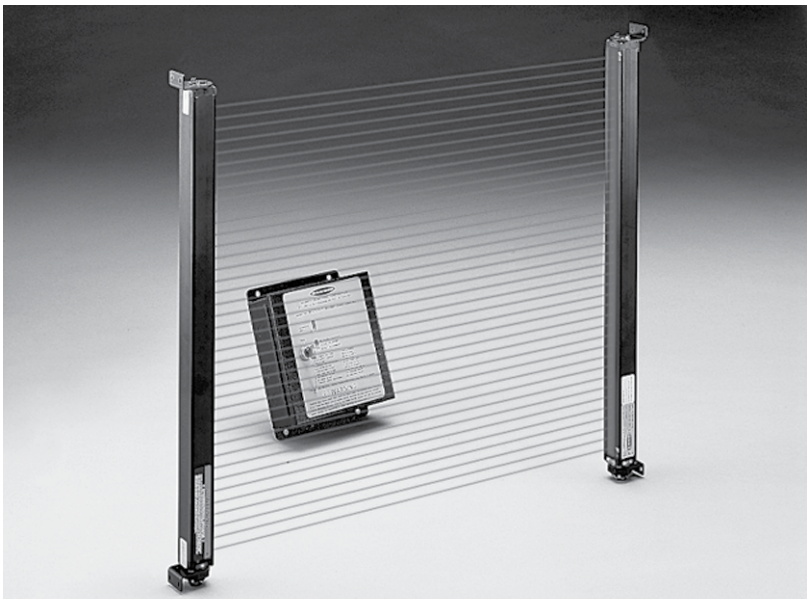
MSC..-1S..E Supplement

For MINI-SCREEN Systems with EDM and Selectable Trip/Latch Output



Models

Models	Input Power	Safety Outputs	EDM Input
MSCA-1S2E	115V ac	**FSD 1 & 2, SSD:** 4 amp max.	Yes
MSCA-1S3E		**FSD 1 & 2, CNC:** 6 amp max. **SSD:** 4 amp max.	
MSCB-1S2E	230V ac	**FSD 1 & 2, SSD:** 4 amp max.	
MSCB-1S3E		**FSD 1 & 2, CNC:** 6 amp max. **SSD:** 4 amp max.	
MSCT-1S2E	24V dc	**FSD 1 & 2, SSD:** 4 amp max.	
MSCT-1S3E		**FSD 1 & 2, CNC:** 6 amp max. **SSD:** 4 amp max.	

⚠ CAUTION . . . Keep Supplement with its Associated Manual

It is very important to keep this document with its associated manual.

It contains information critical to the operation of the MINI-SCREEN safety light screen systems that are covered.

Overview

The associated control boxes are a modification of the MINI-SCREEN MSC..-1 and -1T3 controllers to include Trip/Latch output select switches and the addition of a one-channel External Device Monitoring (EDM) input.

The primary instruction manual for these control boxes is Banner p/n 39022.

The information contained in this supplement is intended either to replace or to modify some of the material in the primary manual. It is very important to keep this document with the primary manual. Both documents contain information critical to the operation of these MINI-SCREEN safety light screen systems.

MSC..-1S..E Supplement: MINI-SCREEN Models with Selectable Trip/Latch Output

In this document, section numbers or figure numbers are followed by the word *replacement* or *addition*. If a section is labeled a replacement, the information contained in that section should replace the corresponding information within the primary manual (that section in the primary manual should be ignored). If the section is labeled an addition, the material in the primary manual is still valid and must be followed, in addition to the material contained in this supplement.

The MSC..-1S2E and -1S3E control boxes have a "Trip/Latch Output Select" feature, instead of the Auto Power-up feature on the models described in the primary manual. Any reference to "Auto Power-up" in the primary instruction manual should now become "Trip Output" or be replaced as follows:

"Auto Power-up is ON" becomes "Trip Output has been selected," or
"Auto Power-up is OFF" becomes "Latch Output has been selected."

Section 2. Addition

2. Overview of MINI-SCREEN System Operation

Remove reference to "Auto power-up (Section 2.2)" in the second bullet, and replace with "Trip/Latch Output Select (Section 2.2(s))."

Section 2.2 Replacement

2.2(s) Trip/Latch Output Select

The MSC..-1S..E control box can be configured for either Trip Output (automatic reset) or Latch Output (monitored manual reset) via a pair of DIP switches located on the controller module inside the control box. See Figure 18 in the primary instruction manual and Section 3.4(s) in this supplement.

Trip Output
Upon power-up, when the control box is configured for Trip Output, the FSD and SSD outputs will automatically close once power is applied, the self-test is accomplished, and the defined area is clear. If the defined area is blocked at power-up, only the SSD closes. The FSD Outputs will close once the interruption of the defined area is removed (a Green condition). In either case, no external input or reset is required.

Trip Output is typically used only in situations where the individual is continually sensed by the defined area or in situations where supplemental safeguards prevent the initiation of hazardous motion while an individual is within the safeguarded space. See Section 3.2.1.1(s) Pass-Through Hazards.

When Trip Output is selected, recovering from a lockout condition will still require a manual reset to be performed.

Latch Output
Upon power-up, when the control box is configured for Latch Output, the SSD output will automatically close once power is applied and the self-test is accomplished.

For the FSD Outputs to close, the defined area must be clear of interruptions (a Green condition) and a monitored manual reset must be accomplished (e.g., a key reset). To perform a monitored manual reset, close the "Key 1 / Key 2" input for approximately ½ second, and then re-open the input. The FSD outputs will close once the open-closed-open action occurs.

⚠ WARNING . . . Initiation of Dangerous Motion

Application of the MINI-SCREEN System must not initiate dangerous machine motion. Machine control circuitry must be designed so that one or more initiation devices be engaged to start the machine, after the MINI-SCREEN is placed into Run mode (i.e., closes its FSD outputs).

The MINI-SCREEN controller must have a manual reset after power-up and after any interruptions of the defined area. The location for the manual reset device (e.g., a normally open keyed switch) must comply with the warning in Section 2.10(s); also refer to that section for information on external key resets.

Latch Output is typically used in situations where an individual can pass completely through the sensing field, so that the sensing field becomes clear and the MINI-SCREEN can not prevent hazardous motion. See Section 3.2.1.1(s) Pass-Through Hazards.

Section 2.8 Addition

2.8(s) External Device Monitoring (EDM)

⚠ CAUTION . . . No EDM

If the application does not require External Device Monitoring, the EDM input must be jumpered**. It is the user's responsibility to ensure that this does not create a hazardous situation.**

Two terminals are provided for monitoring the state of external devices such as MPCEs; see Figure 20(s). These terminals are labeled "Mon a" and "Mon b" at TB2. The MINI-SCREEN EDM inputs can be configured in two ways: one-channel monitoring, or no monitoring. See Section 3.5.5(s) for external hookup.

One-Channel Monitoring: A series connection of closed monitor contacts that are forced-guided (or captive contact) from each device controlled by the MINI-SCREEN. The monitor contacts should open when the FSD outputs close (a clear condition), but this is not required. The EDM input must be closed within 200 milliseconds of the FSD outputs opening (a blocked condition) or a lockout will occur; see Section 5.1(s).

No Monitoring: The EDM input ("Mon a" and "Mon b") must be jumpered if EDM is not used. If the MINI-SCREEN is set for No Monitoring, the user must ensure that any single failure of the external devices will not result in a hazardous condition and will prevent a successive machine cycle (see Section 2.7, Control Reliability).

Section 2.9 Addition

2.9(s) MSA-RM-.. Relay Modules

The MSA-RM-1 relay module used in the model MSC..-1S2E control boxes has individual normally open, forced-guided contacts from FSD1, FSD2 and SSD relays to form each respective output (4 amps at 250V ac). Each FSD output consists of a single normally open contact from one monitored relay; contacts from both relays must be used to ensure proper operation. Both FSD outputs must be used, either in a dual-channel method as shown in Figure 23a(s) or series-connected in a single-channel method, to control each individual hazard.

The MSA-RM-2 relay module used in the model MSC..-1S3E control boxes has redundant normally open, forced-guided contacts from FSD1 and FSD2 relays to form the FSD and CNC outputs (6 amps at 250V ac). The SSD is an individual normally open, forced-guided contact from the SSD relay (4 amps at 250V ac). See Figure 23b(s).

If the Complementary Normally Closed Auxiliary output ("CNC Aux") is used as a stand-alone output (it is not interfaced with one or both of the FSD outputs), it is a non-safety-related output. The CNC Aux output is typically used for monitoring purposes and may not be suitable for safety applications. The CNC Aux output status is the opposite that of the FSD1 and FSD2 safety outputs.

Section 2.10 Addition

2.10(s) External Key Reset

If it is not possible to mount the control box so that it complies with the warning at right, an external Reset switch must be provided for the installation that can comply with the warning. The user must supply a means to reset the MINI-SCREEN system if a latch condition occurs (after clearing an interruption of the defined area in Latch mode), or after a lockout condition (see Section 5 of the primary instruction manual).

When wiring external switches, the corresponding control box-mounted key reset switches should be disconnected (or if that is not possible, the keys removed and placed under supervisory control). The key reset (manual reset) connection is located at TB2 “Key 1” and “Key 2” (see Figure 20 in the primary manual). If disconnected, loose wires from the Key Reset switches must be secured (i.e., tape or wire-tie the loose ends) so they do not cause shorts within the control box.

All reset switches must be located outside the guarded area, where the switch operator has a full and unobstructed view of the entire guarded area and any associated hazards while the reset is performed. The reset switch also must not be reachable from within the guarded area and must be protected (through the use of rings, or guards, for example) against unauthorized or inadvertent operation.

The reset switch must be a normally open switch that is held closed for approximately 0.5 seconds, and then re-opened to accomplish the reset. In the associated primary instruction manual, the “RUN” position is the open condition of the switch; the “Reset” position is closed. The switch must be capable of switching 15 to 50V dc at 20 to 100 mA.

⚠ WARNING . . . Reset Switch Location

Reset switch(es) must be accessible only from outside, and in full view of, the hazardous area. Reset switches must also be out of reach from within the safeguarded area, and must be protected against unauthorized or inadvertent operation (e.g., through the use of rings or guards). If any areas are not visible from the Reset switch, additional means of safeguarding must be provided as described by the ANSI B11 series of safety requirements or other appropriate standards.

Section 3.2.1 Addition

3.2.1.1(s) Pass-Through Hazards

Methods of Reducing or Eliminating Pass-Through Hazards

The pass-through hazard must be eliminated or reduced to acceptable levels (as determined by the user) by employing supplemental safeguarding. One solution is to combine perimeter guarding with area guarding so that an individual is continually sensed while within the hazardous area. Supplemental safeguards for area guarding include safety mats, area scanners, and horizontally mounted safety light curtains.

It is also possible to reduce the separation distance by reducing the stopping time of the machine, or by using a full-length safety light curtain with a small object detection capability that reduces the Dpf adder. While it is recommended to eliminate the pass-through hazard altogether, this may not be a viable option due to cell or machine layout, machine capabilities, cost constraints, environmental, or other application considerations.

An alternate method is to ensure that once the safeguarding device is tripped, resulting in stopping or removing the hazard, the safeguard will latch in a tripped condition, thus requiring a deliberate manual action to reset the safeguard. This type of supplemental safeguarding relies upon the location of the reset switch or actuating control as well as safe work procedures to prevent unexpected start or restart.

The location of the reset switch or actuating control must be located outside the guarded area, and provide the switch operator with a full unobstructed view of the entire guarded area and any associated hazards as the reset is preformed. The reset switch or actuating control must also be positioned so it cannot be reached from within the guarded area and must be protected against unintended or inadvertent operation (e.g., rings or guards).

⚠ WARNING . . . Use of MINI-SCREEN Systems for Perimeter Guarding

If a MINI-SCREEN System is installed for perimeter guarding, the system MUST require actuation of a Reset switch before initiating the dangerous machine motion following an interruption of the defined area.

If a MINI-SCREEN System is used for perimeter guarding, the Machine Primary Control Elements (MPCEs) of the guarded machine must be wired so that the FSD outputs of the control box cause a latched response of the MPCEs. The MPCEs must be reset only by actuation of a Reset switch.

The Reset switch must be located outside of, and not be accessible from within, the area of dangerous motion, and it must be positioned so that the area of dangerous motion may be observed by the switch operator during the reset operation.

Additional safeguarding, as described by the ANSI B11 series of safety requirements or other appropriate standards, must be used if any space between either defined area and any danger point is large enough to allow a person to stand undetected by the MINI-SCREEN System. **Failure to observe this warning could result in serious bodily injury or death.**

Before the reset of the safeguard is performed, safe work procedures must ensure that a start-up procedure is followed and that the operator verifies that the entire hazardous area is clear of all personnel. If any areas can not be observed from the switch location, additional supplemental safeguarding must be used to guard those areas. At a minimum, this should consist of visual and audible warnings of machine start-up.

A reset switch that is key-actuated can give some level of personal or supervisory control by removing the key and taking it into the guarded area. This will hinder a reset while the key is under the control of one individual. However, this method must not be relied upon solely to guard against unintended or inadvertent reset, because others may enter the safeguarded area unnoticed, or additional keys may be in the possession of others.

Section 3.4 Addition

3.4(s) Controller Module Configuration

Replace all references in Section 3.4 and Figure 18 of “Auto Power-up” with “Trip/Latch Output Select.”

Replace the sub-paragraph titled “Auto Power-up Feature ON or OFF” with the following:

Trip/Latch Output Select (Auto/Manual Reset)
Locate the DIP switches to configure the receiver for Trip Output (Auto Reset) or Latch Output (Manual Reset) as described by Figure 18. If Trip Output is selected, the FSD/SSD outputs will turn ON as soon as power is applied, the unit passes an internal self-test/synchronization, and recognizes that all beams are clear. The Trip Output will also automatically reset after all interruptions of one or more beam(s) have been cleared. If Latch Output is selected, the MINI-SCREEN requires a monitored manual reset at power-up and each time all interruptions of one or more beam(s) have been cleared. Switch #2 must be set identically at both banks A and B.

Regardless of the setting of this switch, a key reset is always necessary to recover from an internal lockout condition.

See Sections 2.2(s), 2.10(s), and 3.2.1.1(s) for Warnings and further information.

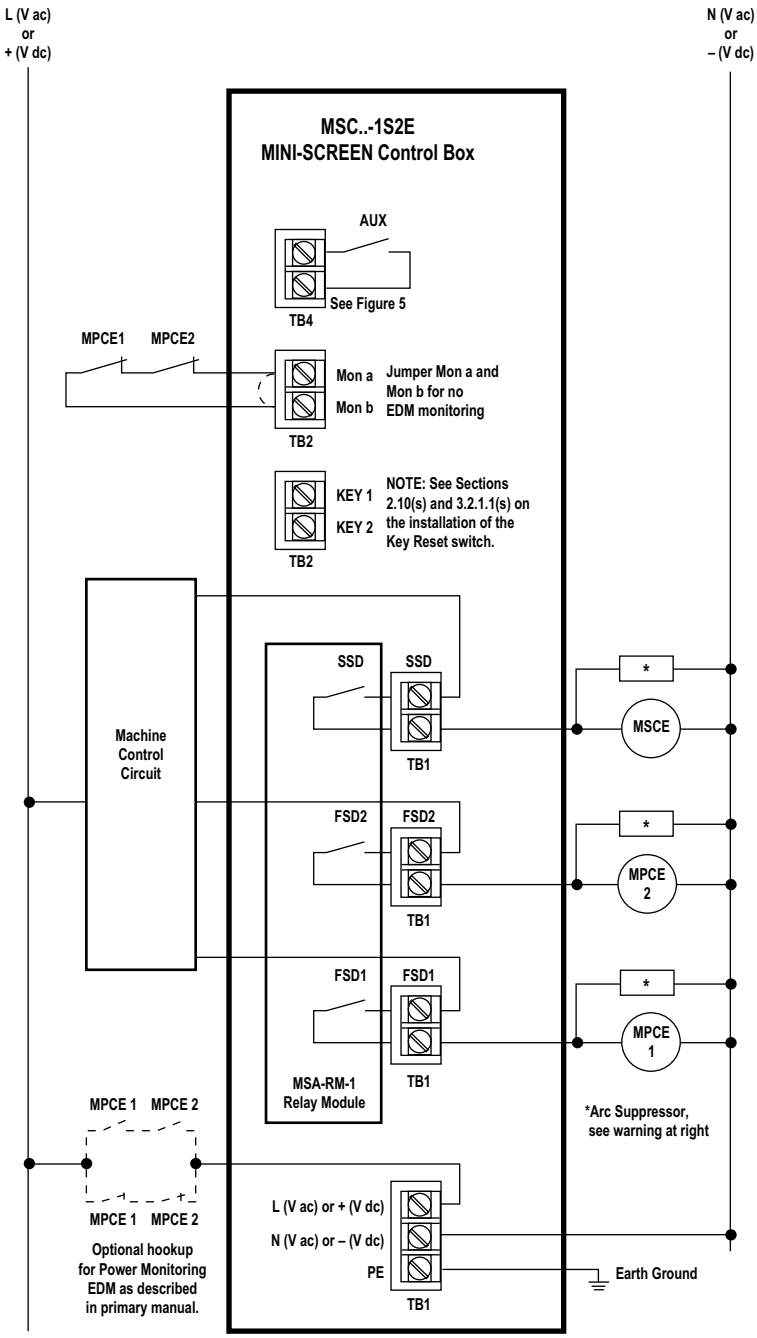
Section 3.5.2 Replacement

3.5.2(s) External Device Monitoring and System Power

Temporary Connection
For the initial checkout procedure, the External Device Monitoring (EDM) must be temporarily configured for “No Monitoring” (jumper TB2 Mon a and Mon b); refer to Figure 20(s) and Section 2.8(s). This will allow the MINI-SCREEN System to be checked out as a stand-alone system, before permanent connections are made to the guarded machine.

Verify that the power has been removed from the machine or that power is not available to the machine controls or actuators. Also verify that the machine controls (MPCEs) are not connected to the FSD and SSD outputs at this time. Permanent connections will be made after MINI-SCREEN initial checkout; see Section 3.5.5(s).

Connection of System AC power (e.g. 115V ac) is at the L and the N terminals of control box wiring barrier TB1. All wiring must comply with NEC and local wiring codes. Do not operate the MINI-SCREEN System without a proper earth ground connection at either of the PE/GND symbols.



⚠ WARNING . . .

User must comply with all product manuals and relevant regulations.

⚠ WARNING . . .

All MINI-SCREEN System output contacts (FSD1, FSD2, and SSD) **must be used.** The generalized wiring configuration shown here is provided only to illustrate the importance of proper installation. The actual details of wiring of the MINI-SCREEN system to any particular machine is solely the responsibility of the installer and end user.

⚠ WARNING . . . Arc Suppressors

If arc suppressors are used, they must be installed as shown across the coils of the safety relays. **Never install arc suppressors directly across the output contacts of any safeguarding device.**

Figure 23 Replacement
Figure 23a(s). Generic Machine Interface, MINI-SCREEN MSC..-1S2E Systems with the MSA-RM-1 relay pack

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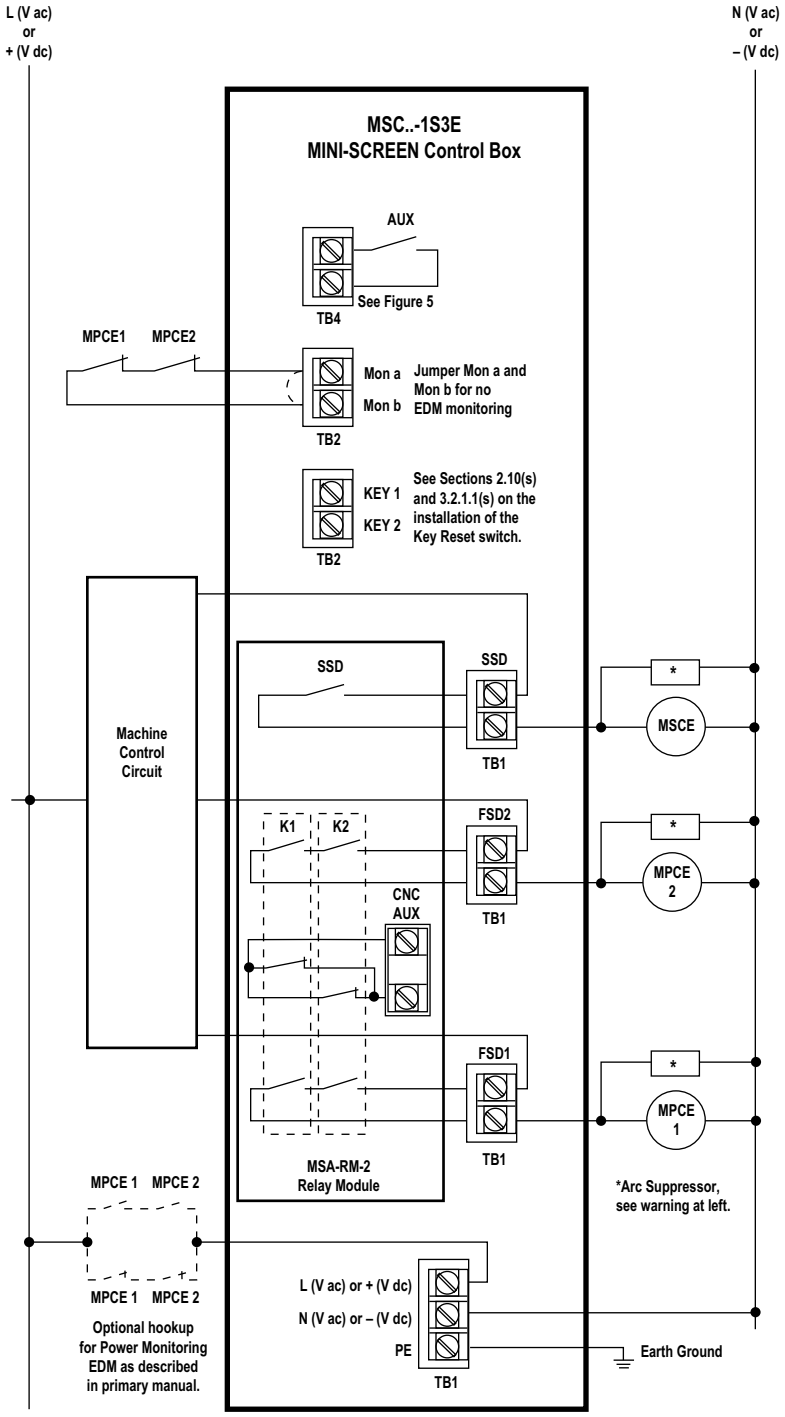

Figure 23 Replacement
Figure 23b(s). Generic MaAchine Interface, MINI-SCREEN MSC..-1T3E Systems with the MSA-RM-2 relay pack

Section 3.5.5 Replacement

3.5.5(s) External Device Monitoring

Permanent Connection

After the initial checkout of Section 3.5.3 has been successfully completed, remove the EDM bypass circuit, installed in Section 3.5.2(s). Then connect the External Device Monitoring (EDM) input to the closed monitoring contacts of the MPCEs. Refer to the NOTICE Regarding MPCE Monitoring Hookup, at right.

TB2 provides connection terminals for the External Device Monitoring input (Mon a and Mon b), and is located at the upper left corner of the control box. External device monitoring must be wired in one of two configurations: one-channel monitoring, or no monitoring; see Section 2.8(s).

After power is connected to the MINI-SCREEN System and the output relay contacts are connected to the machine to be guarded, the operation of the MINI-SCREEN System with the guarded machine must be verified before the combined System may be put into service. To do this, a Qualified Person must perform the Commissioning Checkout Procedure described in Section 6.2 of the primary instruction manual.

⚠ WARNING . . . No EDM

If the application does not require external device monitoring, the EDM input must be jumpered. **It is the user's responsibility to ensure that this does not create a hazardous situation.**

NOTICE Regarding MPCE Monitoring Hookup

It is strongly recommended that one normally closed, forced-guided, monitoring contact of each MPCE be wired as MPCE monitor (as shown in Figure 23 of the primary manual). If this is done, proper operation of the MPCEs will be verified. MPCE monitoring contacts must be used in order to maintain control reliability.

Section 3.5.6 Replacement

3.5.6(s) Auxiliary Relay Output

The MSC..-1S..E controller has an Auxiliary Monitor Relay output. See Figure 5 in the primary manual for operating status condition and output status.

The action of the Auxiliary Monitor Relay contact "follows" the action of output relays FSD1 and FSD2 in either Trip mode or Latch mode. The Auxiliary Monitor Relay contact is a light-duty contact used for control functions that are not safety-related. A typical use is to communicate with a programmable logic controller (PLC). The switching capacity of the Auxiliary Monitor Relay is 125V ac or dc max., 500 mA max. Connection to the Auxiliary Monitor Relay contact is made at wiring barrier TB4.

Section 3.5.7 Addition

3.5.7(s) Accessory Connections at Terminal Strip TB2

NOTE: The "Remote Test Input" has been replaced by the External Device Monitoring input. See Section 2.8 of the primary manual and Section 2.8(s).

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Section 5.1 Addition

5.1(s) Troubleshooting Lockout Conditions

An additional error code will indicate if the EDM input requirements have not been satisfied. See Figure 24(s).

An EDM error will be caused by:

- An open EDM input when the MINI-SCREEN controller tries to close its FSD outputs. The EDM input must be closed before the system is reset (whether manually or automatically).
- The EDM input being slow to close (i.e., more than 200 ms) once the MINI-SCREEN opens its FSD outputs and issues a stop command to the machine.

Troubleshooting an EDM Error (Flashing #7 or "E")

If monitoring MPCEs with EDM input:

- **Flashing #7 (lockout condition):** measure the dc voltage across Mon a and Mon b at TB4 with a voltmeter.
  - If the measurement is approximately 32V dc, there is likely an open circuit caused by a broken wire, a loose connection, or an MPCE that failed in an energized condition (e.g., a welded relay contact of a forced-guided relay). It should not be possible to reset the MINI-SCREEN in this condition.
  - If the measurement is approximately 0V dc, there is likely a closed circuit. The problem is likely a slow or sticky MPCE, causing the EDM input to close 200 ms after the FSDs open. The symptoms may include an intermittent lockout that allows the MINI-SCREEN to be reset.
  - If the measurement is between the two values (0 to 32V dc), a connection or a contact may have become resistive. Depending on the severity, this may result in intermittent operation.

To troubleshoot further:

1. Remove power from the machine and from the MINI-SCREEN system.
2. Disconnect FSD1, FSD2, and the SSD output.
3. Remove existing wiring from EDM input at Mon a and Mon b, and replace with a jumper.
4. Apply power to the MINI-SCREEN system only.

If the MINI-SCREEN can be reset, the fault is probably in either the external wiring associated with the N.C. contacts of the MPCEs or in the MPCEs themselves. One or both of the MPCEs could be at fault; typically both MPCEs should be replaced in this situation. Possible MPCE failures include slow or sluggish reacting, sticky contacts, contact weld, or other faults that cause inconsistent or slow response.

If the MINI-SCREEN can not be reset and the "E" error code is still displayed, replace the controller card or see Section 5.3 of the primary manual.

If not monitoring MPCEs with the EDM input:

- Verify that a jumper is installed at Mon a and Mon b of TB2.
- Verify that EDM input connections are correct and are not loose.
- With the jumper wire in place, measure the dc voltage between the jumper wire and COM (TB3). The measurement should be approximately 17V dc. If not, replace the controller and/ or see Section 5.3 of the primary manual.
- If the MINI-SCREEN can not be reset and the “E” error code is still displayed, replace the controller card or see Section 5.3 of the primary manual.

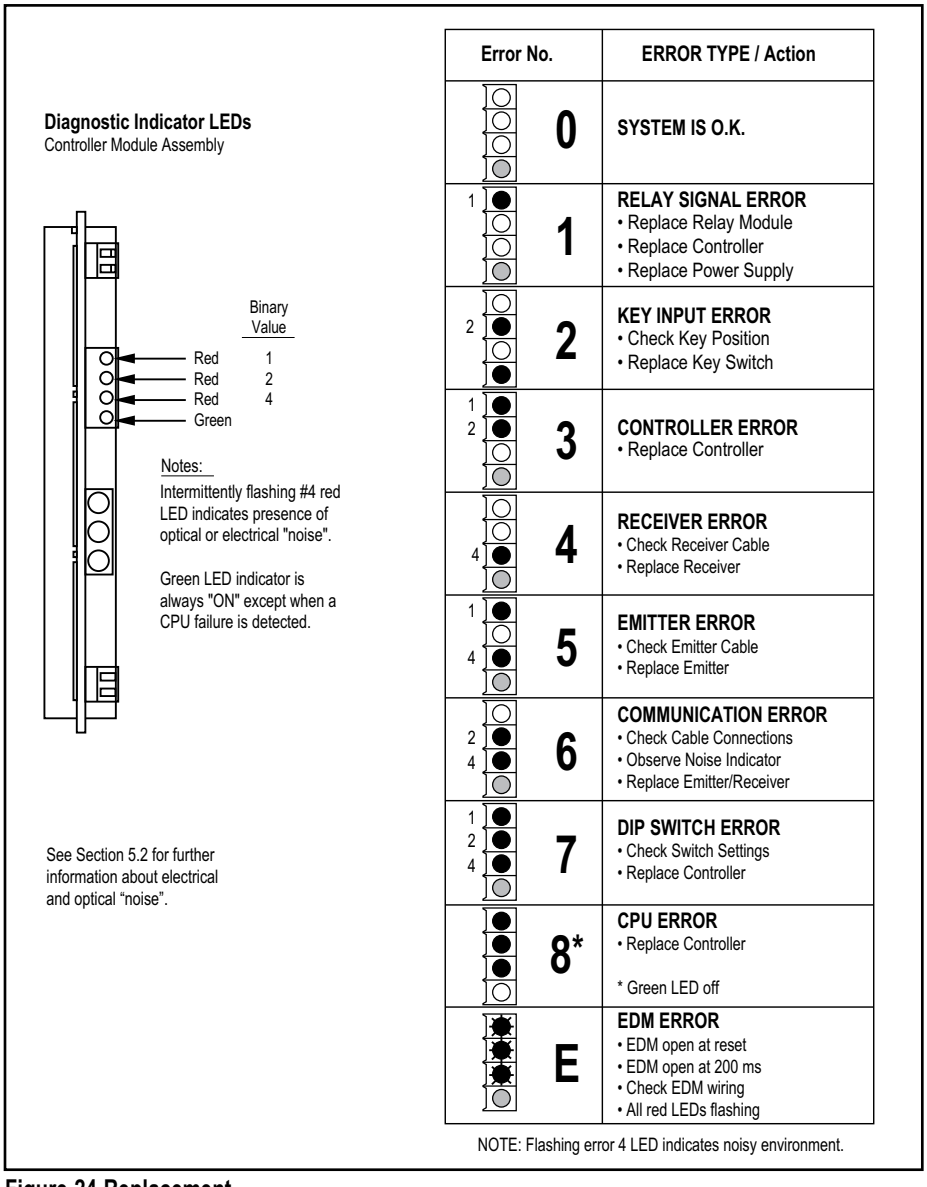

Figure 24 Replacement
Figure 24(s). Interpretation of diagnostic indicator LEDs, with additional error codes

Glossary Addition

External Device Monitoring (EDM)
A means by which a safety device monitors devices that may be controlled by the safety device. Also known as “MPCE monitoring” and “relay back-checking.”

Replacement Control Box Specifications Categories

EDM Input (Replaces “Test Input” category)	Terminals must be closed before the controller attempts to reset (close) the FSD outputs after clearing an interruption of the defined area. The EDM input should open when the FSD outputs close (a clear condition), but this is not required. The EDM input must be closed within 200 milliseconds of the FSD outputs opening (a blocked condition) or a lockout will occur. The contacts of the monitored device must be capable of switching 15 to 50V dc at 20 to 100 mA.
Output Configuration (FSD1, FSD2, and SSD) **(Replaces “Output Configuration” category)**	Relays have forced-guided contacts. **FSD1 and FSD2:** **MSC..-1S2E:** 250V ac at 4A max (resistive load) **MSC..-1S3E:** 250V ac at 6A max (resistive load) **SSD:** 250V ac at 4A max (resistive load) **CNC AUX (MSC..-1S3E):** 250V ac at 6A max (resistive load), complementary normally closed **Mechanical life:** 10,000,000 operations (minimum) **Electrical life:** 100,000 operations (typical @ 1.0kVA switched power, resistive load) Arc suppression is recommended when switching inductive loads; see Warning in Figure 23(s).

Section Addition

Replacement Parts, MINI-SCREEN Systems

Model	Description	For Control Box Models
MSAS-1E	Microprocessor control module	**MSC..-1S2E/-1S3E**
MSA-RM-1	Replacement relay module	**MSC..-1S2E**
MSA-RM-2	Replacement relay module	**MSC..-1S3E**
MSA-PSA-1	Replacement power supply	**MSCA-1S2E/-1S3E**
MSA-PSB-1	Replacement power supply	**MSCB-1S2E/-1S3E**
MSA-PST-1	Replacement power supply	**MSCT-1S2E/-1S3E**

MSC..-1S..E Supplement: MINI-SCREEN Models with Selectable Trip/Latch Output

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