500-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1509 mm (59.4 in.)
MCF47-14-1575-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1585 mm (62.4 in.)
MCF47-14-1650-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1659 mm (65.3 in.)
MCF47-14-1725-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1735 mm (68.3 in.)



MCF4700-14 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
MCF47-14-1800-(X1, X2, or X3)	MicroSafe Flexible MCF4700-14 Transmitter, 1809 mm (71.2 in.)

MCF4700-14 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
---	--

Model	NumberDescription
MCF47-14-075-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 78 mm (3.1 in.) Mid and Last Segments Only
MCF47-14-150-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 159 mm (6.3 in.)
MCF47-14-225-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 235 mm (9.3 in.)
MCF47-14-300-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 309 mm (12.2 in.)
MCF47-14-375-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 385 mm (15.2 in.)
MCF47-14-450-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 459 mm (18.1 in.)
MCF47-14-525-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 535 mm (21.1 in.)
MCF47-14-600-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 609 mm (24.0 in.)
MCF47-14-675-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 685 mm (27.0 in.)
MCF47-14-750-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 759 mm (29.9 in.)
MCF47-14-825-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 835 mm (32.9 in.)
MCF47-14-900-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 909 mm (35.8 in.)
MCF47-14-975-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 985 mm (38.8 in.)
MCF47-14-1050-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1059 mm (41.7 in.)
MCF47-14-1125-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1135 mm (44.7 in.)
MCF47-14-1200-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1209 mm (47.6 in.)
MCF47-14-1275-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1285 mm (50.6 in.)
MCF47-14-1350-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1359 mm (53.3 in.)
MCF47-14-1425-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1435 mm (56.5 in.)
MCF47-14-1500-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1509 mm (59.4 in.)
MCF47-14-1575-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1585 mm (62.4 in.)
MCF47-14-1650-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1659 mm (65.3 in.)
MCF47-14-1725-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1735 mm (68.3 in.)
MCF47-14-1800-(R1, R2, or R3)	MicroSafe Flexible MCF4700-14 Receiver, 1809 mm (71.2 in.)

MCF4700-20 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
--	--

Model	NumberDescription
MCF47-20-075-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 78 mm (317 in.) Mid and Last Segments Only
MCF47-20-150-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 159 mm (6.3 in.)
MCF47-20-225-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 235 mm (9.3 in.)
MCF47-20-300-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 309 mm (12.2 in.)
MCF47-20-375-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 385 mm (15.2 in.)
MCF47-20-450-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 459 mm (18.1 in.)
MCF47-20-525-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 535 mm (21.1 in.)
MCF47-20-600-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 609 mm (24.0 in.)
MCF47-20-675-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 685 mm (27.0 in.)
MCF47-20-750-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 759 mm (29.9 in.)
MCF47-20-825-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 835 mm (32.9 in.)
MCF47-20-900-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 909 mm (35.8 in.)
MCF47-20-975-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 985 mm (38.8 in.)
MCF47-20-1050-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1059 mm (41.7 in.)

MCF4700-20 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
MCF47-20-1125-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1135 mm (44.7 in.)
MCF47-20-1200-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1209 mm (47.6 in.)
MCF47-20-1275-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1285 mm (50.6 in.)
MCF47-20-1350-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1359 mm (53.3 in.)
MCF47-20-1425-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1435 mm (56.5 in.)
MCF47-20-1500-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1509 mm (59.4 in.)
MCF47-20-1575-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1585 mm (62.4 in.)
MCF47-20-1650-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1659 mm (65.3 in.)
MCF47-20-1725-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1735 mm (68.3 in.)
MCF47-20-1800-(X1, X2, or X3)	MicroSafe Flexible MCF4700-20 Transmitter, 1809 mm (71.2 in.)

MCF4700-20 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MCF47-20-075-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 78 mm (3.1 in.) Mid and Last Segments Only
MCF47-20-150-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 159 mm (6.3 in.)
MCF47-20-225-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 235 mm (9.3 in.)
MCF47-20-300-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 309 mm (12.2 in.)
MCF47-20-375-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 385 mm (15.2 in.)
MCF47-20-450-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 459 mm (18.1 in.)
MCF47-20-525-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 535 mm (21.1 in.)
MCF47-20-600-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 609 mm (24.0 in.)
MCF47-20-675-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 685 mm (27.0 in.)
MCF47-20-750-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 759 mm (29.9 in.)
MCF47-20-825-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 835 mm (32.9 in.)
MCF47-20-900-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 909 mm (35.8 in.)
MCF47-20-975-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 985 mm (38.8 in.)
MCF47-20-1050-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1059 mm (41.7 in.)
MCF47-20-1125-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1135 mm (44.7 in.)
MCF47-20-1200-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1209 mm (47.6 in.)
MCF47-20-1275-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1285 mm (50.6 in.)
MCF47-20-1350-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1359 mm (53.3 in.)
MCF47-20-1425-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1435 mm (56.5 in.)
MCF47-20-1500-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1509 mm (59.4 in.)
MCF47-20-1575-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1585 mm (62.4 in.)
MCF47-20-1650-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1659 mm (65.3 in.)
MCF47-20-1725-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1735 mm (68.3 in.)
MCF47-20-1800-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1809 mm (71.2 in.)

MCF4700-30 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model	NumberDescription
MCF47-30-150-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 159 mm (6.3 in.)
MCF47-30-300-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 309 mm (12.2 in.)
MCF47-30-450-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 459 mm (18.1 in.)
MCF47-30-600-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 609 mm (24.0 in.)
MCF47-30-750-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 759 mm (29.9 in.)
MCF47-30-900-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 909 mm (35.8 in.)



MCF4700-30 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
MCF47-30-1050-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 1059 mm (41.7 in.)
MCF47-30-1200-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 1209 mm (47.6 in.)
MCF47-30-1350-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 1359 mm (53.3 in.)
MCF47-30-1500-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 1509 mm (59.4 in.)
MCF47-30-1650-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 1659 mm (65.3 in.)
MCF47-30-1800-(X1, X2, or X3)	MicroSafe Flexible MCF4700-30 Transmitter, 1809 mm (71.2 in.)

MCF4700-30 Receivers - First (R1), Mid (R2) and Last (X3) Segments	
Model	NumberDescription
MCF47-30-150-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 159 mm (6.3 in.)
MCF47-30-300-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 309 mm (12.2 in.)
MCF47-30-450-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 459 mm (18.1 in.)
MCF47-30-600-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 609 mm (24.0 in.)
MCF47-30-750-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 759 mm (29.9 in.)
MCF47-30-900-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 909 mm (35.8 in.)
MCF47-30-1050-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 1059 mm (41.7 in.)
MCF47-30-1200-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 1209 mm (47.6 in.)
MCF47-30-1350-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 1359 mm (53.3 in.)
MCF47-30-1500-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 1509 mm (59.4 in.)
MCF47-30-1650-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 1659 mm (65.3 in.)
MCF47-30-1800-(R1, R2, or R3)	MicroSafe Flexible MCF4700-30 Receiver, 1809 mm (71.2 in.)

MCF4700-20 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MCF47-20-075-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 78 mm (3.1 in.) Mid and Last Segments Only
MCF47-20-150-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 159 mm (6.3 in.)
MCF47-20-225-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 235 mm (9.3 in.)
MCF47-20-300-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 309 mm (12.2 in.)
MCF47-20-375-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 385 mm (15.2 in.)
MCF47-20-450-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 459 mm (18.1 in.)
MCF47-20-525-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 535 mm (21.1 in.)
MCF47-20-600-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 609 mm (24.0 in.)
MCF47-20-675-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 685 mm (27.0 in.)
MCF47-20-750-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 759 mm (29.9 in.)
MCF47-20-825-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 835 mm (32.9 in.)
MCF47-20-900-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 909 mm (35.8 in.)
MCF47-20-975-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 985 mm (38.8 in.)
MCF47-20-1050-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1059 mm (41.7 in.)
MCF47-20-1125-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1135 mm (44.7 in.)
MCF47-20-1200-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1209 mm (47.6 in.)
MCF47-20-1275-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1285 mm (50.6 in.)
MCF47-20-1350-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1359 mm (53.3 in.)
MCF47-20-1425-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1435 mm (56.5 in.)
MCF47-20-1500-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1509 mm (59.4 in.)
MCF47-20-1575-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1585 mm (62.4 in.)
MCF47-20-1650-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1659 mm (65.3 in.)
MCF47-20-1725-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1735 mm (68.3 in.)
MCF47-20-1800-(R1, R2, or R3)	MicroSafe Flexible MCF4700-20 Receiver, 1809 mm (71.2 in.)

14.4 MICROSAFE JOINTED MCJ4700 SERIES

14.4.1 MCJ4700 SEGMENT DIMENSIONS

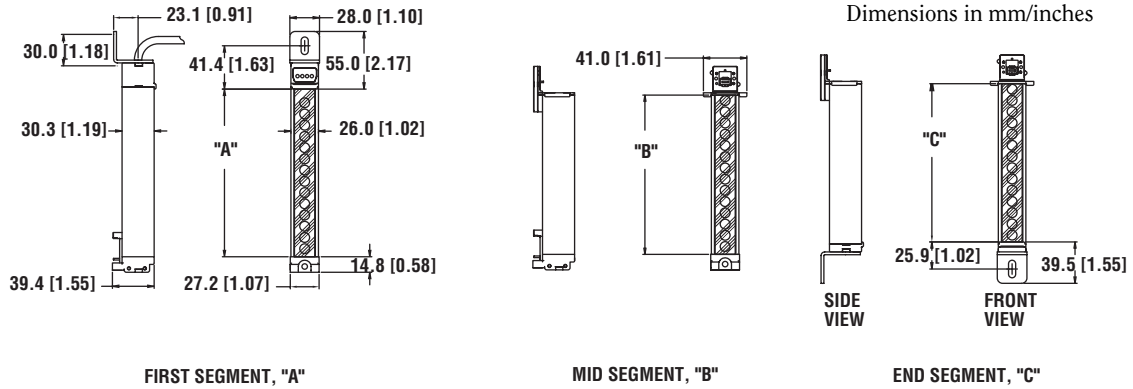


Figure 14-3 MicroSafe Jointed MCJ4700 Dimensions

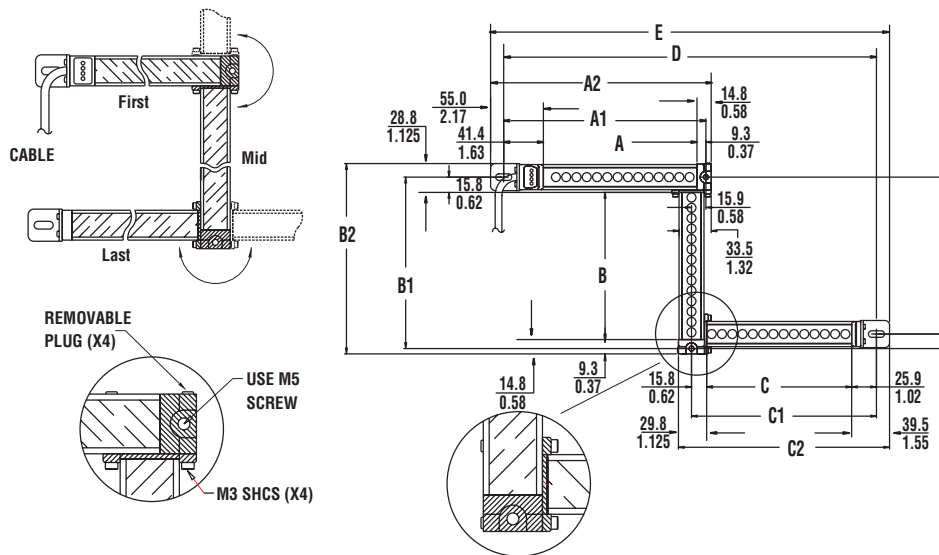
Table 14-15 MCJ470-12 Dimensions

MCJ4700-12 A, B & C mm/in.	MCJ4700-20 and MCJ4700-30 A mm/in.	MCJ4700-20 and MCJ4700-30 B & C mm/in.
FIRST, MIDDLE & LAST SEGMENTS	FIRST SEGMENT ONLY	MIDDLE AND LAST SEGMENTS
102.0/4.0	159.0/6.3	*78.0/3.1
202.0/8.0	*235.0/9.3	152.0/6.0
302.0/11.9	309.0/12.2	*228.0/9.0
402.0/15.8	*385.0/15.2	302.0/11.9
502.0/19.8	459.0/18.1	*378.0/14.9
602.0/23.7	*535.0/21.1	452.0/17.8
702.0/27.6	609.0/24.0	*528.0/20.8
802.0/31.6	*685.0/27.0	602.0/23.7
902.0/35.5	759.0/29.9	*678.0/26.7
1002.0/39.5	*835.0/32.9	752.0/29.6
1102.0/43.4	909.0/35.8	*828.0/32.6
	*985.0/38.8	902.0/35.5
	1059.0/41.7	*978.0/38.5
	*1135.0/44.7	1052.0/41.4
	1209.0/47.6	*1128.0/44.4
	*1285.0/50.6	1202.0/47.3
	1359.0/53.5	*1278.0/50.3
	*1435.0/56.5	1352.0/53.2
	1509.0/59.4	*1428.0/56.2
	*1585.0/62.4	1502.0/59.1
	1659.0/65.3	*1578.0/62.1
	*1735.0/68.3	1652.0/65.0
	1809.0/71.2	*1728.0/68.0
	*Not available in 30 mm resolution	1802.0/70.9
		*Not available in 30 mm resolution.

14.4.2 90° JOINTED MICROSAFE MCJ4700 DIMENSIONS

ASSEMBLY CONFIGURATIONS & MTG DIM'S

Dimensions in $\frac{\text{mm}}{\text{in.}}$



Mounting dimension formulas based on detection zones A, B, C

A = Detection Zone (First Segment)
 A1 = A + 50.7 mm (1.99 in.) (mounting holes)
 A2 = A + 69.8 mm (2.75 in.)

B = Detection Zone (Middle Segment)
 B1 = B + 25.1 mm (0.99 in.) (mounting holes)
 B2 = B + 44.6 mm (1.76 in.)

C = Detection Zone (Last Segment)
 C1 = C + 41.7 mm (1.64 in.) (mounting holes)
 C2 = C + 68.9 mm (2.72 in.)

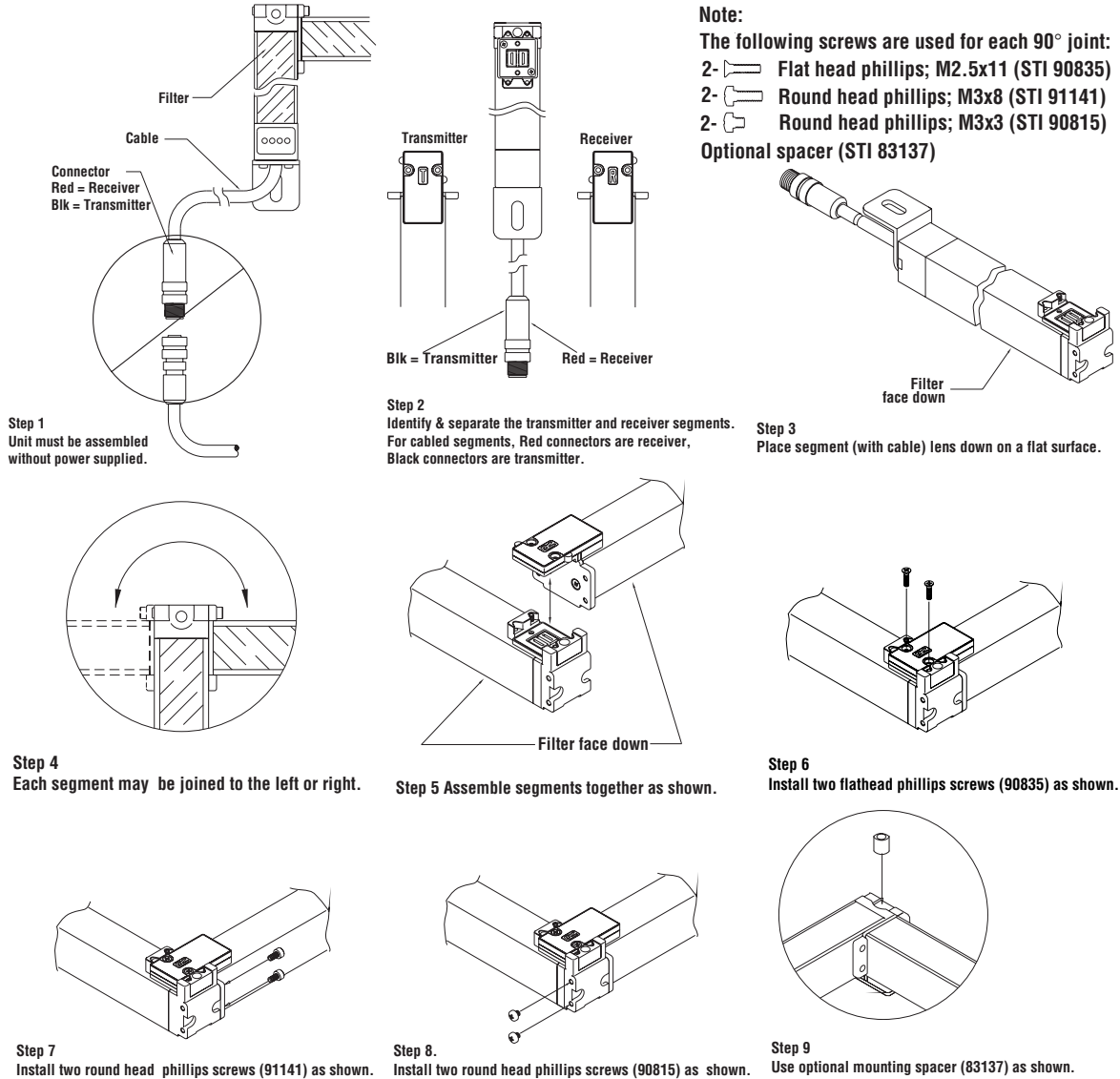
D = A1 + C1 - 15.0 mm (0.59 in.) (mounting holes)
 E = A2 + C2 - 33.5 mm (1.32 in.)
 F = B1 - 15.0 mm (0.59 in.) (mounting holes)

Figure 14-4 90° Jointed MicroSafe MCJ4700 Dimensions

14.4.3 SENSOR ASSEMBLY INSTRUCTIONS

It is possible to assemble the joints in either a 90 or 270-degree orientation. Prior to assembling the sensor, verify the desired configuration of the segments. Power must not be connected during assembly. Ensure that receiver segments are mounted to receiver segments, and transmitters are mounted to transmitter segments. The receiver first segment has a red connector on the cable, and the other receiver segments are identified with a "R" on the joint. Transmitters are identified with a "T".

Figure 14-5 Assembly Instructions Steps



14.4.4 INSTALLATION

After the unit is assembled in the desired configuration, measure the mounting holes on the configured system. Confirm these dimensions by using the drawing *Figure 14-2 & Figure 14-4*. The mounting holes should match within a reasonable tolerance. Use the dimensions from the drawing for proper alignment.

The first segment is the segment which connects to the power supply/controller. Make sure the first transmitter is mounted directly across from the first receiver segment. This orientation must

continue with all of the remaining segments. The transmitter and receiver segments must be installed parallel to and in line with each other.

14.4.5 MINIMUM OBJECT RESOLUTION AT JOINTS

To make maximum use of the detection zone’s minimum object resolution, it may be necessary to place suitable hard guarding between jointed corners in order to prevent unguarded access.

Warning: The object resolution at the joint is listed in the table below. The safe mounting calculation must be made using object resolution listed in this table. Additional supplemental guarding is required where unprotected entry to the hazard zone is accessible. A mechanical barrier should be used to prevent personnel injury. The user must follow all procedures in this manual for proper installation and operation of the MicroSafe Jointed light curtain.

Table 14-16 MCJ4700 Joint Resolution (Resolution at the Corner)

	Floating Blanking OFF	Floating Blanking 1 Channel	Floating Blanking 2 Channels
MCJ-12	25 mm	31 mm	37 mm
MCJ-20	29 mm	40 mm	50 mm
MCJ-30	32 mm	52 mm	73 mm

14.4.6 MCJ4700 SPARE PARTS

Table 14-17 Transmitter and Receiver Segments

MCJ4700-12 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model Number	Description
MCJ47-12-100-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 102 mm (4.0 in.)
MCJ47-12-200-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 202 mm (8.0 in.)
MCJ47-12-300-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 302 mm (11.9 in.)
MCJ47-12-400-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 402 mm (15.8 in.)
MCJ47-12-500-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 502 mm (19.7 in.)
MCJ47-12-600-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 602 mm (23.7 in.)
MCJ47-12-700-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 702 mm (27.6 in.)
MCJ47-12-800-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 802 mm (31.6 in.)
MCJ47-12-900-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 902 mm (35.5 in.)
MCJ47-12-1000-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 1002 mm (39.5 in.)
MCJ47-12-1100-(X1 or X3)	MicroSafe Jointed MCJ4700-12 Transmitter, 1102 mm (43.4 in.)

MCJ4700-12 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MCJ47-12-100-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 102 mm (4.0 in.)
MCJ47-12-200-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 202 mm (8.0 in.)
MCJ47-12-300-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 302 mm (11.9 in.)
MCJ47-12-400-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 402 mm (15.8 in.)
MCJ47-12-500-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 502 mm (19.7 in.)
MCJ47-12-600-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 602 mm (23.7 in.)
MCJ47-12-700-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 702 mm (27.6 in.)
MCJ47-12-800-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 802 mm (31.6 in.)
MCJ47-12-900-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 902 mm (35.5 in.)
MCJ47-12-1000-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 1002 mm (39.5 in.)
MCJ47-12-1100-(R1, or R3)	MicroSafe Jointed MCJ4700-12 Receiver, 1102 mm (43.4 in.)

MCJ4700-20 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model	NumberDescription
MCJ47-20-075-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 78 mm (3.1 in.) Mid and Last Segments Only
MCJ47-20-150-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 159 mm (6.3 in.)
MCJ47-20-225-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 235 mm (9.3 in.)
MCJ47-20-300-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 309 mm (12.12 in.)
MCJ47-20-375-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 385 mm (15.2 in.)
MCJ47-20-450-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 459 mm (18.1 in.)
MCJ47-20-525-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 535 mm (21.1 in.)
MCJ47-20-600-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 609 mm (24.0 in.)
MCJ47-20-675-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 685 mm (27.0 in.)
MCJ47-20-750-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 759 mm (29.9 in.)
MCJ47-20-825-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 835 mm (32.8 in.)
MCJ47-20-900-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 909 mm (35.8 in.)
MCJ47-20-975-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 985 mm (38.8 in.)
MCJ47-20-1050-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1059 mm (41.7 in.)
MCJ47-20-1125-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1135 mm (44.7 in.)
MCJ47-20-1200-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1209 mm (47.6 in.)
MCJ47-20-1275-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1285 mm (50.6 in.)
MCJ47-20-1350-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1359 mm (53.3 in.)
MCJ47-20-1425-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1435 mm (56.5 in.)
MCJ47-20-1500-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1509 mm (59.4 in.)
MCJ47-20-1575-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1585 mm (62.4 in.)
MCJ47-20-1650-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1659 mm (65.3 in.)
MCJ47-20-1725-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1735 mm (68.3 in.)
MCJ47-20-1800-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-20 Transmitter, 1809 mm (71.2 in.)

MCJ4700-20 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MCJ47-20-075-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 78 mm (3.1 in.) Mid and Last Segments Only
MCJ47-20-150-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 159 mm (6.3 in.)
MCJ47-20-225-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 235 mm (9.3 in.)
MCJ47-20-300-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 309 mm (12.2 in.)
MCJ47-20-375-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 385 mm (15.2 in.)
MCJ47-20-450-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 459 mm (18.1 in.)
MCJ47-20-525-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 535 mm (21.1 in.)
MCJ47-20-600-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 609 mm (24.0 in.)
MCJ47-20-675-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 685 mm (27.0 in.)
MCJ47-20-750-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 759 mm (29.9 in.)
MCJ47-20-825-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 835 mm (32.9 in.)
MCJ47-20-900-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 909 mm (35.8 in.)
MCJ47-20-975-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 985 mm (38.8 in.)
MCJ47-20-1050-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1059 mm (41.7 in.)
MCJ47-20-1125-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1135 mm (44.7 in.)



MCJ4700-20 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
MCJ47-20-1200-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1209 mm (47.6 in.)
MCJ47-20-1275-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1285 mm (50.6 in.)
MCJ47-20-1350-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1359 mm (53.3 in.)
MCJ47-20-1425-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1435 mm (56.5 in.)
MCJ47-20-1500-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1509 mm (59.4 in.)
MCJ47-20-1575-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1585 mm (62.4 in.)
MCJ47-20-1650-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1659 mm (65.3 in.)
MCJ47-20-1725-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1735 mm (68.3 in.)
MCJ47-20-1800-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-20 Receiver, 1809 mm (71.2 in.)

MCJ4700-30 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model	NumberDescription
MCJ47-30-150-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 159 mm (6.3 in.)
MCJ47-30-300-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 309 mm (12.2 in.)
MCJ47-30-450-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 459 mm (18.1 in.)
MCJ47-30-600-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 609 mm (24.0 in.)
MCJ47-30-750-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 759 mm (29.9 in.)
MCJ47-30-900-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 909 mm (35.8 in.)
MCJ47-30-1050-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 1059 mm (41.7 in.)
MCJ47-30-1200-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 1209 mm (47.6 in.)
MCJ47-30-1350-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 1359 mm (53.3 in.)
MCJ47-30-1500-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 1509 mm (59.4 in.)
MCJ47-30-1650-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 1659 mm (65.3 in.)
MCJ47-30-1800-(X1, X2, or X3)	MicroSafe Jointed MCJ4700-30 Transmitter, 1809 mm (71.2 in.)

MCJ4700-30 Receivers - First (R1), Mid (R2) and Last (X3) Segments	
Model	NumberDescription
MCJ47-30-150-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 159 mm (6.3 in.)
MCJ47-30-300-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 309 mm (12.2 in.)
MCJ47-30-450-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 459 mm (18.1 in.)
MCJ47-30-600-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 609 mm (24.0 in.)
MCJ47-30-750-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 759 mm (29.9 in.)
MCJ47-30-900-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 909 mm (35.8 in.)
MCJ47-30-1050-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 1059 mm (41.7 in.)
MCJ47-30-1200-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 1209 mm (47.6 in.)
MCJ47-30-1350-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 1359 mm (53.3 in.)
MCJ47-30-1500-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 1509 mm (59.4 in.)
MCJ47-30-1650-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 1659 mm (65.3 in.)
MCJ47-30-1800-(R1, R2, or R3)	MicroSafe Jointed MCJ4700-30 Receiver, 1809 mm (71.2 in.)

14.5 MINISAFE MS4700 SERIES

14.5.1 MS4700 DIMENSIONS

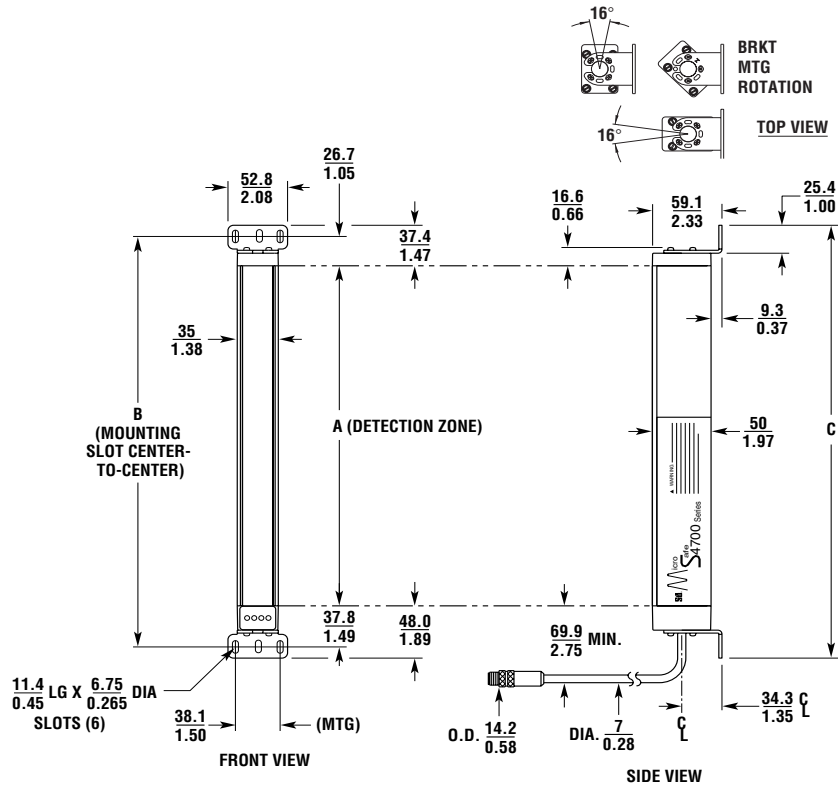


Figure 14-6 MS4700 Mechanical Drawing

Table 14-18 MS4700-12 Dimensions

MS4700-12		
A mm/in.	B mm/in.	C mm/in.
102.0/4.0	167.0/6.6	187.0/7.4
202.0/8.0	267.0/10.5	287.0/11.3
302.0/11.9	367.0/14.4	387.0/15.2
402.0/15.8	467.0/18.4	487.0/19.2
502.0/19.8	567.0/22.3	587.0/23.1
602.0/23.7	667.0/26.3	687.0/27.0
702.0/27.6	767.0/30.2	787.0/31.0
802.0/31.6	867.0/34.1	887.0/34.9
902.0/35.5	967.0/38.1	987.0/38.9
1002.0/39.5	1067.0/42.0	1087.0/42.8
1102.0/43.4	1167.0/45.9	1187.0/46.7
1202.0/47.3	1267.0/49.9	1287.0/50.7
1302.0/51.3	1367.0/53.8	1387.0/54.6
1402.0/55.2	1467.0/57.8	1487.0/58.5
1502.0/59.1	1567.0/61.7	1587.0/62.5
1602.0/63.1	1667.0/65.6	1687.0/66.4



Table 14-19 MS4700-14 & MS4700-20 Dimensions

MS4700-14 & -20		
A in./mm	B in./mm	C in./mm
159.0/6.3	224.0/8.8	244.0/9.6
235.0/9.3	300.0/11.8	320.0/12.6
309.0/12.2	374.0/14.7	394.0/15.5
385.0/15.2	450.0/17.7	470.0/18.5
459.0/18.1	524.0/20.6	544.0/21.4
535.0/21.1	600.0/23.6	620.0/24.4
609.0/24.0	674.0/26.5	694.0/27.3
685.0/27.0	750.0/29.5	770.0/30.3
759.0/29.9	824.0/32.4	844.0/33.2
835.0/32.9	900.0/35.4	920.0/36.2
909.0/35.8	974.0/38.3	994.0/39.1
985.0/38.9	1050.0/41.3	1070.0/42.1
1059.0/41.7	1124.0/44.3	1144.0/45.0
1135.0/44.7	1200.0/47.2	1220.0/48.0
1209.0/47.6	1274.0/50.2	1294.0/50.9
1285.0/50.6	1350.0/53.1	1370.0/53.9
1359.0/53.5	1424.0/56.1	1444.0/56.9
1435.0/56.5	1500.0/59.1	1520.0/59.8
1509.0/59.4	1574.0/62.0	1594.0/62.8
1585.0/62.4	1650.0/65.0	1670.0/65.7
1659.0/65.3	1724.0/67.9	1744.0/68.7
1735.0/68.3	1800.0/70.9	1820.0/71.7
1809.0/71.2	1874.0/73.8	1894.0/74.6

Table 14-20 MS4700-30 Dimensions

MS4700-30		
A mm/in.	B mm/in.	C mm/in.
159.0/6.3	224.0/8.8	244.0/9.6
309.0/12.2	374.0/14.7	394.0/15.5
459.0/18.1	524.0/20.6	544.0/21.4
609.0/24.0	674.0/26.5	694.0/27.3
759.0/29.9	824.0/32.4	844.0/33.2
909.0/35.8	974.3/38.3	994.0/39.1
1059.0/41.7	1124.0/44.3	1144.0/45.0
1209.0/47.6	1274.0/50.2	1294.0/50.9
1359.0/53.5	1424.0/56.1	1444.0/56.9
1509.0/59.4	1574.0/62.0	1594.0/62.8
1659.0/65.3	1724.0/67.9	1744.0/68.7
1809.0/71.2	1874.0/73.8	1894.0/74.6

14.5.2 **MS4700 SPARE PARTS**

Table 14-21 Transmitter and Receiver Segments

*MS4700-12 Transmitters	
Model Number	Description
MS47__-12-100-X	Minisafe MS4700 Transmitter, 102 mm (4.0 in.)
MS47__-12-200-X	MiniSafe MS4700 Transmitter, 202 mm (8.0 in.)
MS47__-12-300-X	MiniSafe MS4700 Transmitter, 302 mm (11.9 in.)
MS47__-12-400-X	MiniSafe MS4700 Transmitter, 402 mm (15.8 in.)
MS47__-12-500-X	MiniSafe MS4700 Transmitter, 502 mm (19.8 in.)
MS47__-12-600-X	MiniSafe MS4700 Transmitter, 602 mm (23.7 in.)
MS47__-12-700-X	MiniSafe MS4700 Transmitter, 702 mm (27.6 in.)
MS47__-12-800-X	MiniSafe MS4700 Transmitter, 802 mm (31.6 in.)
MS47__-12-900-X	MiniSafe MS4700 Transmitter, 902 mm (35.5 in.)
MS47__-12-1000-X	MiniSafe MS4700 Transmitter, 1002 mm (39.5 in.)
MS47__-12-1100-X	MiniSafe MS4700 Transmitter, 1102 mm (43.4 in.)
MS47__-12-1200-X	MiniSafe MS4700 Transmitter, 1202 mm (47.3 in.)
MS47__-12-1300-X	MiniSafe MS4700 Transmitter, 1302 mm (51.3 in.)
MS47__-12-1400-X	MiniSafe MS4700 Transmitter, 1402 mm (55.2 in.)
MS47__-12-1500-X	MiniSafe MS4700 Transmitter, 1502 mm (59.1 in.)
MS47__-12-1600-X	MiniSafe MS4700 Transmitter, 1602 mm (63.1 in.)

*Note: Select [SR] or [LR]

MS4700-12 Receivers	
Model Number	Description
MS47-12-100-R	Minisafe MS4700 Receiver, 102 mm (4.0 in.)
MS47-12-200-R	MiniSafe MS4700 Receiver, 202 mm (8.0 in.)
MS47-12-300-R	MiniSafe MS4700 Receiver, 302 mm (11.9 in.)
MS47-12-400-R	MiniSafe MS4700 Receiver, 402 mm (15.8 in.)
MS47-12-500-R	MiniSafe MS4700 Receiver, 502 mm (19.8 in.)
MS47-12-600-R	MiniSafe MS4700 Receiver, 602 mm (23.7in.)
MS47-12-700-R	MiniSafe MS4700 Receiver, 702 mm (27.6 in.)
MS47-12-800-R	MiniSafe MS4700 Receiver, 802 mm (31.6 in.)
MS47-12-900-R	MiniSafe MS4700 Receiver, 902 mm (35.5 in.)
MS47-12-1000-R	MiniSafe MS4700 Receiver, 1002 mm (39.5 in.)
MS47-12-1100-R	MiniSafe MS4700 Receiver, 1102 mm (43.4 in.)
MS47-12-1200-R	MiniSafe MS4700 Receiver, 1202 mm (47.3 in.)
MS47-12-1300-R	MiniSafe MS4700 Receiver, 1302 mm (51.3 in.)
MS47-12-1400-R	MiniSafe MS4700 Receiver, 1402 mm (55.2 in.)
MS47-12-1500-R	MiniSafe MS4700 Receiver, 1502 mm (59.1 in.)
MS47-12-1600-R	MiniSafe MS4700 Receiver, 1602 mm (63.1 in.)



*MS4700-14 Transmitters	
Model Number	Description
MS47__-14-150-X	Minisafe MS4700 Transmitter, 159 mm (6.3 in)
MS47__-14-225-X	Minisafe MS4700 Transmitter, 235 mm (9.3 in)
MS47__-14-300-X	MiniSafe MS4700 Transmitter, 309 mm (12.2 in)
MS47__-14-375-X	Minisafe MS4700 Transmitter, 385 mm (15.2 in)
MS47__-14-450-X	MiniSafe MS4700 Transmitter, 459 mm (18.1 in)
MS47__-14-525-X	Minisafe MS4700 Transmitter, 535 mm (21.1 in)
MS47__-14-600-X	MiniSafe MS4700 Transmitter, 609 mm (24.0 in)
MS47__-14-675-X	Minisafe MS4700 Transmitter, 685 mm (27.0 in)
MS47__-14-750-X	MiniSafe MS4700 Transmitter, 759 mm (29.9 in)
MS47__-14-825-X	Minisafe MS4700 Transmitter, 835 mm (32.9 in)
MS47__-14-900-X	MiniSafe MS4700 Transmitter, 909 mm (35.8 in)
MS47__-14-975-X	Minisafe MS4700 Transmitter, 985 mm (38.8 in)
MS47__-14-1050-X	MiniSafe MS4700 Transmitter, 1059 mm (41.7 in)
MS47__-14-1125-X	Minisafe MS4700 Transmitter, 1135 mm (44.7 in)
MS47__-14-1200-X	MiniSafe MS4700 Transmitter, 1209 mm (47.6 in)
MS47__-14-1275-X	Minisafe MS4700 Transmitter, 1285 mm (50.6 in)
MS47__-14-1350-X	MiniSafe MS4700 Transmitter, 1359 mm (53.5 in)
MS47__-14-1425-X	Minisafe MS4700 Transmitter, 1435 mm (56.5 in)
MS47__-14-1500-X	MiniSafe MS4700 Transmitter, 1509 mm (59.4 in)
MS47__-14-1575-X	Minisafe MS4700 Transmitter, 1585 mm (62.4 in)
MS47__-14-1650-X	MiniSafe MS4700 Transmitter, 1659 mm (65.3 in)
MS47__-14-1725-X	Minisafe MS4700 Transmitter, 1735 mm (68.3 in)
MS47__-14-1800-X	MiniSafe MS4700 Transmitter, 1809 mm (71.2 in)

*Note: Select [SR] or [LR]

MS4700-14 Receivers	
Model Number	Description
MS47__-14-150-R	Minisafe MS4700 Receiver, 159 mm (6.3 in)
MS47__-14-225-R	Minisafe MS4700 Receiver, 235 mm (9.3 in)
MS47__-14-300-R	MiniSafe MS4700 Receiver, 309 mm (12.2 in)
MS47__-14-375-R	Minisafe MS4700 Receiver, 385 mm (15.2 in)
MS47__-14-450-R	MiniSafe MS4700 Receiver, 459 mm (18.1 in)
MS47__-14-525-R	Minisafe MS4700 Receiver, 535 mm (21.1 in)
MS47__-14-600-R	MiniSafe MS4700 Receiver, 609 mm (24.0 in)
MS47__-14-675-R	Minisafe MS4700 Receiver, 685 mm (27.0 in)
MS47__-14-750-R	MiniSafe MS4700 Receiver, 759 mm (29.9 in)
MS47__-14-825-R	Minisafe MS4700 Receiver, 835 mm (32.9 in)
MS47__-14-900-R	MiniSafe MS4700 Receiver, 909 mm (35.8 in)
MS47__-14-975-R	Minisafe MS4700 Receiver, 985 mm (38.8 in)
MS47__-14-1050-R	MiniSafe MS4700 Receiver, 1059 mm (41.7 in)
MS47__-14-1125-R	Minisafe MS4700 Receiver, 1135 mm (44.7 in)
MS47__-14-1200-R	MiniSafe MS4700 Receiver, 1209 mm (47.6 in)
MS47__-14-1275-R	Minisafe MS4700 Receiver, 1285 mm (50.6 in)
MS47__-14-1350-R	MiniSafe MS4700 Receiver, 1359 mm (53.5 in)

MS4700-14 Receivers	
MS47__-14-1425-R	Minisafe MS4700 Receiver, 1435 mm (56.5 in)
MS47__-14-1500-R	MiniSafe MS4700 Receiver, 1509 mm (59.4 in)
MS47__-14-1575-R	Minisafe MS4700 Receiver, 1585 mm (62.4 in)
MS47__-14-1650-R	MiniSafe MS4700 Receiver, 1659 mm (65.3 in)
MS47__-14-1725-R	Minisafe MS4700 Receiver, 1735 mm (68.3 in)
MS47__-14-1800-R	MiniSafe MS4700 Receiver, 1809 mm (71.2 in)

*MS4700-20 Transmitters	
Model Number	Description
MS47__-20-150-X	Minisafe MS4700 Transmitter, 159 mm (6.3 in)
MS47__-20-225-X	Minisafe MS4700 Transmitter, 235 mm (9.3 in)
MS47__-20-300-X	MiniSafe MS4700 Transmitter, 309 mm (12.2 in)
MS47__-20-375-X	Minisafe MS4700 Transmitter, 385 mm (15.2 in)
MS47__-20-450-X	MiniSafe MS4700 Transmitter, 459 mm (18.1 in)
MS47__-20-525-X	Minisafe MS4700 Transmitter, 535 mm (21.1 in)
MS47__-20-600-X	MiniSafe MS4700 Transmitter, 609 mm (24.0 in)
MS47__-20-675-X	Minisafe MS4700 Transmitter, 685 mm (27.0 in)
MS47__-20-750-X	MiniSafe MS4700 Transmitter, 759 mm (29.9 in)
MS47__-20-825-X	Minisafe MS4700 Transmitter, 835 mm (32.9 in)
MS47__-20-900-X	MiniSafe MS4700 Transmitter, 909 mm (35.8 in)
MS47__-20-975-X	Minisafe MS4700 Transmitter, 985 mm (38.8 in)
MS47__-20-1050-X	MiniSafe MS4700 Transmitter, 1059 mm (41.7 in)
MS47__-20-1125-X	Minisafe MS4700 Transmitter, 1135 mm (44.7 in)
MS47__-20-1200-X	MiniSafe MS4700 Transmitter, 1209 mm (47.6 in)
MS47__-20-1275-X	Minisafe MS4700 Transmitter, 1285 mm (50.6 in)
MS47__-20-1350-X	MiniSafe MS4700 Transmitter, 1359 mm (53.5 in)
MS47__-20-2025-X	Minisafe MS4700 Transmitter, 1435 mm (56.5 in)
MS47__-20-1500-X	MiniSafe MS4700 Transmitter, 1509 mm (59.4 in)
MS47__-20-1575-X	Minisafe MS4700 Transmitter, 1585 mm (62.4 in)
MS47__-20-1650-X	MiniSafe MS4700 Transmitter, 1659 mm (65.3 in)
MS47__-20-1725-X	Minisafe MS4700 Transmitter, 1735 mm (68.3 in)
MS47__-20-1800-X	MiniSafe MS4700 Transmitter, 1809 mm (71.2 in)

*MS4700-20 Receivers	
Model Number	Description
MS47__-20-150-R	Minisafe MS4700 Receiver, 159 mm (6.3 in)
MS47__-20-225-R	Minisafe MS4700 Receiver, 235 mm (9.3 in)
MS47__-20-300-R	MiniSafe MS4700 Receiver, 309 mm (12.2 in)
MS47__-20-375-R	Minisafe MS4700 Receiver, 385 mm (15.2 in)
MS47__-20-450-R	MiniSafe MS4700 Receiver, 459 mm (18.1 in)
MS47__-20-525-R	Minisafe MS4700 Receiver, 535 mm (21.1 in)
MS47__-20-600-R	MiniSafe MS4700 Receiver, 609 mm (24.0 in)
MS47__-20-675-R	Minisafe MS4700 Receiver, 685 mm (27.0 in)
MS47__-20-750-R	MiniSafe MS4700 Receiver, 759 mm (29.9 in)
MS47__-20-825-R	Minisafe MS4700 Receiver, 835 mm (32.9 in)
MS47__-20-900-R	MiniSafe MS4700 Receiver, 909 mm (35.8 in)
MS47__-20-975-R	Minisafe MS4700 Receiver, 985 mm (38.8 in)



*MS4700-20 Receivers	
MS47__-20-1050-R	MiniSafe MS4700 Receiver, 1059 mm (41.7 in)
MS47__-20-1125-R	Minisafe MS4700 Receiver, 1135 mm (44.7 in)
MS47__-20-1200-R	MiniSafe MS4700 Receiver, 1209 mm (47.6 in)
MS47__-20-1275-R	Minisafe MS4700 Receiver, 1285 mm (50.6 in)
MS47__-20-1350-R	MiniSafe MS4700 Receiver, 1359 mm (53.5 in)
MS47__-20-2025-R	Minisafe MS4700 Receiver, 1435 mm (56.5 in)
MS47__-20-1500-R	MiniSafe MS4700 Receiver, 1509 mm (59.4 in)
MS47__-20-1575-R	Minisafe MS4700 Receiver, 1585 mm (62.4 in)
MS47__-20-1650-R	MiniSafe MS4700 Receiver, 1659 mm (65.3 in)
MS47__-20-1725-R	Minisafe MS4700 Receiver, 1735 mm (68.3 in)
MS47__-20-1800-R	MiniSafe MS4700 Receiver, 1809 mm (71.2 in)

MS4700-30 Transmitters	
Model Number	Description
MS47__-30-150-X	Minisafe MS4700 Transmitter, 159 mm (6.3 in)
MS47__-30-300-X	MiniSafe MS4700 Transmitter, 309 mm (12.2 in)
MS47__-30-450-X	MiniSafe MS4700 Transmitter, 459 mm (18.1 in)
MS47__-30-600-X	MiniSafe MS4700 Transmitter, 609 mm (24.0 in)
MS47__-30-750-X	MiniSafe MS4700 Transmitter, 759 mm (29.9 in)
MS47__-30-900-X	MiniSafe MS4700 Transmitter, 909 mm (35.8 in)
MS47__-30-1050-X	MiniSafe MS4700 Transmitter, 1059 mm (41.7 in)
MS47__-30-1200-X	MiniSafe MS4700 Transmitter, 1209 mm (47.6 in)
MS47__-30-1350-X	MiniSafe MS4700 Transmitter, 1359 mm (53.5 in)
MS47__-30-1500-X	MiniSafe MS4700 Transmitter, 1509 mm (59.4 in)
MS47__-30-1650-X	MiniSafe MS4700 Transmitter, 1659 mm (65.3 in)
MS47__-30-1800-X	MiniSafe MS4700 Transmitter, 1809 mm (71.2 in)

*Note: Select [SR] or [LR]

MS4700-30 Receivers	
Model Number	Description
MS47-30-150-R	Minisafe MS4700 Receiver, 159 mm (6.3 in)
MS47-30-300-R	MiniSafe MS4700 Receiver, 309 mm (12.2 in)
MS47-30-450-R	MiniSafe MS4700 Receiver, 459 mm (18.1 in)
MS47-30-600-R	MiniSafe MS4700 Receiver, 609 mm (24.0 in)
MS47-30-750-R	MiniSafe MS4700 Receiver, 759 mm (29.9 in)
MS47-30-900-R	MiniSafe MS4700 Receiver, 909 mm (35.8 in)
MS47-30-1050-R	MiniSafe MS4700 Receiver, 1059 mm (41.7 in)
MS47-30-1200-R	MiniSafe MS4700 Receiver, 1209 mm (47.6 in)
MS47-30-1350-R	MiniSafe MS4700 Receiver, 1359 mm (53.5 in)
MS47-30-1500-R	MiniSafe MS4700 Receiver, 1509 mm (59.4 in)
MS47-30-1650-R	MiniSafe MS4700 Receiver, 1659 mm (65.3 in)
MS47-30-1800-R	MiniSafe MS4700 Receiver, 1809 mm (71.2 in)

14.6 MiniSAFE FLEXIBLE MSF4700 SERIES

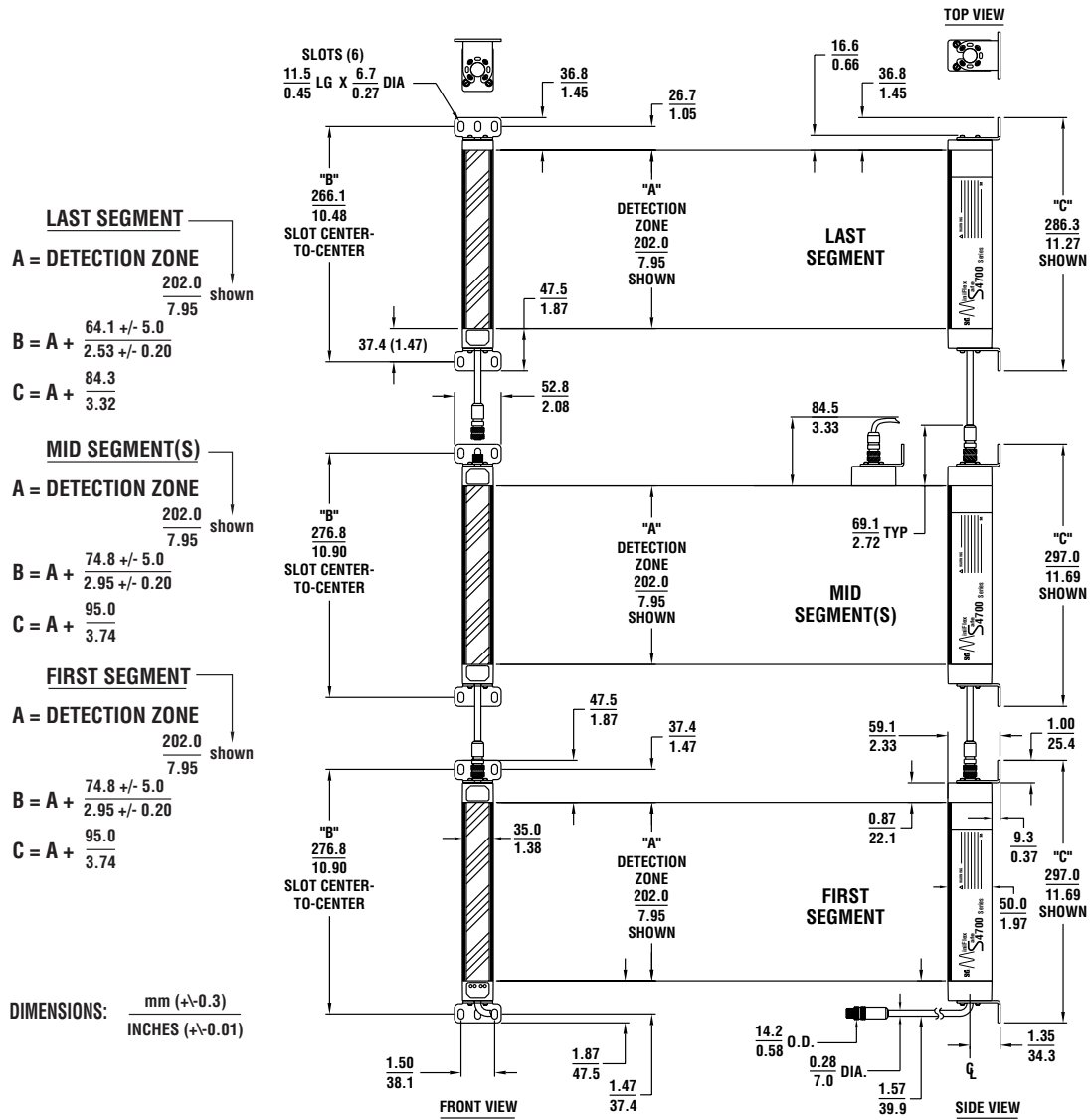


Figure 14-7 MiniSafe Flexible MSF4700 Dimensions

14.6.1 **MSF4700 SERIES DIMENSIONS**

Table 14-22 MSF4700-12 Dimensions First & Middle Segment

A mm/in.	B mm/in.	C mm/in.
102/4.0	185/7.3	214/8.4
202/8.0	285/11.2	314/12.4
302/11.9	385/15.2	414/16.3
402/15.8	485/19.1	514/20.2
502/19.8	585/23.0	614/24.2
602/23.7	685/27.0	714/28.1
702/27.6	785/30.9	814/32.0
802/31.6	885/34.8	914/36.0
902/35.5	985/38.8	1014/39.9
1002/39.5	1085/42.7	1114/43.9
1102/43.4	1185/46.7	1214/47.8

Table 14-23 MSF4700-12 Dimensions Last Segment

A mm/in.	B mm/in.	C mm/in.
102/4.0	169/6.7	198/7.8
202/8.0	269/10.6	298/11.7
302/11.9	369/14.5	398/15.7
402/15.8	469/18.5	498/19.6
502/19.8	569/22.4	598/23.5
602/23.7	669/26.3	698/27.5
702/27.6	769/30.3	798/31.4
802/31.6	869/34.2	898/35.4
902/35.5	969/38.1	998/39.3
1002/39.5	1069/42.1	1098/47.2
1102/43.4	1169/46.0	1198/47.2

Table 14-24 MSF4700-14, MSF4700-20 and MSF4700-30 First and Middle Segment

A mm/in.	B mm/in.	C mm/in.
159/6.3	242/9.5	271/10.7
*235/9.3	318/12.5	347/13.7
309/12.2	392/15.4	421/16.6
*385/15.2	468/18.4	497/19.6
459/18.1	542/21.3	571/22.5
*535/21.1	618/24.3	647/25.5
609/24.0	692/27.2	721/28.4
*685/27.0	768/30.2	797/31.4
759/29.9	842/33.1	871/34.3
*835/32.9	918/36.1	947/37.3
909/35.8	992/39.1	1021/40.2
*985/38.9	1068/42.0	1097/43.2
1059/41.7	1142/45.0	1171/46.1
*1135/44.7	1218/48.0	1247/49.1
1209/47.6	1292/50.9	1321/52.0
*1285/50.6	1368/53.9	1397/55.0

1359/53.5	1442/56.8	1471/57.9
*1435/56.5	1518/59.8	1547/60.9
1509/59.4	1592/62.7	1621/63.8
*1585/62.4	1668/65.7	1697/66.8
1659/65.3	1742/68.6	1771/69.7
*1735/68.3	1818/71.6	1847/72.7
1809/71.2	1892/74.5	1921/75.6
	* Not available in 30 mm resolution	

Table 14-25 MSF4700-14, MSF4700-20 and MSF4700-30 Last Segment

A mm/in.	B mm/in.	C mm/in.
159/6.3	226/8.9	255/10.0
*235/9.3	302/11.9	331/13.0
309/12.2	376/14.8	405/15.9
*385/15.2	452/17.8	481/18.9
459/18.1	526/20.7	555/21.9
*535/21.1	602/23.7	631/24.8
609/24.0	676/26.6	705/27.8
*685/27.0	752/29.6	781/30.7
759/39.9	826/32.5	855/33.7
*835/32.9	902/35.5	931/36.7
909/35.8	976/38.4	1005/39.6
*985/38.9	1052/41.4	1081/42.6
1059/41.7	1126/44.3	1155/45.5
*1135/44.7	1202/47.3	1231/48.5
1209/47.6	1276/50.2	1305/51.4
*1285/50.6	1352/53.2	1381/54.4
1359/53.5	1426/56.1	1455/57.3
*1435/56.5	1502/59.1	1531/60.3
1509/59.4	1576/62.0	1605/63.2
*1585/62.4	1652/65.0	1681/66.2
1659/65.3	1726/68.0	1755/69.1
*1735/68.3	1802/70.9	1831/72.1
1809/71.2	1876/73.9	1905/75.0
	* Not available in 30 mm resolution	

14.6.2 MSF4700 SPARE PARTS

Table 14-26 Transmitter and Receiver Segments

MSF4700-12 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model Number	Description
MSF47-12-100-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 102 mm (4.0 in.)
MSF47-12-200-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 202 mm (8.0 in.)
MSF47-12-300-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 302 mm (11.9 in.)
MSF47-12-400-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 402 mm (15.8 in.)
MSF47-12-500-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 502 mm (19.8 in.)
MSF47-12-600-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 602 mm (23.7 in.)
MSF47-12-700-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 702 mm (27.6 in.)



MSF4700-12 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
MSF47-12-800-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 802 mm (31.6 in.)
MSF47-12-900-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 902 mm (35.5 in.)
MSF47-12-1000-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 1002 mm (39.5 in.)
MSF47-12-1100-(X1, X2, or X3)	MiniSafe Flexible MSF4700-12 Transmitter, 1102 mm (43.4 in.)

MSF4700-12 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MSF47-12-100-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 102 mm (4.0 in.)
MSF47-12-200-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 202 mm (8.0 in.)
MSF47-12-300-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 302 mm (11.9 in.)
MSF47-12-400-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 402 mm (15.8 in.)
MSF47-12-500-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 502 mm (19.8 in.)
MSF47-12-600-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 602 mm (23.7 in.)
MSF47-12-700-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 702 mm (27.6 in.)
MSF47-12-800-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 802 mm (31.6 in.)
MSF47-12-900-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 902 mm (35.5 in.)
MSF47-12-1000-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 1002 mm (39.5 in.)
MSF47-12-1100-(R1, R2, or R3)	MiniSafe Flexible MSF4700-12 Receiver, 1102 mm (43.4 in.)

MSF4700-14 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model	NumberDescription
MSF47-14-075-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 78 mm (3.1 in.) Mid and Last Segments Only
MSF47-14-150-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 159 mm (6.3 in.)
MSF47-14-225-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 235 mm (9.3 in.)
MSF47-14-300-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 309 mm (12.1 in.)
MSF47-14-375-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 385 mm (15.1 in.)
MSF47-14-450-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 459 mm (18.1 in.)
MSF47-14-525-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 535 mm (21.1 in.)
MSF47-14-600-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 609 mm (24.0 in.)
MSF47-14-675-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 685 mm (27.0 in.)
MSF47-14-750-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 759 mm (29.9 in.)
MSF47-14-825-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 835 mm (32.9 in.)
MSF47-14-900-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 909 mm (35.8 in.)
MSF47-14-975-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 985 mm (38.8 in.)
MSF47-14-1050-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1059 mm (41.7 in.)
MSF47-14-1125-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1135 mm (44.7 in.)
MSF47-14-1200-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1209 mm (47.60 in.)
MSF47-14-1275-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1285 mm (50.6 in.)
MSF47-14-1350-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1359 mm (53.3 in.)
MSF47-14-1425-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1435 mm (56.5 in.)
MSF47-14-1500-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1509 mm (59.4 in.)
MSF47-14-1575-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1585 mm (62.4 in.)
MSF47-14-1650-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1659 mm (65.3 in.)
MSF47-14-1725-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1735 mm (68.3 in.)
MSF47-14-1800-(X1, X2, or X3)	MiniSafe Flexible MSF4700-14 Transmitter, 1809 mm (71.2 in.)

MSF4700-14 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MSF47-14-075-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 78 mm (3.1 in.) Mid and Last Segments Only
MSF47-14-150-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 159 mm (6.3 in.)
MSF47-14-225-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 235 mm (9.3 in.)
MSF47-14-300-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 309 mm (12.2 in.)
MSF47-14-375-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 385 mm (15.2 in.)
MSF47-14-450-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 459 mm (18.1 in.)
MSF47-14-525-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 535 mm (21.1 in.)
MSF47-14-600-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 609 mm (24.0 in.)
MSF47-14-675-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 685 mm (27.0 in.)
MSF47-14-750-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 759 mm (29.9 in.)
MSF47-14-825-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 835 mm (32.9 in.)
MSF47-14-900-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 909 mm (35.8 in.)
MSF47-14-975-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 985 mm (38.8 in.)
MSF47-14-1050-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1059 mm (41.7 in.)
MSF47-14-1125-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1135 mm (44.7 in.)
MSF47-14-1200-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1209 mm (47.6 in.)
MSF47-14-1275-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1285 mm (50.6 in.)
MSF47-14-1350-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1359 mm (53.3 in.)
MSF47-14-1425-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1435 mm (56.5 in.)
MSF47-14-1500-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1509 mm (59.4 in.)
MSF47-14-1575-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1585 mm (62.4 in.)
MSF47-14-1650-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1659 mm (65.3 in.)
MSF47-14-1725-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1735 mm (68.3 in.)
MSF47-14-1800-(R1, R2, or R3)	MiniSafe Flexible MSF4700-14 Receiver, 1809 mm (71.2 in.)

MSF4700-20 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model	NumberDescription
MSF47-20-075-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 78 mm (3.1 in.) Mid and Last Segments Only
MSF47-20-150-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 159 mm (6.3 in.)
MSF47-20-225-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 235 mm (9.3 in.)
MSF47-20-300-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 309 mm (12.2 in.)
MSF47-20-375-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 385 mm (15.2 in.)
MSF47-20-450-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 459 mm (18.1 in.)
MSF47-20-525-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 535 mm (21.1 in.)
MSF47-20-600-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 609 mm (24.0 in.)
MSF47-20-675-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 685 mm (27.0 in.)
MSF47-20-750-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 759 mm (29.9 in.)
MSF47-20-825-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 835 mm (32.9 in.)
MSF47-20-900-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 909 mm (35.8 in.)
MSF47-20-975-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 985 mm (38.8 in.)
MSF47-20-1050-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1059 mm (41.7 in.)
MSF47-20-1125-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1135 mm (44.7 in.)
MSF47-20-1200-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1209 mm (47.6 in.)
MSF47-20-1275-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1285 mm (50.6 in.)



MSF4700-20 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
MSF47-20-1350-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1359 mm (53.3 in.)
MSF47-20-1425-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1435 mm (56.5 in.)
MSF47-20-1500-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1509 mm (59.4 in.)
MSF47-20-1575-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1585 mm (62.4 in.)
MSF47-20-1650-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1659 mm (65.3 in.)
MSF47-20-1725-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1735 mm (68.3 in.)
MSF47-20-1800-(X1, X2, or X3)	MiniSafe Flexible MSF4700-20 Transmitter, 1809 mm (71.2 in.)

MSF4700-20 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MSF47-20-075-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 78 mm (3.1 in.) Mid and Last Segments Only
MSF47-20-150-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 159 mm (6.3 in.)
MSF47-20-225-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 235 mm (9.3 in.)
MSF47-20-300-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 309 mm (12.2 in.)
MSF47-20-375-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 385 mm (15.2 in.)
MSF47-20-450-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 459 mm (18.1 in.)
MSF47-20-525-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 535 mm (21.1 in.)
MSF47-20-600-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 609 mm (24.0 in.)
MSF47-20-675-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 685 mm (27.0 in.)
MSF47-20-750-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 759 mm (29.9 in.)
MSF47-20-825-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 835 mm (32.9 in.)
MSF47-20-900-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 909 mm (35.8 in.)
MSF47-20-975-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 985 mm (38.8 in.)
MSF47-20-1050-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1059 mm (41.7 in.)
MSF47-20-1125-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1135 mm (44.7 in.)
MSF47-20-1200-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1209 mm (47.6 in.)
MSF47-20-1275-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1285 mm (50.6 in.)
MSF47-20-1350-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1359 mm (53.3 in.)
MSF47-20-1425-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1435 mm (56.5 in.)
MSF47-20-1500-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1509 mm (59.4 in.)
MSF47-20-1575-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1585 mm (62.4 in.)
MSF47-20-1650-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1659 mm (65.3 in.)
MSF47-20-1725-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1735 mm (68.3 in.)
MSF47-20-1800-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1809 mm (71.2 in.)

MSF4700-30 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
Model	NumberDescription
MSF47-30-150-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 159 mm (6.3 in.)
MSF47-30-300-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 309 mm (12.2 in.)
MSF47-30-450-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 459 mm (18.1 in.)
MSF47-30-600-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 609 mm (24.0 in.)
MSF47-30-750-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 759 mm (29.9 in.)
MSF47-30-900-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 909 mm (35.8 in.)
MSF47-30-1050-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 1059 mm (41.7 in.)
MSF47-30-1200-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 1209 mm (47.6 in.)
MSF47-30-1350-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 1359 mm (53.3 in.)

MSF4700-30 Transmitters - First (X1), Mid (X2) and Last (X3) Segments	
MSF47-30-1500-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 1509 mm (59.4 in.)
MSF47-30-1650-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 1659 mm (65.3 in.)
MSF47-30-1800-(X1, X2, or X3)	MiniSafe Flexible MSF4700-30 Transmitter, 1809 mm (71.2 in.)

MSF4700-30 Receivers - First (R1), Mid (R2) and Last (X3) Segments	
Model	NumberDescription
MSF47-30-150-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 159 mm (6.3 in.)
MSF47-30-300-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 309 mm (12.2 in.)
MSF47-30-450-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 459 mm (18.1 in.)
MSF47-30-600-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 609 mm (24.0 in.)
MSF47-30-750-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 759 mm (29.9 in.)
MSF47-30-900-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 909 mm (35.8 in.)
MSF47-30-1050-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 1059 mm (41.7 in.)
MSF47-30-1200-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 1209 mm (47.6 in.)
MSF47-30-1350-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 1359 mm (53.3 in.)
MSF47-30-1500-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 1509 mm (59.4 in.)
MSF47-30-1650-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 1659 mm (65.3 in.)
MSF47-30-1800-(R1, R2, or R3)	MiniSafe Flexible MSF4700-30 Receiver, 1809 mm (71.2 in.)

MSF4700-20 Receivers - First (R1), Mid (R2) and Last (R3) Segments	
Model	NumberDescription
MSF47-20-075-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 78 mm (3.1 in.) Mid and Last Segments Only
MSF47-20-150-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 159 mm (6.3 in.)
MSF47-20-225-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 235 mm (9.3 in.)
MSF47-20-300-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 309 mm (12.2 in.)
MSF47-20-375-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 385 mm (15.2 in.)
MSF47-20-450-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 459 mm (18.1 in.)
MSF47-20-525-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 535 mm (21.1 in.)
MSF47-20-600-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 609 mm (24.0 in.)
MSF47-20-675-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 685 mm (27.0 in.)
MSF47-20-750-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 759 mm (29.9 in.)
MSF47-20-825-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 835 mm (32.9 in.)
MSF47-20-900-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 909 mm (35.8 in.)
MSF47-20-975-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 985 mm (38.8 in.)
MSF47-20-1050-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1059 mm (41.7 in.)
MSF47-20-1125-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1135 mm (44.7 in.)
MSF47-20-1200-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1209 mm (47.6 in.)
MSF47-20-1275-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1285 mm (50.6 in.)
MSF47-20-1350-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1359 mm (53.3 in.)
MSF47-20-1425-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1435 mm (56.5 in.)
MSF47-20-1500-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1509 mm (59.4 in.)
MSF47-20-1575-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1585 mm (62.4 in.)
MSF47-20-1650-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1659 mm (65.3 in.)
MSF47-20-1725-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1735 mm (68.3 in.)
MSF47-20-1800-(R1, R2, or R3)	MiniSafe Flexible MSF4700-20 Receiver, 1809 mm (71.2 in.)



14.7 DIN AND LCM NEMA CONTROLLERS

14.7.1 DIN CONTROLLER DIMENSION DRAWING

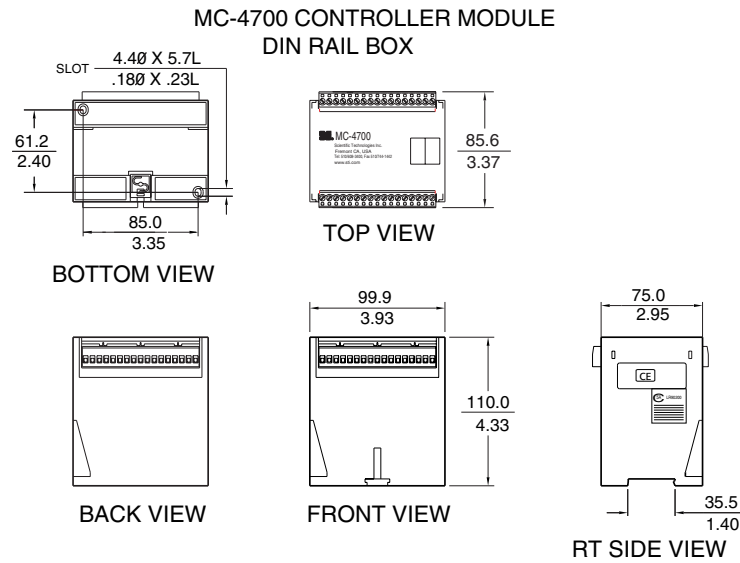


Figure 14-8 DIN Controller Dimension Drawing

14.7.2 LCM METAL CHASSIS CONTROLLER DIMENSION DRAWING

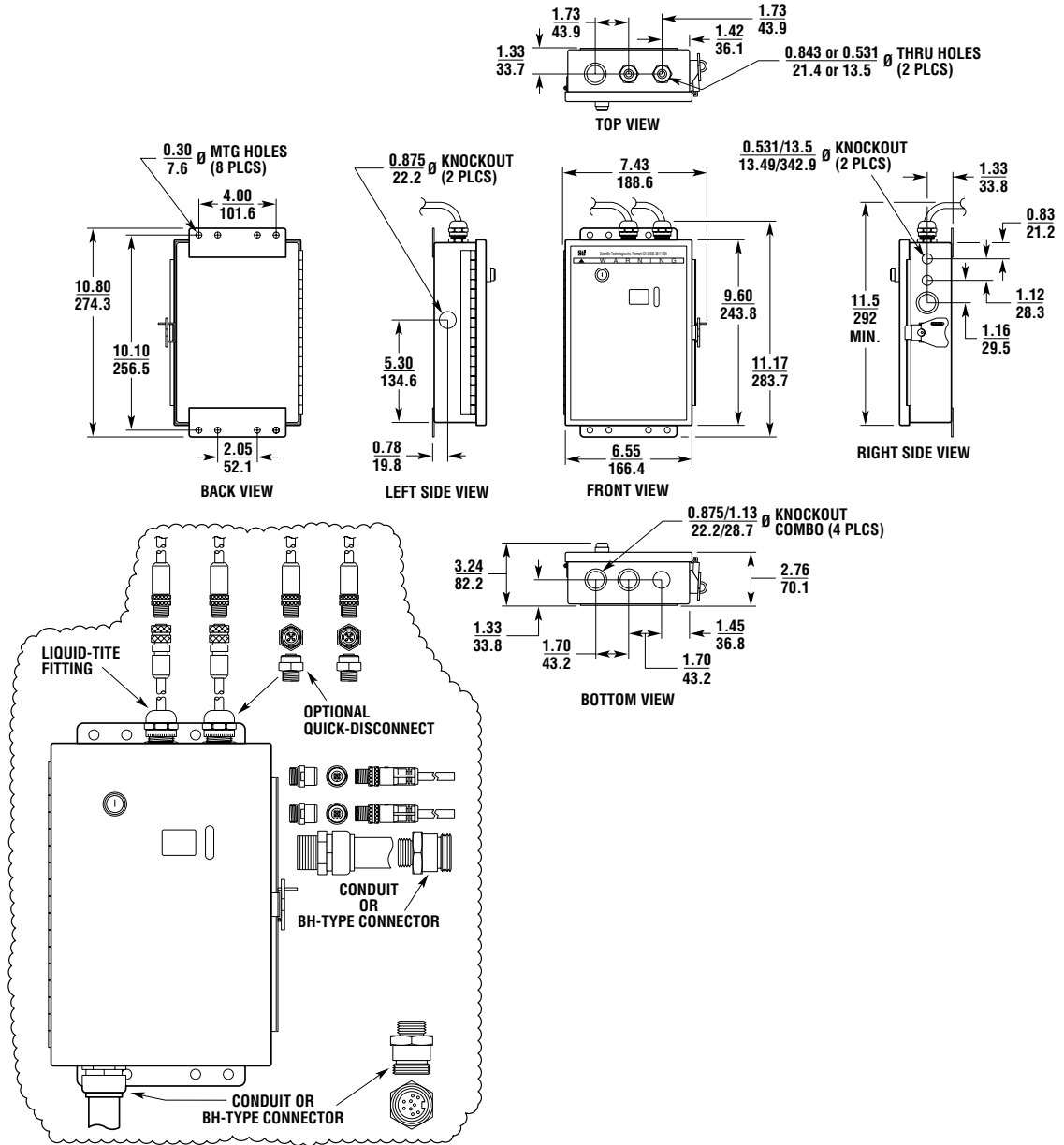


Figure 14-9 LCM Nema Metal Chassis Controller Dimension Drawing

14.7.3 LCM SPARE PARTS

Model Number	Part Number	Description
LCM1	70116-1000	Din Mount Controller, 24 VDC, PNP
LCM2	70116-1001	Din Mount Controller, 24 VDC, PNP, w/DeviceNet
LCM3	N/A	Din Mount Controller, 24 VDC, PNP, w/ Multi Channel Select (Not CE marked)
LCM-100	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC
LCM-101	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 3 pin Mini for Power, 5 pin Mini for Outputs
LCM-102	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (2 NO)
LCM-103	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (1 NO/1 NC) and MPCE.
LCM-104	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 12 pin Bulk Head for Power, Outputs and MPCE
LCM-105	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr.
LCM-110	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, Lid Mounted Reset Switch
LCM-111	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 3 pin Mini for Power & 5 pin Mini for Outputs, Lid Mounted Reset Switch
LCM-112	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (2 NO), Lid Mounted Reset Switch
LCM-113	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (1 NO/1 NC) and MPCE.,Lid Mounted Reset Switch
LCM-114	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 12 pin Mini for Power, Outputs and MPCE, Lid Mounted Reset Switch.
LCM-115	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, Lid Mounted Reset Switch.
LCM-120	N/A	Metal Controller, IP65, Solid State Output, 24 VDC
LCM-130	N/A	Metal Controller, IP65, Solid State Output, 24 VDC, Lid Mounted Reset Switch.
LCM-140	N/A	Metal Controller, IP65, Relay Safety Output, 24 VDC
LCM-150	N/A	Metal Controller, IP65, Relay Safety Output, 24 VDC, Lid Mounted Reset Switch
LCM-200	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, DeviceNet Interface
LCM-201	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 3 pin Mini for Power, 5 pin mini for Outputs, D-net M12.
LCM-202	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (2 NO), D-net M12
LCM-203	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (1 NO/1 NC), MPCE and D-net M12.
LCM-204	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 12 pin Mini for Power, Outputs, MPCE and D-net M12.
LCM-205	N/A	Metal Controller, IP65, Relay Safety Output, 100 230 VAC, M12 QD on xmtr & rcvr, D-net M12.

Model Number	Part Number	Description
LCM-210	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, Lid Mounted Reset Switch, DeviceNet Interface
LCM-211	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 3 pin Mini for Power, 5 pin Mini for Outputs, Lid Mounted Reset Switch, DeviceNet Interface
LCM-212	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (2 NO), Lid Mounted Reset Switch, DeviceNet Interface
LCM-213	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (1 NO/1 NC), MPCE, Lid Mounted Reset Switch, DeviceNet Interface
LCM-214	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 12 pin Mini for Power, Outputs, MPCE and Lid Mounted Reset Switch, DeviceNet Interface
LCM-215	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, Lid Mounted Reset Switch, DeviceNet Interface
LCM-220	N/A	Metal Controller, IP65, Solid State Output, 24 VDC, DeviceNet Interface.
LCM-230	N/A	Metal Controller, IP65, Solid State Output, 24 VDC, Lid mounted Reset Switch, DeviceNet Interface.
LCM-240	N/A	Metal Controller, IP65, Solid State Output, 24 VDC, DeviceNet Interface.
LCM-250	N/A	Metal Controller, IP65, Solid State Output, 24 VDC, Lid mounted Reset Switch, DeviceNet Interface.
LCM-300	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, Non-CE Marked Multiple Stored Channel Select
LCM-301	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, Non-CE Marked Multiple Stored Channel Select, M12 QD on xmtr & rcvr, 3 pin Mini for Power, 5 pin Mini for Outputs, 8 pin M12 for MCS/MPCE/Start.
LCM-302	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, Non-CE Marked Multiple Stored Channel Select, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (2 NO), 8 pin M12 for MCS/MPCE/Start.
LCM-303	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (1 NO/1 NC), MPCE, 8 pin M12 for MCS/MPCE/Start.
LCM-310	N/A	Metal Controller, IP65, Relay Safety Output, Non-CE Multiple Stored Channel Select, Lid mounted Reset Switch.
LCM-311	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 3 pin Mini for Power, 5 pin Mini for Outputs, 8 pin M12 for MCS/MPCE/Start.
LCM-312	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (2 NO), 8 pin M12 for MCS/MPCE/Start, Lid mounted Reset Switch.
LCM-313	N/A	Metal Controller, IP65, Relay Safety Output, 100 - 230 VAC, M12 QD on xmtr & rcvr, 9 pin Mini for Power & Outputs (1 NO/1 NC), MPCE, 8 pin M12 for MCS/MPCE/Start, Lid mounted Reset Switch.
LCM-320	N/A	Metal Controller, IP65, Solid State Output, 24 VDC, and Non-CE Marked Multiple Stored Channel Select
LCM-330	N/A	Metal Controller, IP65, Solid State Output, 24 VDC, Lid mounted Reset Switch and Non-CE Marked Multiple Stored Channel Select
LCM-340	N/A	Metal Controller, IP65, Solid State Output, 24 VDC and Non-CE Marked Multiple Stored Channel Select
LCM-350	N/A	Metal Controller, IP65, Relay Safety Output, 24 VDC, Lid mounted Reset Switch, and Non-CE Marked Multiple Stored Channel Select



Model Number	Part Number	Description
Cables		
MC47RC03	60567-1030	LCM Din Controller Receiver Cable, 3 meter
MC47RC10	60567-1100	LCM Din Controller Receiver Cable, 10 meter
MC47RC30	60567-1300	LCM Din Controller Receiver Cable, 30 meter
MC47TC03	60568-0030	LCM Din Controller Transmitter Cable, 3 meter
MC47TC10	60568-0100	LCM Din Controller Transmitter Cable, 10 meter
MC47TC30	60568-0300	LCM Din Controller Transmitter Cable, 30 meter
	60630-0030	LCM Metal Controller Receiver Cable, 3 meter
	60630-0100	LCM Metal Controller Receiver Cable, 10 meter
	60630-0300	LCM Metal Controller Receiver Cable, 30 meter
	60629-0030	LCM Metal Controller Transmitter Cable, 3 meter
	60629-0100	LCM Metal Controller Transmitter Cable, 10 meter
	60629-0300	LCM Metal Controller Transmitter Cable, 03 meter
	60623-0003	MCF Series Transmitter Interconnect Cable, 0.3 m (12 in.)
	60623-0005	MCF Series Transmitter Interconnect Cable, 0.5 m (20 in.)
	60623-0010	MCF Series Transmitter Interconnect Cable, 1 m (3.3 ft.)
	60623-0020	MCF Series Transmitter Interconnect Cable, 2 m (6.6 ft.)
	60623-0030	MCF Series Transmitter Interconnect Cable, 3 m (10 ft.)
	60623-0050	MCF Series Transmitter Interconnect Cable, 5 m (16.4 ft.)
	60623-0100	MCF Series Transmitter Interconnect Cable, 10 m (32.8 ft.)
	60623-0130	MCF Series Transmitter Interconnect Cable, 30 m (42.8 ft.)
	60624-0003	MCF Series Receiver Interconnect Cable, 0.3 m (12 in.)
	60624-0005	MCF Series Receiver Interconnect Cable, 0.5 m (20 in.)
	60624-0010	MCF Series Receiver Interconnect Cable, 1 m (3.3 ft.)
	60624-0020	MCF Series Receiver Interconnect Cable, 2 m (6.6 ft.)
	60624-0030	MCF Series Receiver Interconnect Cable, 3 m (10 ft.)
	60624-0050	MCF Series Receiver Interconnect Cable, 5 m (16.4 ft.)
	60624-0100	MCF Series Receiver Interconnect Cable, 10 m (32.8 ft.)
	60624-0130	MCF Series Receiver Interconnect Cable, 30 m (42.8 ft.)
	42800-0200	Test Object, 12 mm
	42800-0240	Test Object, 14 mm
	42800-0110	Test Object, 20 mm
	42800-0220	Test Object, 30 mm
	43763-0010	RM-1 Resource Module
	43983-0010	RM-3 Resource Module
	40152-0010	RM-X Safety Relay, 22.5 DIN enclosure
	99584-0030	MC4700 manual with MCJ47, MCF47, MS47 in English
	99584-0032	MC4700 manual with MCJ47, MCF47, MS47 in French
	99584-0033	MC4700 manual with MCJ47, MCF47, MS47 in Spanish
	99584-0034	MC4700 manual with MCJ47, MCF47, MS47 in German
	99584-0035	MC4700 manual with MCJ47, MCF47, MS47 in Italian
	43127-0020	TVS, Transient Voltage Suppressor Kit
	48127-0010	RC Network Arc Suppressor Kit

15 GLOSSARY

15

15.1 GLOSSARY DEFINITIONS

Detection Zone: The zone within which a specified test piece will be detected by the light curtain.

MPCE: The electrically powered element that 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.

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

ON State: The state in which the output circuit is complete and permits the machine to operate.

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

Test Object: An opaque cylindrical object used to verify the detection capability of the light curtain.

APPENDIX A —CHECKOUT PROCEDURE

A.1 CHECKOUT PROCEDURE LOG

The following checkout procedure must be performed by qualified personnel during initial 4700 system installation and at least every three months or more frequently depending on machine usage and company guidelines.

Machine Identification: _____ Date: _____

Item	Condition	Comments
1. Verify that the guarded machine is compatible with the type of machine which maybe used with the 4700 system. See Section 1— <i>Important Safety Warnings</i> for further information.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
2. Verify that the mounting distance of the 4700 system is equal to or greater than the minimum safe distance from the danger point. See Section 8— <i>Safe Mounting Distance</i> for further information.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
3. Determine that all access to the danger point not protected by the 4700 system is guarded by other means, such as gates, fencing or other approved methods. Verify that all additional guarding devices are installed and operating properly.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
4. Make sure the operator is not able to stand between the 4700 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.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
5. Inspect the electrical connections between the guarded machine's control system and the 4700 system. Verify that they are properly connected to the machine such that a stop signal from the 4700 system results in an immediate halt of the machine's cycle. See Section 10— <i>Connecting To The Machine Control Circuit</i> .	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
6. If the MPCE monitoring feature is not used, proceed to step 7. To test the MPCE feature, verify that the feature has been enabled. Turn the machine power on. Cycle the machine. Place a temporary jumper wire between the MPCE connections. The 4700 should enter a alarm condition. Remove the temporary jumper. Press and release the start button.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
7. Record the test results in the machine log, then perform the Test Procedure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

Technician
Signature: _____

APPENDIX B —TEST PROCEDURE

B.1 TEST PROCEDURE LOG

The following test procedure must be performed by qualified personnel during initial 4700 system installation, according to the employer's regular inspection program and after any maintenance, adjustment or modification to the 4700 system or the guarded machine. Testing ensures that the light curtain, safety system, and machine control system work together to properly stop the machine. Failure to test properly could result in serious injury to personnel. To test the 4700 system, use the correct size test object.

Machine Identification: _____ Date: _____

Item	Condition	Comments
1. Disable the guarded machine. Apply power to the 4700 system.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
2. Visually inspect the machine to ensure that access to the danger point is only through the 4700 detection zone. If not, additional guarding, including mechanical barriers may be required. Verify that all additional guarding devices and barriers are installed and operating properly.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
3. Verify that the mounting distance of the 4700 system is equal to or greater than the calculated minimum safety distance from the danger point. See Section 8— <i>Safe Mounting Distance</i> for further information. Ensure that the operator is not able to stand between the 4700 detection zone and the danger point.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
4. Check for signs of external damage to the 4700 system, the machine and the electrical cables and wiring. If damage is found, lock the machine off and report to the supervisor.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
5. Interrupt the 4700 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 stop light is lit. If in start/restart interlock mode, verify that the red machine stop and yellow interlock lights are on. Press and release start button before proceeding to step 6.	<input type="checkbox"/> Pass <input type="checkbox"/> 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.	<input type="checkbox"/> Pass <input type="checkbox"/> 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.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	
8. If the safety devices or the machine fails any of these tests, do not run the machine. Immediately tag or lockout the machine to prevent its use and notify the supervisor.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail	

Technician

Signature: _____



APPENDIX C —DEVICE NET OPERATING INSTRUCTIONS

⚠ WARNING! DeviceNet is not a safety rated system and is only used to provide status information. Never use information provided by DeviceNet to control a machine.

C.1 INTRODUCTION

The 4700 systems are available which allow communication of non-safety, monitoring and diagnostic information across the DeviceNet BUS.

C.2 FEATURES

- Connects to network using simple removable terminal blocks
- The following information is available to DeviceNet:

C.2.1 SYSTEM IDENTIFICATION

- Manufacturer, Product Name, Product Serial Number

C.2.2 SYSTEM STATUS

- Operating Mode
- Detection zone
- Safety Outputs
- Signal Strength
- Number of Beams Installed
- Number of Beams Selected

C.2.3 SYSTEM SETTINGS

- Operating Mode/Automatic Start/Start interlock
- MPCE Monitoring Enabled/Disabled
- 1-Beam Floating Blanking Active/Inactive
- 2- Beam Floating Blanking Active/Inactive
- Exact Channel Select Active/Inactive
- Blanking pattern for Exact Channel Select

C.2.4 DIAGNOSTIC INFORMATION

- Receiver Diagnostic Codes
- Signal Strength
- Error Code
- Error Description
- Device Serial Number

An Electronic Data Sheet (EDS) is supplied with each controller to assist in device configuration.

Table C-1 Specifications for 4700 System Controller with DeviceNet

<i>(See main 4700 system manual for additional system specifications)</i>	
DeviceNet Power	24 VDC, 50 mA - Supplied by deviceNet BUS Network
DeviceNet Configuration	Vendor Code: 405 (Scientific Technologies Inc.) Device Type: 130 (Safety Light curtain) Product Code: 6 (4700 series) Connection Type Supported: Explicit Messages, Poll, Strobe, Change of State MAC ID: 0-63 (network confirmed, 63 is default) Baud Rate Supported: 125K, 250K, 500K (network configured, 125K is default) EDS File Name: 4700.eds Bit Map Icon File Name: 4700.bmp, 4700.ico EDS and Bitmap files supplied on 3-1/2" disk
Poll, Bit Strobe and COS I/O Assembly Instances	4700 device I/O assemblies consist of: —Poll and Bit Strobe: Product specific input assembly containing operating mode detection zone status, safety output status, MTS and Remote Start input status, Exact Channel Select and Floating Blanking switch settings. —COS: Product specific input assembly containing operating mode.



Table C-2 4700 Status Information Sent in Response to a poll command

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
1	0				Exact Channel Mode	Restart interlock Mode	Start interlock Mode	Automatic Start Mode	alarm (Lockout)	
	1	Controller alarm		Receiver alarm	MPCE Monitoring Enabled	Detection Zone	machine stop	machine run	interlock	
	2									
	3	2-Beam Floating Blanking	1-Beam Floating Blanking	Weak Signal						
	4	Receiver Diagnostic codes								
	5	Number of Beams in Curtain								
	6	Number of Exact Channel Select Beams								
	7									

Table C-3 I/O Data for Change of State
 The following is I/O Assembly data attribute format response data for a Change of State. A Change of state message is sent when any of the mode signals in byte 0 changes. *All the information in byte 0 will be monitored and sent for change of State messaging.*

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2	0	N/A	N/A	N/A	Exact Channel Select	Restart interlock Mode	Start interlock Mode	Automatic Start Mode	alarm (Lockout)

Table C-4 I/O Data
 The following is the I/O Assembly data attribute format for Exact Channel Select Blanking Pattern and is sent through Explicit Messaging. Two DeviceNet messages will be sent to provide the total listing of specific beams being blanked.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Beam Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112
	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128

C.3 BASIC DEVICENET NETWORK CONNECTIONS

The figure below illustrates the basic wiring principles used to integrate STI products into a small DeviceNet network. In this basic network, Phoenix style screw connectors and M12 micro-style connectors are used to connect this communication system together. Our LCM-2XX series controllers use the M12 micro-style connectors conforming to the DeviceNet standard.

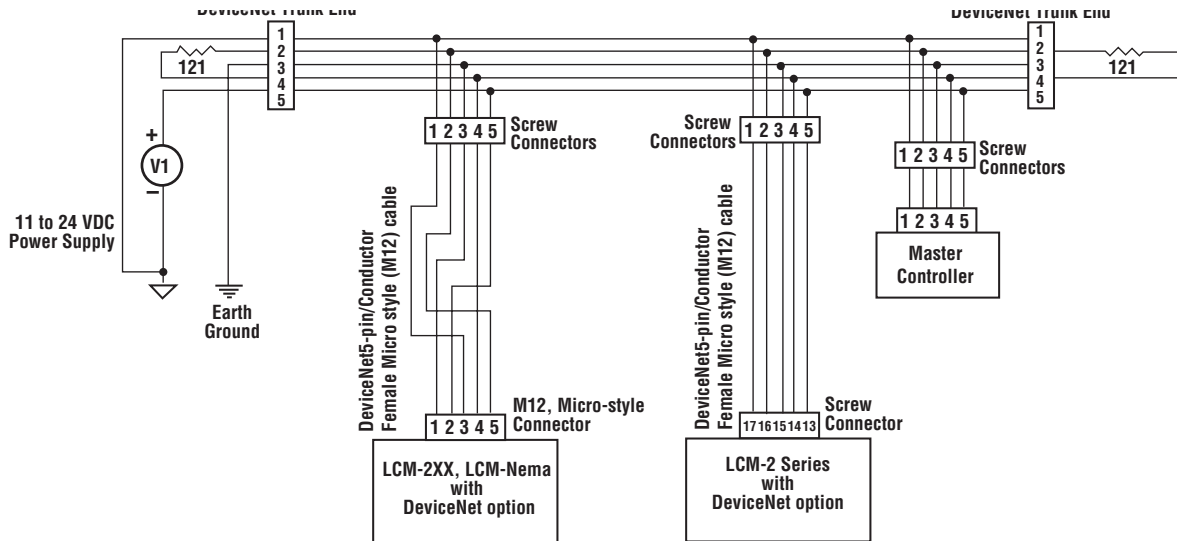


Figure C-1 Basic DeviceNet configuration

C.4 LCM-2XX SERIES INTERNAL D-NET WIRE COLORS AND PIN OUTS

The following internal connections are in compliance with the electrical requirements of the DeviceNet standard however, the internal connections of these Nema controllers do not follow the wire insulation color code as outlined by that standard.

When using the Nema type enclosure the internal DeviceNet Interface (Daughter Board) is connected to a pre-manufactured 5-wire M12 micro-style connector to a 5-pin Phoenix Style screw connector. The M12 male connector as shown in figure 2, provides the external connection for the network.

C.4.1 SCREW CONNECTORS FOR LCM-2XX SERIES D-NET INTERFACE MODULE

The following figure illustrates the wire insulation colors and pin outs for the screw connectors on the DeviceNet Interface (Daughter Board).

Shown are the following designations for the internal screw type connector:

- 1.V_: (blue)
- 2.CAN_Low: (gray)
- 3.Drain: (brown)
- 4.CAN_High: (black)
- 5.V+: (white)

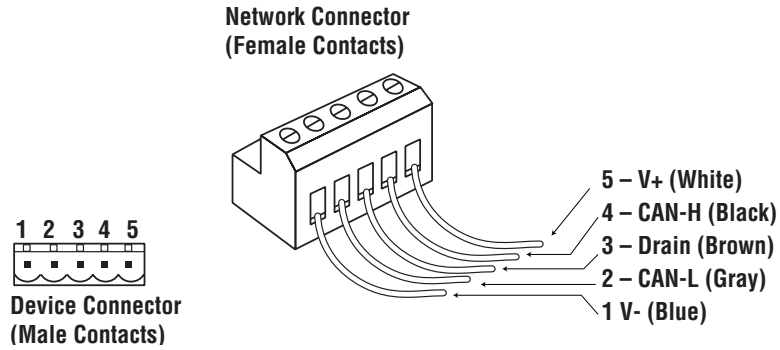


Figure C-2 Pin Outs for Internal Screw Connectors used internally in the LCM-2XX

C.4.2 M-12 MICRO_STYLE CONNECTOR FOR LCM-2XX SERIES

The Nema box controllers offer an optional M-12 micro-style connector for external connection to a DeviceNet Network with the following pin out definition.

The micro_style connectors (Fig 2, internal colors correspond to the M12 connector used on the LCM-2XX series controller).

- 1.Drain (brown)
- 2.V+ (white)
- 3.V_ (blue)
- 4.CAN_High (black)
- 5.CAN_Low (gray)

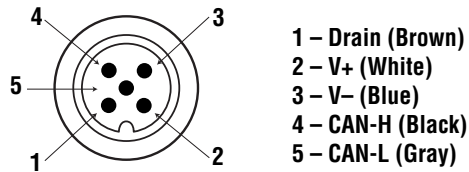


Figure C-3 Pin Outs for Micro_Style Connectors

Note : Device-Net requires that connectors on devices must have male contacts.

C.4.3 LCM-2 , MC4700 DIN CONTROLLER EXTERNAL DEVICE-NET CONNECTION

STI provides a 5-pin Phoenix-style connector for the LCM-2 controller.

The MC4700 includes a reference to this connection in its manual in section 3, figure 3-4. The connections are also shown in figures 10-2 and 10-3.

The following figure illustrates the wire insulation colors and pin outs for the screw connectors on the LCM-2 Din module.

Note: The DeviceNet wiring pin out for the LCM-2 is the opposite or mirror image of the DeviceNet standard so, a standard network connection may have to be re-wired for this controller.

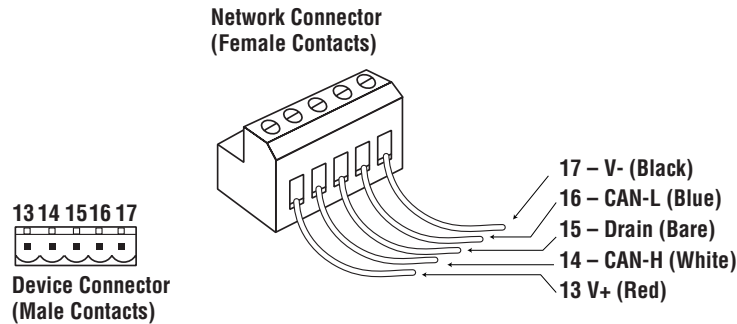


Figure C-4 Pin Outs for Phoenix-style connectors used in the STI MC4700, LCM-2 interface

C.5 DEVICENET CONFIGURATION SWITCHES

To accommodate DeviceNet configuration switches the LCM-2 (DIN version only) has DIP switches located near the bottom of the Power/Device-Net board. This board is located on the top side of the DIN module and looks similar to figure 1.

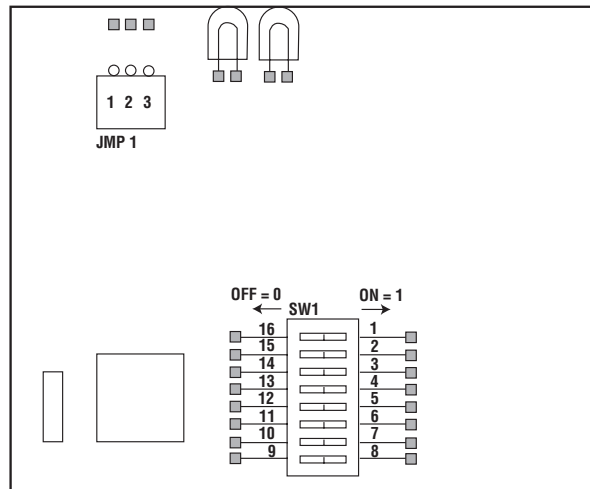


Figure C-5 LCM-2 Power/DeviceNet board

These DIP switches can be used to set the Device-Net Baud Rate and Node number on the LCM-2 controller. When all of the switches are set to “1” or “ON” the LCM-2 is programmable via software using a dedicated Device-Net configuration tool. When the DIP switches are used to set the Device-Net configuration, use the following table to define the Baud Rate and the Node number. Note: The Node number setting is a binary number from 0 to 63.



C.5.1 SWITCH FUNCTION SELECTION DESCRIPTION

Switch	Function Selection	Description
1	Node Number 0 – 63 Default Setting = 63	000000 = 0, Node 0
2		000001 = 1, Node 1
3		000010 = 2, Node 2
4		000011 = 3, Node 3
5		Etc.,
6		111111 = 63, Node 63
7	Baud Rate 125K – 500K Default = Programmable	00 = 125K
8		01 = 250K
		10 = 500K
		11 = Programmable Node and Baud Rate via network software

Table C-5 Configuration Switches for Device-Net

C.6 QUICK DISCONNECT OPTION

Refer to the diagrams below for installation.

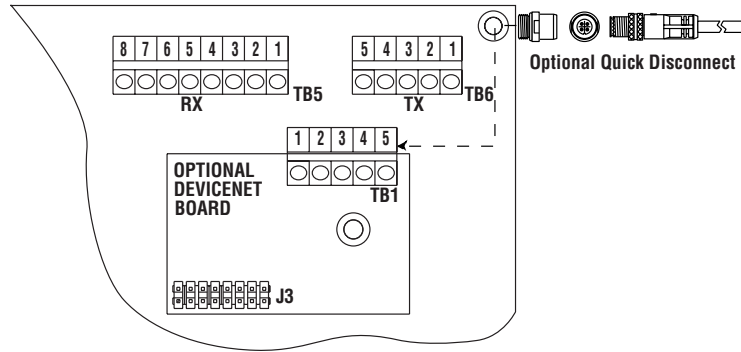


Figure 15-1 DeviceNet Install Location

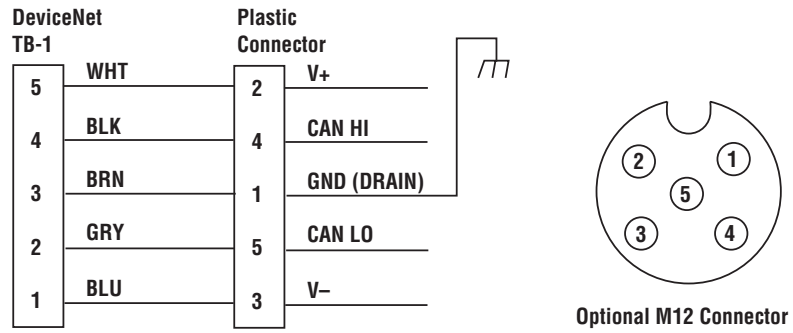


Figure 15-2 DeviceNet Wiring with Optional M12 Connector

16 OTHERS

16.1 WARRANTY

STI warrants its products to be free from defects of material and workmanship and will, without charge, replace or repair any equipment found defective upon inspection at its factory, provided the equipment has been returned, transportation prepaid, within one year from the date of installation and not to exceed 18 months from date of factory shipment.

The foregoing warranty is in lieu of and excludes all other warranties not expressly set forth herein, whether expressed or implied by operation of law or otherwise including but not limited to any implied warranties of merchantability or fitness for a particular purpose. No representation or warranty, express or implied, made by any sales representative, distributor, or other agent or representative of STI which is not specifically set forth herein shall be binding upon STI. STI shall not be liable for any incidental or consequential damages, losses or expenses directly or indirectly arising from the sale, handling, improper application or use of the goods or from any other cause relating thereto and STI's liability hereunder, in any case, is expressly limited to repair or replacement (at STI's option) of goods.

Warranty is specifically at the factory or an STI authorized service location. Any on site service will be provided at the sole expense of the Purchaser at standard field service rates.

All associated equipment must be protected by properly rated electronic/electrical protection devices. STI shall not be liable for any damage due to improper engineering or installation by the purchaser or third parties. Proper installation, operation and maintenance of the product becomes the responsibility of the user upon receipt of the product.

16.2 PATENTS

Elements of the electronics and optics essential to meet the specifications and performance standards of STI controls are covered by one or more of the following U.S. Patent Numbers: 3,774,039; 3,867,628; 3,967,111; 3,996,476; 4,007,387; 4,101,784; 5,015,840; Design 255,031, and other patents pending.

16.3 TRADEMARKS

MicroSafe™, MicroSafe Joint™, MicroSafe Flexible™ and MiniSafe™ are trademark of Scientific Technologies, Inc.; STI® is the registered trademark of Scientific Technologies Inc.

16.4 REPAIRS

STI offers product repair service at our factory. If you need repairs made to any STI product contact our Customer Service Department.

16.5 DOCUMENTATION CRITERIA

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