

EZ-SCREEN® Type 2 System Instruction Manual

- European English Version -



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1 SAFETY INFORMATION

1.1 GENERAL

This block details all the necessary safety information relating to the EZ-SCREEN Type 2 System and its intended use.

The EZ-SCREEN Type 2 System complies with Category 2/ Type 2 safety requirements as specified in EN 954-1, IEC 61496-2 or IEC 61496-1.

1.2 SAFETY NOTICES

1.2.1 Types

In order to install and operate the product in a safe and efficient way, safety notices are displayed on the product and throughout this Instruction Manual.

The Safety Notices are categorised as follows:

WARNING!

This type of notice is posted:

- Where potential hazards or unsafe practices exist which **COULD** result in severe personal injury or death if the warning is ignored
- Where there is a risk of serious injury or death if instructions are not followed; e.g. warning to disconnect power before accessing the inside of an electrical cabinet.

The WARNING is on a YELLOW background.



Note

☛ This type of notice is classified as a Note and is posted where the information is purely advisory.

1.3 PRODUCT SAFETY LABELLING

Table 1 on Page 1 lists the labels used on the product together with their descriptions and locations.




Table 1 Label Identification Point Systems

Symbol	Location/Meaning
<p>Yellow background</p> <p>WARNING!</p> <p>WARNING!</p>	<p>Located on EZ-SCREEN Type 2 System Emitters and Receivers.</p> <p>Indicates the following important information:</p> <p>1. CORRECT USE OF THIS CONTROL DEVICE IS AN ESSENTIAL PART OF PROPER MACHINE CONTROL. SEE THE INSTRUCTION MANUAL PACKED WITH THIS DEVICE FOR ALL INSTALLATION DETAILS, WIRING DIAGRAMS, OPERATING INSTRUCTIONS, PERIODIC CHECKOUT PROCEDURES AND WARNINGS. FAILURE TO FOLLOW ALL INSTRUCTIONS OR WARNINGS COULD LEAD TO SERIOUS BODILY INJURY OR DEATH.</p> <p>2. ATTENTION MACHINE OPERATOR POWER-UP TEST PROCEDURE (SEE INSTRUCTION MANUAL OR SYSTEM DAILY CHECKOUT SHEET) MUST BE PERFORMED AT EVERY POWER-UP, SHIFT CHANGE AND MACHINE SETUP CHANGE. IN CERTAIN APPLICATIONS FAILURE TO PERFORM THIS TEST PROCEDURE CAN LEAD TO SERIOUS BODILY INJURY OR DEATH.</p>
<p>Yellow background</p> <p>WARNING!</p>	<p>LASER LIGHT HANDBR LAT-1-LS DO NOT STARE INTO BEAM. CLASS 2 LASER PRODUCT</p> <p>Peak Power: 2.8 mW, 640-660 nm 33 kHz 25% duty cycle COMPLIES WITH 21 CFR PART 1040.10 & EN60825-1;1994</p> <p>AVOID EXPOSURE - LASER LIGHT EMITTED FROM THIS APERTURE</p> <p>REQUIRES ONE 9V BATTERY REMOVE TWO PHILIPS SCREWS FOR BATTERY ACCESS BELOW</p>

1.4 WARNINGS & NOTES IN THE MANUAL

Mandatory WARNING! notices are written and positioned prior to the information they are applicable to throughout the Manual to indicate potential danger or hazards.

There are three different types used in this Manual:

- General **WARNINGS!** indicated by the symbol  (see example [Warning on Page 3](#))
- Electrical Shock Hazard **WARNINGS!** indicated by the symbol  (see example [Warning on Page 27](#))
- Laser Light Emission **WARNINGS!** indicated by the symbol  (see example [Warning on Page 29](#))

The User must read the relevant WARNINGS! appertaining to the event before proceeding further.

Notes are also written and positioned prior to the information they are applicable to throughout the Manual but are non-mandatory.

1.5 SAFETY STANDARDS

The EZ-SCREEN Type 2 System complies with the following international safety standards:

IEC/EN 61496-1 (2004-02) & IEC/EN 61496-2 (1997-11)

Safety of Machinery – Electro-Sensitive Protection Equipment

IEC 60529 (2001-02) & IEC 60529 Corr. 1 (2003-01)

Ingress Protection Provided By Enclosures

EN 954-1 (1997) Category 2

Safety of Machinery – Safety Related Parts of Control Systems, General Principles for Design

IEC/EN 60204-1 (2000-05)

Safety Electrical Equipment

For complete EZ-SCREEN Type 2 System compliance information refer to [Block 3.1.4 on Page 16](#).

Further information and guidance may be found in the following reference standards:

ISO/TR 12100-1 (2003)

Safety of Machinery – Basic Concepts, General Principles for Design Part 1: Basic Terminology, Methodology

ISO/TR 12100-2 (2003)

Safety of Machinery – Basic Concepts, General Principles for Design Part 2: Technical Principals and Specifications

ISO 13850 (1996)

Safety of Machinery – Electrical, Manually Controlled Emergency Stopping Devices, Functional Aspects – Principles for Design

ISO 13851 (2002)

Two-Hand Control Devices - Functional Aspects - Principles of Design

ISO 13852 (2002)

Safety of Machinery – Safety Distances to Prevent Danger Zones Being Reached by the Upper Limbs

ISO 13853 (1998)

Safety of Machinery – Safety Distances to Prevent Danger Zones Being Reached by the Lower Limbs

ISO/DIS 13855 (2002)

Safety of Machinery – The Positioning of Protective Equipment in Respect to Approach Speeds of Parts of the Human Body

ISO 14120 (2002)

Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards

ISO 14121 (1999)

Safety of Machinery – Principles of Risk Assessment

ISO 14118 (2000)

Safety of Machinery - Prevention of Unexpected Start-up

ISO 14119 (1998)

Safety of Machinery – Interlocking Devices Associated with Guards – Principles for Design and Selection

IEC/EN 60947-5-1 (2003-11)

Low Voltage Switch Gear – Electromechanical Control Circuit Devices

IEC/EN 60947-1 (2004-03)

Low Voltage Switch gear – General Rules

IEC 60825-1 (2001-8)

Safety of Laser Products

EN 50081-2 (1994)

Electromagnetic compatibility, Generic emission standard, Industrial environment

EN 55011 (CISPR11) (1998)

Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment

1.6 INGRESS PROTECTION RATINGS

The EZ-SCREEN Type 2 System meets the following Ingress protection classes as per IEC 60529:

- Emitter/Receiver Enclosures IP65

1.7 ELECTRICAL SAFETY

The EZ-SCREEN Type 2 System has been designed to meet with the Electrical Safety Standards as detailed in [Block 3.1.4 on Page 16](#).

1.8 MINIMUM SAFETY DISTANCE

WARNINGS!

ADEQUATE MINIMUM SAFETY DISTANCE

BANNER EZ-SCREEN TYPE 2 SYSTEM EMITTERS AND RECEIVERS MUST BE MOUNTED AT A DISTANCE FROM THE NEAREST HAZARD SUCH THAT AN INDIVIDUAL CANNOT REACH THE HAZARD BEFORE CESSATION OF HAZARDOUS MOTION OR SITUATION, AS DESCRIBED IN ISO/DIS 13855. FAILURE TO DO SO COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

NOTICE REGARDING MPCES

EACH OF THE MPCES (MACHINE PRIMARY CONTROL ELEMENTS) (MPCE 1 AND MPCE 2) MUST BE CAPABLE OF IMMEDIATELY STOPPING THE HAZARDOUS MACHINE MOTION, IRRESPECTIVE OF THE STATE OF THE OTHER. THESE TWO CHANNELS OF MACHINE CONTROL NEED NOT BE IDENTICAL, BUT THE STOP TIME PERFORMANCE OF THE MACHINE (T, USED TO CALCULATE THE MINIMUM SAFETY DISTANCE) MUST TAKE INTO ACCOUNT THE SLOWER OF THE TWO CHANNELS.

DETERMINE CORRECT STOP TIME

STOP TIME (T) MUST INCLUDE THE RESPONSE TIME OF ALL DEVICES OR CONTROLS THAT REACT TO STOP THE MACHINE. IF ALL DEVICES ARE NOT INCLUDED, THE CALCULATED MINIMUM SAFETY DISTANCE (S) IS TOO SHORT. THIS CAN LEAD TO SERIOUS BODILY INJURY OR DEATH. BE SURE TO INCLUDE THE STOP TIME OF ALL RELEVANT DEVICES AND CONTROLS IN THE CALCULATIONS.

Minimum Safety Distance (S) is the minimum distance required between the defined area and the closest reachable hazard point. Minimum Safety Distance is calculated so that when an object or a person is detected (by blocking a sensing beam), the EZ-SCREEN Type 2 System sends a stop signal to the machine, causing it to stop by the time the person can reach any machine hazard point (see [Figure 1 on Page 3](#)).

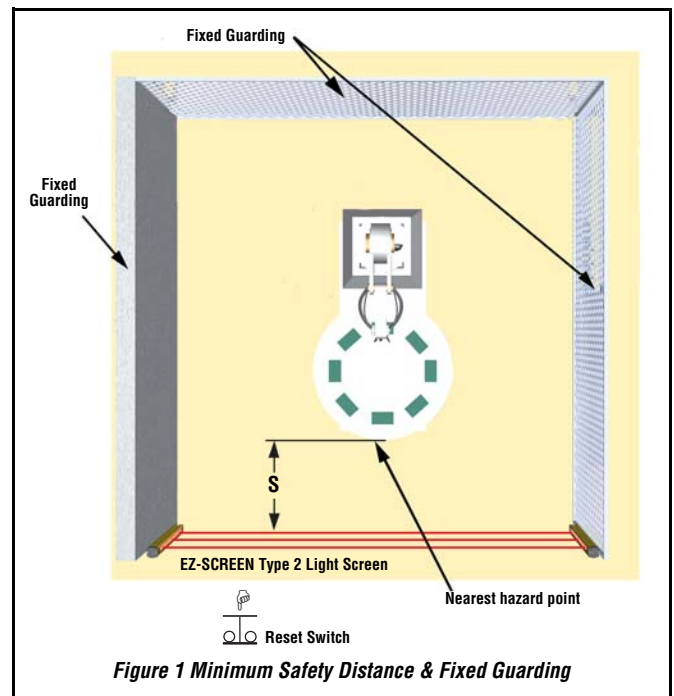


Figure 1 Minimum Safety Distance & Fixed Guarding

Calculation of Minimum Safety Distance takes into account several factors, including a calculated human speed, the total system stopping time (which itself has several components), and the depth penetration factor. After the Minimum Safety Distance (S) is determined, the calculated distance should be recorded in [Step 2\) on Page 41](#) of this manual, and on the Daily Check-out Card.

- After **S** is determined, the calculated distance shall be recorded in [Step 2\) on Page 41](#) of this manual, and/or on the Daily Check-out Card.

1.8.1 Calculating Minimum Safety Distance

Direction of Approach Normal to Detection Zone

Calculation of Minimum Safety Distance takes into account several factors, including a calculated human speed, the total system stopping time (which itself has several components), and the additional distance based on the intrusion of the hand or object towards the danger zone prior to actuation of the safety device.

The formula used to calculate Minimum Safety Distance is:

S = **K x T + C** where:

S = Minimum Safety Distance in millimetres; from danger zone to centre line of detection zone (see [Detection Zone on page 65](#)). Minimum allowable safety distance is 100 mm (175 mm for non-industrial applications) regardless of calculated value.

K = Recommended hand-speed constant (in mm) derived from data on approach speeds of the body or parts of the body as stated in ISO/DIS 13855;
 - 2000 mm/s applies to all minimum distances of **S** up to and including 500 mm, or
 - 1600 mm/s can be used if **S** is found to be greater than 500 mm.

T = Overall response time of machine; that is, time between physical initiation of safety device and machine coming to a stop or risk being removed. This can be broken down into two parts: **T_s** and **T_r** where **T = T_s + T_r**

T_s = Response time of machine measured between application of stop signal from EZ-SCREEN Type 2 System and machine coming to a stop or risk being removed (including stop times of all relevant control elements measured at maximum machine velocity, for example IM-T-.. Interface Modules). **T_s** is usually measured by a stop-time measuring device.

☛ *If specified machine stop time is used, it is recommended that at least 20% be added as a safety factor to account for clutch/brake system deterioration.*

T_r = Response time of EZ-SCREEN Type 2 System (11 ms to 25 ms depending on model (see [Figure 8 on Page 15](#)).

C = Additional distance in millimetres, based on intrusion of hand or object towards danger zone prior to actuation of safety device. C is calculated using the formula as follows:

C = 8 x (d-14) where d is the resolution of the device which must be less than 40 mm.

☛ *This measurement must take into account the slower of the two MPCE (see [MPCE on page 66](#)) channels, and response time of all devices or controls (such as interface modules) that react to stop machine. If all devices are not included, the calculated Minimum Safety Distance (S) will be too short and serious injury could result.*

User should consider all factors, including physical ability of operator, when determining value of K to be used.

Access to danger zone by reaching over or round EZ-SCREEN Type 2 System shall be prevented using values stated in ISO 13852.

Example

30 mm Resolution Model EZ-SCREEN Type 2 System (height 600 mm)

To calculate Minimum Safety Distance (S) as stated in ISO/DIS 13855 by applying formula $S = K \times (T_s + T_r) + C$ is as follows:

K = 1600 mm/second

T_s = 0,32 (0,25 s is specified by machine manufacturer; plus 20% safety factor; plus 20 ms for interface module IM-T-9A response time)

T_r = 0,016 s, specified response time of Model No. LS2TP30-600Q88 EZ-SCREEN Type 2 System and

C = $8 \times (30-14) = 128$

S = $1600 \times (0,32 + 0,016) + 128$

S = **666 mm**

Therefore, in this example, the EZ-SCREEN Type 2 System Emitter and Receiver must be mounted so that no part of the Light Screen is closer than **666 mm** from the closest reachable hazard point of the guarded machine.

1.8.2 Mounting Methods for Multiple Systems

To prevent light from the Emitter of one system from affecting the Receiver of another system, the beams from the systems must be isolated from one another through the use of physical non-reflective barriers (see [Figure 14 on Page 23](#)). Mounting the Emitters and Receivers so that the beams travel in the opposite directions, as shown in [Figure 12 on Page 21](#), also helps to isolate systems.

1.8.3 Pass-Through Hazards

A pass-through hazard is associated with applications where personnel may pass through a safeguard (which issues a stop command to remove the hazard), and then continues into the guarded area, such as in perimeter guarding. Subsequently, their presence is no longer detected, and the related danger becomes the unexpected start or restart of the machine while personnel are within the guarded area.

In the use of Light Screens, a pass-through hazard typically results from large Minimum Safety Distances calculated from long stopping times, large minimum object sensitivities, reach-over, reach-through, or other installation considerations. A pass-through hazard can be generated with as little as 75 mm between the defined area and the machine frame or fixed guarding.

1.8.3.1 Reducing or Eliminating Pass-Through Hazards

! WARNING!

USE OF EZ-SCREEN TYPE 2 SYSTEM FOR PERIMETER GUARDING

IF AN EZ-SCREEN TYPE 2 SYSTEM IS INSTALLED IN AN APPLICATION THAT RESULTS IN A PASS-THROUGH HAZARD (FOR EXAMPLE, PERIMETER GUARDING), EITHER THE EZ-SCREEN TYPE 2 SYSTEM OR THE MPCs OF THE GUARDED MACHINE MUST CAUSE A LATCHED RESPONSE FOLLOWING AN INTERRUPTION OF THE DEFINED AREA. THE RESET OF THIS LATCHED CONDITION MAY ONLY BE ACHIEVED BY ACTUATING A RESET THAT IS SEPARATE FROM THE NORMAL MEANS OF MACHINE CYCLE INITIATION. THE SWITCH MUST BE POSITIONED AS DESCRIBED IN [Block 1.13.3 on Page 9](#). ADDITIONAL GUARDING MUST BE USED IF A PASS-THROUGH HAZARD CAN NOT BE ELIMINATED OR REDUCED TO AN ACCEPTABLE LEVEL OF RISK (AS DESCRIBED IN ISO 14121. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

Pass-Through hazards should be eliminated or reduced whenever possible. While it is recommended to eliminate the pass-through hazard altogether, this may not be possible due to machine layout, machine capabilities, or other application considerations.

One solution is to ensure that personnel are continually sensed while within the hazardous area. This can be accomplished by using supplementary guarding, as described in ISO/DIS 13855 or other appropriate standard (see [Block 1.10 on Page 6](#)).

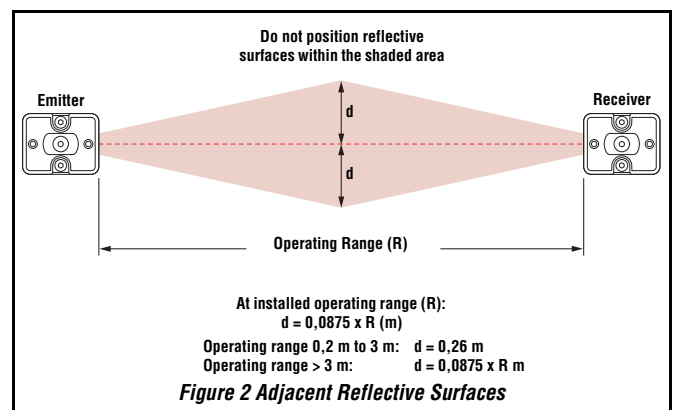
An alternate method is to ensure that once the safeguarding device is tripped it latches, and requires a deliberate manual action to Reset. This method of safeguarding relies upon the location of the Reset Switch as well as safe work practices and procedures to prevent an unexpected start or restart of the guarded machine.

1.9 ADJACENT REFLECTIVE AREAS

A reflective surface located adjacent to the defined area may deflect one or more beams around an object in the defined area. In the worst case, an optical short circuit may occur, allowing an object to pass undetected through the defined area (see [Figure 2 on Page 5](#)).

! WARNING!

AVOID INSTALLATION NEAR REFLECTIVE SURFACES
AVOID MOUNTING THE EZ-SCREEN TYPE 2 SYSTEM NEAR ANY REFLECTIVE SURFACES. A REFLECTIVE SURFACE LOCATED NEARBY MAY REFLECT LIGHT AROUND AN OBJECT OR PERSON, PREVENTING ITS DETECTION BY THE RECEIVER. THIS POSSIBILITY IS DETECTED DURING THE TRIP TEST. FAILURE TO PREVENT REFLECTION PROBLEMS RESULTS IN INCOMPLETE GUARDING; SERIOUS BODILY INJURY OR DEATH COULD RESULT.



For more detailed information and problem solving of unwanted reflections, refer to [Block 6.2.1.3 on Page 46](#).

1.10 SUPPLEMENTARY GUARDING

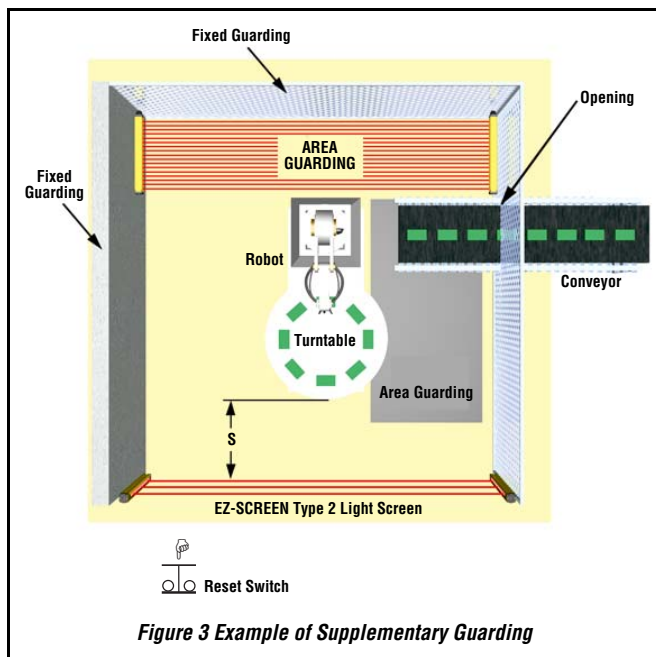
WARNINGS!

HAZARD MUST ONLY BE ACCESSIBLE THROUGH DEFINED AREA
THE INSTALLATION OF THE EZ-SCREEN TYPE 2 SYSTEM MUST PREVENT ANY INDIVIDUAL FROM REACHING AROUND, UNDER, OVER OR THROUGH THE DEFINED AREA AND INTO THE HAZARD WITHOUT BEING DETECTED. MECHANICAL BARRIERS (FOR EXAMPLE, FIXED GUARDING) OR SUPPLEMENTARY GUARDING (AS DESCRIBED IN ISO/DIS 13855 OR OTHER APPROPRIATE STANDARD MAY BE REQUIRED TO COMPLY WITH THIS REQUIREMENT.

PROPER ORIENTATION OF SYSTEM EMITTERS & RECEIVERS
EZ-SCREEN TYPE 2 SYSTEM EMITTERS AND RECEIVERS MUST BE INSTALLED WITH THEIR CORRESPONDING CABLED ENDS POINTING IN THE SAME DIRECTION (FOR EXAMPLE, BOTH CABLED ENDS UP). FAILURE TO ORIENT THEM PROPERLY IMPAIRS PERFORMANCE OF THE EZ-SCREEN TYPE 2 SYSTEM AND RESULTS IN INCOMPLETE GUARDING. THIS COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

The EZ-SCREEN Type 2 System must be properly positioned such that an individual can not reach through the defined area and access the hazard as described in [Block 1.8 on Page 3](#).

Additionally, the hazard can not be accessible by reaching around, under, or over the defined area. To accomplish this, supplementary guarding (mechanical barriers, such as screens or bars), as described in ISO 14120 must be installed. Access is then only possible through the defined area of the EZ-SCREEN Type 2 System or through other guarding devices that prevent access to the hazard (see [Figure 3 on Page 6](#)).



The mechanical barriers used for this purpose are typically called fixed guarding. There must be no gaps between the fixed guard and the defined area. Any openings in the fixed guard must comply with the safe opening requirements of ISO 14120, ISO 13852 and ISO 13853.

1.11 CONDITIONS OF EQUIPMENT USE

WARNING!

USE OF EZ-SCREEN TYPE 2 SYSTEM

THE EZ-SCREEN TYPE 2 SYSTEM MEETS THE TYPE 2 REQUIREMENTS OF IEC 61496 AND CATEGORY 2 REQUIREMENTS OF EN 954-1. DO NOT USE THE EZ-SCREEN TYPE 2 SYSTEM UNLESS IT IS INSTALLED, TESTED, AND INSPECTED IN ACCORDANCE WITH THE EZ-SCREEN TYPE 2 INSTRUCTION MANUAL. DO NOT USE THE EZ-SCREEN TYPE 2 SYSTEM WHERE CONTROL RELIABILITY IS REQUIRED, CATEGORY 3, CATEGORY 4, OR TYPE 4 AOPD (ACTIVE OPTO-ELECTRONIC PROTECTIVE DEVICE) HAVE BEEN MANDATED (SEE EN 954-1 AND IEC 61496), OR OTHER APPROPRIATE STANDARD), OR WHERE A RISK ASSESSMENT HAS DETERMINED THAT FREQUENT ACCESS BY PERSONNEL TO THE HAZARD COULD RESULT IN A IRREVERSIBLE OR A SERIOUS INJURY. TYPICAL USE IS FOR SAFEGUARDING IN SITUATIONS THAT THE CONSEQUENCE OF AN ACCIDENT WILL RESULT IN ONLY SLIGHT (NORMALLY REVERSIBLE) INJURIES THAT ARE TYPICALLY TREATED BY THE NORMAL HEALING PROCESSES AND MINOR MEDICAL TREATMENT (I.E. FIRST AID).

The Banner EZ-SCREEN Type 2 System (the System) is intended for point-of-operation machine guarding applications and other safeguarding applications, as determined by a risk assessment. It is the User's responsibility to verify whether the safeguarding is appropriate for the application and is installed, as instructed by this manual, by a [Qualified Person as specified in Block 1.13.2 on Page 8](#).

Before installing the EZ-SCREEN Type 2 System, this manual should be read in its entirety, paying particular attention to Block 1.14 on Page 9 and all of Chapter 3. The System's ability to perform its safeguarding function depends upon the appropriateness of the application and upon its proper mechanical and electrical installation and interfacing to the guarded machine. **If all mounting, installation, interfacing, testing/checking and checkout procedures are not followed properly, the System cannot provide the protection for which it was designed.**

EZ-SCREEN Type 2 System(s) are typically used, but are not limited to the following applications:

(Dependent on machine risk assessment)

- Small assembly equipment
- Automated production equipment
- "Table-top" robotic work cells
- Component insertion / "pick-and-place" machines
- Small packaging machines
- Equipment and process protection (non-personnel safety)
- Applications that could result in only slight (normally reversible) injuries (such as a bump, bruise, knock-down, trapping but not crushing, minor cuts and abrasions, etc.)

EZ-SCREEN Type 2 System(s) may NOT be used for the following unsuitable applications:

- As a primary safeguard in frequently accessed hazardous situations that could result in serious injuries (normally irreversible, including death); see [Warning on Page 6](#).
- In any case where Control Reliability, Category 3, Category 4, or Type 4 AOPD (active opto-electronic protective device) has been mandated. See EN 954-1, IEC 61496-1, or other appropriate standard.
- With any machine that cannot be stopped immediately after a stop signal is issued, such as single-stroke (or “full-revolution”) clutched machinery.
- With any machine with inadequate or inconsistent machine response time and stopping performance.
- With any machine that ejects materials or component parts through the defined area.
- In any environment that is likely to adversely affect photoelectric sensing system efficiency. For example, corrosive chemicals or fluids or unusually severe levels of smoke or dust, if not controlled, may degrade the efficiency of the System.
- As a tripping device to initiate or reinstate machine motion (PSDI applications) unless the machine and its control system fully comply with the relevant standard or regulation (see ISO 12100-2, IEC 60204-1, IEC 61496-1 or other appropriate standard).

If an EZ-SCREEN Type 2 System is installed for perimeter-guarding use (i.e., where a pass-through hazard may exist), the dangerous machine motion can be initiated by normal means only after the safeguarded area is clear of individuals and the EZ-SCREEN Type 2 System has been reset. See [Block 1.8.3 on Page 5](#) for further information.

See www.bannerengineering.com for further information.

1.12 MACHINE INTERFACE ASPECTS

1.12.1 OSSD Outputs

Both OSSD (Output Signal Switching Device) outputs must be connected to the machine control so that the machine’s safety-related control system interrupts the circuit or power to the MPCE (Machine Primary Control Elements), resulting in a non-hazardous condition.

FSDs (Final Switching Devices) typically accomplish this when the OSSDs go to an OFF state ([Figure 30 on Page 60](#) refers).

☛ *It should be noted that the EZ-SCREEN Type 2 System is not capable of the Banner Safety Handshake and consequently cannot be interfaced with an USSI.*

1.12.2 FSD Interfacing Connection

FSDs (Final Switching Devices) can take many forms, though the most common are forced-guided, mechanically linked relays or an interface module.

Depending on the application, the use of FSDs can facilitate controlling voltage and current that differs from the OSSD outputs of the EZ-SCREEN Type 2 System. FSDs can also be used to control an additional number of hazards by creating multiple safety stop circuits.

1.12.2.1 Safety Stop Circuits

A safety stop allows for an orderly cessation of motion for safeguarding purposes, which results in a stop of motion and removal of power from the MPCEs (assuming this does not create additional hazards). A safety stop circuit typically comprises a minimum of two normally open (N.O.) contacts from forced-guided, mechanically linked relays. Such a circuit can be described as a Safe Switching Point. Typically, safety stop circuits are either single-channel, which is a series connection of at least two N.O. contacts; or dual-channel, which is a separate connection of two N.O. contacts. In either method, the safety function relies on the use of redundant contacts to control a single hazard (if one contact fails ON, the second contact arrests the hazard and prevent the next cycle from occurring).

The interfacing of the safety stop circuits must be accomplished so that the safety function can not be suspended, overridden, or defeated, unless accomplished in a manner at the same or greater degree of safety as the machine’s safety related control system that includes the EZ-SCREEN Type 2 System.

The N.O. safety outputs from an Interface Module provide a series connection of redundant contacts that form safety stop circuits for use in either single-channel or dual-channel control.

1.12.2.2 Dual-Channel Control

Dual-channel control provides the ability to electrically extend the safe switching point beyond the FSD contacts. This method of interfacing is capable of detecting certain failures in the control wiring between the safety stop circuit and the MPCEs. These failures include a short-circuit of one channel to a secondary source of energy or voltage, or the loss of the switching ability of one of the FSD outputs. Such failures could lead to the loss of redundancy — or to a complete loss of safety, if not detected and corrected.

The possibility of a failure to the wiring increases as the physical distance between the FSD safety stop circuits and the MPCEs increase, as the length or the routing of the interconnecting wires increases, or if the FSD safety stop circuits and the MPCEs are located in different enclosures. For this reason, dual-channel control should be used in any installation where the FSDs are located remotely from the MPCEs.

1.12.2.3 Single-Channel Control

Single-channel control uses a series connection of FSD contacts to form a safe switching point. After this point in the machine's safety-related control system, failures can occur that would result in the loss of the safety function (such as a short-circuit to a secondary source of energy or voltage).

For this reason, single-channel control interfacing should be used only in installations where FSD safety stop circuits and the MPCEs are mounted within the same control panel, adjacent to each other and are directly connected to each other; or where the possibility of such a failure can be excluded. If this can not be achieved, then dual-channel control should be used.

Methods to exclude the possibility of these failures include, but are not limited to:

- Physically separating interconnecting control wires from each other and from secondary sources of power
- Routing interconnecting control wires in separate conduit, runs, or channels
- Locating all elements (modules, switches, and devices under control) within one control panel, adjacent to each other and directly connected with short wires
- Properly installing multi-conductor cabling and multiple wires through strain relief fittings (over-tightening of a strain-relief can cause short-circuits at that point)
- Using positive-opening or direct-drive components, installed and mounted in a positive mode

1.12.3 MPCEs

Each of the two MPCE 1 and MPCE 2 (Machine Primary Control Elements) must be capable of immediately stopping the dangerous machine motion, irrespective of the state of the other. These two channels of machine control need not be identical, but the stop time performance of the machine (T_s used to calculate the Minimum Safety Distance, see [Block 1.8.1 on Page 4](#)) must take into account the slower of the two channels. Some machines offer only one Primary Control Element. For such machines, it is necessary to duplicate the circuit of the single MPCE to add a second. Refer to [Figure 31 on Page 61](#) or consult the machine manufacturer for additional information.

1.13 SECURITY PROTOCOL

Certain procedures for installing, maintaining and operating the EZ-SCREEN Type 2 System must be performed by either a [Designated Person as specified in Block 1.13.1 on Page 8](#) or a [Qualified Person as specified in Block 1.13.2 on Page 8](#).

1.13.1 Designated Person

A **Designated Person** is identified and designated in writing, by the employer, as being appropriately trained and qualified to perform the specified check-out procedures on the EZ-SCREEN Type 2 System. A machine operator so designated may be a **Designated Person**. The **Designated Person** is empowered to:

- Perform manual resets and hold possession of the Reset key

1.13.2 Qualified Person

A **Qualified Person**, by possession of a recognized degree or certificate of professional training, or by extensive knowledge, training and experience, has successfully demonstrated the ability to solve problems relating to the installation of the EZ-SCREEN Type 2 System and its integration with the guarded machine. In addition to everything for which the **Designated Person** is empowered, the **Qualified Person** is empowered to:

- Install the EZ-SCREEN Type 2 System
- Perform all EZ-SCREEN Type 2 System check-out procedures (see [Block 6.1.1 on Page 39](#))
- Have access and make changes to the EZ-SCREEN Type 2 System configuration settings and hold possession of the Banner special tool that removes the screws fastening the security plate that prevents access to the configuration display panel
- Reset the system following a lockout condition (see [Lockout Condition on page 66](#)).

1.13.3 Remote Reset Switch - System Test

WARNING!

RESET SWITCH LOCATION

THE RESET SWITCH MUST BE:

OUTSIDE OF THE HAZARDOUS AREA, IN A LOCATION THAT ALLOWS THE SWITCH OPERATOR FULL VIEW OF THE ENTIRE GUARDED AREA; OUT OF REACH FROM WITHIN THE SAFEGUARDED SPACE; PROTECTED AGAINST UNAUTHORIZED OR INADVERTENT OPERATION. IF ANY AREAS ARE NOT VISIBLE FROM THE RESET SWITCH, ADDITIONAL MEANS OF SAFEGUARDING (E.G. SAFETY MATS OR ADDITIONAL LIGHT SCREENS) SHALL BE PROVIDED, AS DESCRIBED BY EN 954-1 SERIES OR OTHER APPROPRIATE STANDARDS. FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY OR DEATH.

TEST FUNCTION

A MACHINE OR AUTOMATIC TEST (OR CHECK) OF THE EZ-SCREEN TYPE 2 SYSTEM AND ITS INTERFACE MAYBE REQUIRED AS DETERMINED BY RISK ASSESSMENT AND APPROPRIATE STANDARD (E.G. ISO 14121 AND EN 954-1). FAILURE TO TEST OR CHECK THE SAFEGUARDING FUNCTION AT APPROPRIATE INTERVALS CAN LEAD TO THE LOSS OF THE SAFETY FUNCTION.

System Resets are performed using a remote mounted Normally Closed (N.C.) momentary type Reset Switch.

The Reset Switch can be used in the following way:

- As a Test/Start/Restart/Reset for Latch Models
- As a Test/Reset for Trip Models

The Test/Reset wire of the Receiver must be connected to the supply voltage via a remotely positioned Normally Closed (N.C.) Reset Switch and the contacts of the Machine Control TEST circuit (typically a Normally Open (N.O.) contact held or energized closed).

To perform a manual reset or a system Test, the normally closed (N.C.) switch should be opened for a minimum of 0,25 s and then re-closed.

☛ *If this input is connected to 0 VDC or left floating, the system goes to a lockout condition on power-up.*

The switch must be located outside the guarded area, and must not be within reach from within the guarded area. Its location should provide a clear view of the entire guarded area. If any hazardous areas are not in view from the switch location, additional means of guarding must be provided. The switch should be protected from accidental or unintended actuation (for example, through the use of rings or guards).

☛ **Resetting a guarding device must not initiate hazardous motion.**

Safe work procedures must require that a start-up procedure is followed and that the individual performing the Reset verifies that the entire hazardous area is clear of all personnel, before each Reset of the guarding device is performed. If any area can not be observed from the Reset Switch location, additional supplementary guarding must be used; at minimum, visual and audible warnings of machine start-up.

1.14 CONTROL RELIABILITY & SAFETY CATEGORIES

To summarize the expected safety circuit performance in high-risk situations, requirements of Control Reliability and Categories 3 and 4 (EN 954-1) demand that a reasonably foreseeable, single failure does not lead to the loss of the safety function, and does not prevent a normal or immediate stop from occurring. The failure or the fault must be detected at or before the next demand of safety (e.g. at the beginning or end of a cycle, or when a safeguard is actuated). The safety-related part of the control system then must issue an immediate stop command, or prevent the next machine cycle or hazardous situation until the failure or fault is corrected.

The effect of EN 954-1 is to place a “floor” or a baseline for situations in which a minimum level of performance has been mandated or in cases where a risk assessment has determined a need for Control Reliability, Category 3 or Category 4 level of performance.

In lower-risk safety applications, safeguards and safety circuits do not require the level of performance and fault tolerance described by Control Reliability, Category 3 or Category 4. Applications involving situations that could result in a slight or normally reversible injury (e.g., only requiring first aid) can be solved by EN 954-1 Category 2.

EN 954-1 Category 2 does not require the same level of performance and fault tolerance as required by Control Reliability, Category 3 or Category 4. Safety-related parts of control systems designed to Category 2 “shall be designed so that their function(s) are checked at suitable intervals by the machine control system.” This allows a single fault to lead to the loss of the safety function between the check [test] of the system, but the loss of safety function is detected by the check. By comparison, in a system designed to EN 954-1 Category 4, a single fault or an accumulation of faults does not lead to a loss of the safety function.

While EN 954-1 generally applies to the machine level, IEC 61496-1 and IEC 61496-2 specifies requirements for the design, construction and testing for two levels or “types” of active opto-electronic protective devices (AOPDs) or light curtains (light screens). “Type 2” and “Type 4” describe differing requirements to ensure that appropriate safety-related performance is achieved. The appropriate type is dependent on the overall degree of risk reduction, as determined by the machine’s Risk Assessment (See ISO 14121).

A Type 2 AOPD relies on periodic testing to detect a failure to danger. Between tests, a single fault can result in the loss of the safety function. While this level of performance and fault tolerance is generally not allowed in Category 4 situations, it is acceptable in the lower-risk situations described by Category 2.

While the EZ-SCREEN Type 2 accomplishes internal self-tests on a continual bases, the installation should provide an additional periodic test/check of the EZ-SCREEN Type 2 System and its interface to ensure the integrity of the safety function (see [Block 1.13.3 on Page 9](#) - Test/Reset procedure). A component failure detected by periodic test/check must cause a “stop” signal to be sent to the guarded machine and puts the System into a Lockout condition.

Recovery from this type of Lockout condition requires:

- Replacement of the failed component (to restore the safety function) and
- The appropriate reset procedure (see [Block 5.2.2.2 on Page 36](#)).

The Diagnostic Display is used to diagnose causes of a Lockout condition (see [Block 6.2.1.2 on Page 46](#)).

1.15 ELECTROMAGNETIC COMPATIBILITY (EMC)

The EZ-SCREEN Type 2 System is in compliance with EN 50081-2 and EN 55011 (CISPR11) for EMC requirements.

1.16 EQUIPMENT VIBRATION LEVELS

The EZ-SCREEN Type 2 System is in compliance with IEC 61496-1 for shock and vibration levels.

1.17 EQUIPMENT RADIATION LEVELS

The Alignment Tool used for aligning the EZ-SCREEN Type 2 System is in compliance with IEC 60825 for laser radiation levels.

1.18 PRODUCT USE IN EXPLOSIVE ATMOSPHERES

The EZ-SCREEN Type 2 System is **not** specifically designed or intended for use in a volatile or explosive atmosphere.

If the EZ-SCREEN Type 2 System is to be used in an explosive atmosphere, then the Sensors should be fitted in special explosion-proof enclosures suitable for this purpose. Contact Banner for further information (see [Banner Customer Information as listed on page 69](#)).

1.19 PRODUCT REPAIR

In the unlikely event of a failure of the EZ-SCREEN Type 2 System or a component, it is strongly recommended that the product or component be returned to Banner for repair and **not** outsourced or sent to a third party repair organisation (see [Banner Customer Information as listed on page 69](#)).

If this recommendation is ignored, Banner accepts no responsibility or liability for the product and any guarantee of the product is deemed invalid.

2 INTRODUCTION

This Chapter details information of an introductory nature to the equipment.

2.1 PRODUCT FEATURES

The Banner EZ-SCREEN Type 2 System described by this manual has the following product features:

- Integrated Light Screens designed in particular for Hand Detection
- Synchronized, modulated infrared sensing beams, 30 mm resolution with defined area heights from 150 mm to 1800 mm in increments of 150 mm
- Operating range of up to 15 metres
- Compact housing
- Versions with Trip or Latch output operation (Automatic or Manual Start/Restart)
- Integral electronics and optics within the housing
- A Receiver self-check occurs at power-up, upon restart, when requested by a TEST signal (see [Block 1.13.3 on Page 9](#)), and automatically every 0,5 seconds during RUN mode.
- FMEA tested according to IEC 61496-1, type 2 ESPE requirements
- Opposed mode opto electronic guarding
- Emitter and Receiver LEDs providing system status
- Highly immune to EMI, RFI, ambient light, weld flash, and strobe light
- Vibration-tolerant, factory burned-in Emitter and Receiver circuitry for toughness and dependability
- Redundant OSSD output circuitry
- Microprocessor-controlled
- Visual indication for Emitter/Receiver TOP/BOTTOM alignment

2.2 DISCLAIMER INFORMATION

IMPORTANT... READ THIS BLOCK BEFORE PROCEEDING!

This Manual is intended to provide complete application, installation, operation, and maintenance instructions. In addition, it is suggested that any questions regarding application or use of EZ-SCREEN Type 2 System be directed to the factory applications department (see [Banner Customer Information as listed on page 69](#)).

Banner EZ-SCREEN Type 2 System can guard against accidents only when they are properly installed and integrated into the machine, properly operated, and properly maintained. See [Chapter 4](#) of this manual for installation procedures, considerations, and precautions. See [Chapter 5](#) and [Chapter 6](#) for operating and maintenance information. It is the responsibility of the purchaser and/or user to apply this EZ-SCREEN Type 2 System in full compliance with European Standards as listed in [Block 1.5 on Page 2](#).

The user has the responsibility to ensure that all local, state, national laws, rules, codes, and regulations relating to the use of this machine guarding system in any particular application are satisfied. Extreme care is urged to ensure that all legal requirements have been met and that all installation and maintenance instructions contained in this manual are followed.

2.3 ABOUT THIS MANUAL

This Manual consists of a number of Chapters.

A block numbering system is also used in the Manual to assist in easy location and readability of information in a logical way.

Chapters are numbered 1, 2, 3 and so forth.

Block numbering is broken down into up to 4 levels of information as follows:

Level **1** TITLE IN UPPER CASE 15 PT

Level **1.1** TITLE IN UPPER CASE 14 PT

Level **1.1.1** Title in Title Case 12 pt

Level **1.1.1.1** Title in Title Case 10 pt



Illustrations are numbered 1, 2, 3, 4, etc. throughout the Manual.

Tables are numbered 1, 2, 3, 4, etc. throughout the Manual.

For ON LINE versions of the Manual, there is an interactive Table of Contents (Bookmarks) on the left hand side, which breaks down into 4 block levels as well as Figure and Table Listings.

If the bookmarks are not visible when the document is opened: they may be activated by clicking Window then Bookmarks from the menu. Clicking a bookmark directs the Reader to the information.

For printed versions of this document, there is a conventional Table of Contents at the beginning of this document.

For Readers of the ON LINE version of this document, Cross References are identified in blue type and are hypertexted. That is to say, when scrolling through the document using the mouse, the cursor changes from  to . At this point if the mouse is clicked, the document is routed directly to that particular reference. The Reader can return to the original place in the document by clicking on the **Bookmark ▼** then selecting **Go to Bookmark** or alternatively clicking on the highlighted bookmark.

In general emphasis is used to emphasize information of medium importance such as Machine functions etc.

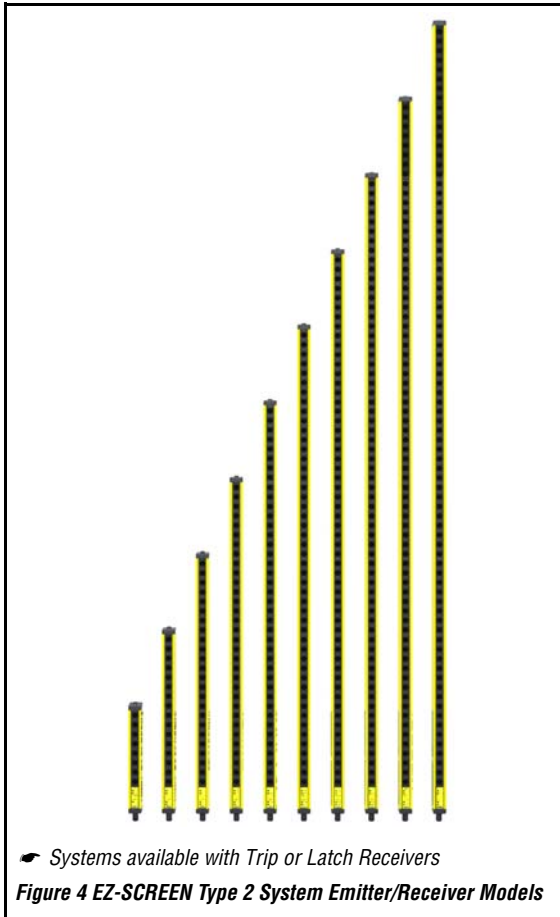
In general **bold emphasis** is used to emphasize information of particular importance such as Machine commands, titles etc.

Change bars are also used in the document to indicate revisions. They are positioned in the left or right hand margins adjacent to the change.

At the end of the Manual there are a number of Appendices.

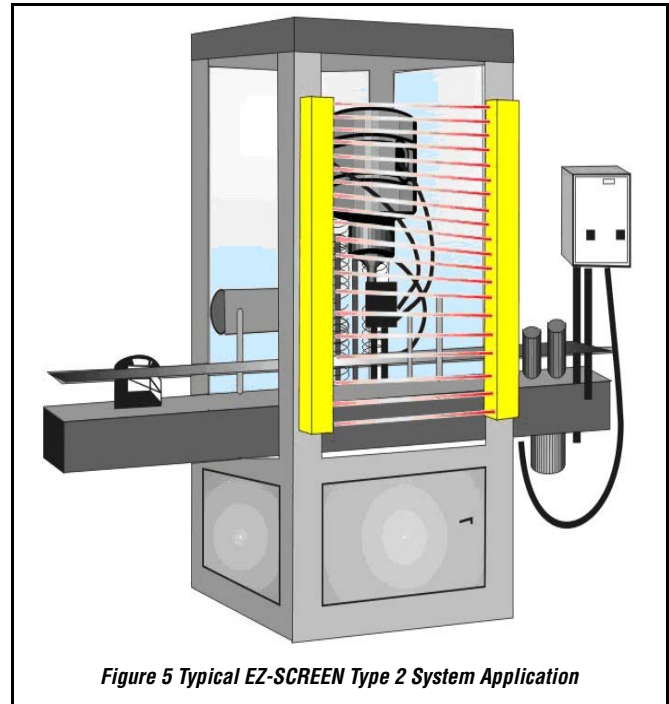
2.4 SYSTEM DESCRIPTION

Banner EZ-SCREEN Type 2 System(s) (Figure 4 on Page 12) come in a range of heights from 150 mm to 1800 mm and are generally used as safeguarding devices in automation where it is necessary to control and protect access to dangerous zones.



Banner EZ-SCREEN Type 2 System(s) can be used to stop moving machinery in the typical applications detailed in [Block 1.11 on Page 6](#).

[Figure 5 on Page 12](#) shows a typical application for a Banner EZ-SCREEN Type 2 System.



In typical operation, if any part of an operator's body (or any opaque object) of more than a pre-determined cross section is detected, the OSSD (Output Signal Switching Device) solid-state outputs turn off. These outputs are connected to the guarded machine's FSDs (Final Switching Devices) that control the MPCs (Machine Primary Control Elements) which immediately stop the motion of the guarded machine.

A Banner EZ-SCREEN Type 2 System comprises an Emitter and a Receiver and houses internally the command and control functions. There is no external controller.

Trip & Latch Functions (Automatic & Manual Start/Restart) are described in [Block 2.4.2 on Page 13](#).

All models require a supply voltage of +24 VDC \pm 20%.

Both Emitter and Receiver feature individual LEDs to provide continuous indication of the system's operating status and error conditions. See [Block 5.1 on Page 35](#) for more information.

2.4.1 Main Components

See Figure 6 on Page 13, Figure 7 on Page 13 and Table 3 on Page 18.

Emitter & Receiver

The Emitter and Receiver housings are constructed from extruded aluminium housing with yellow polyester powder finish.

Emitters have a row of synchronized, modulated, infrared (invisible) light-emitting diodes (LEDs).

Receivers have a corresponding row of synchronized photo detectors. The area of the Light Screen created by the Emitter and Receiver is called the defined area; its width and height being determined by the length of the sensor pair and the distance between them. The maximum range is dependent on the resolution, which decreases if corner mirrors are used. Emitter and Receiver pairs with 30 mm resolution have a maximum range of 15 m.

Receivers are available in **Trip** or **Latch** versions.

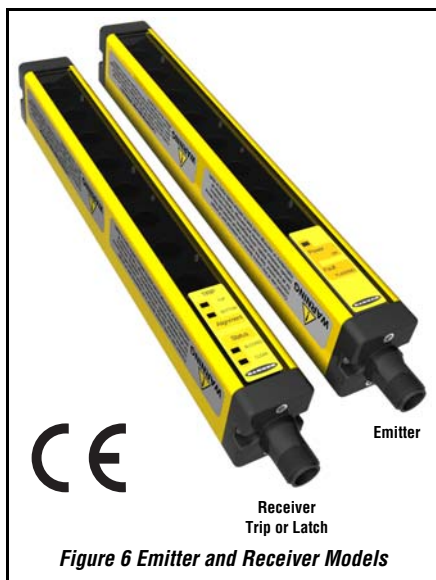


Figure 6 Emitter and Receiver Models

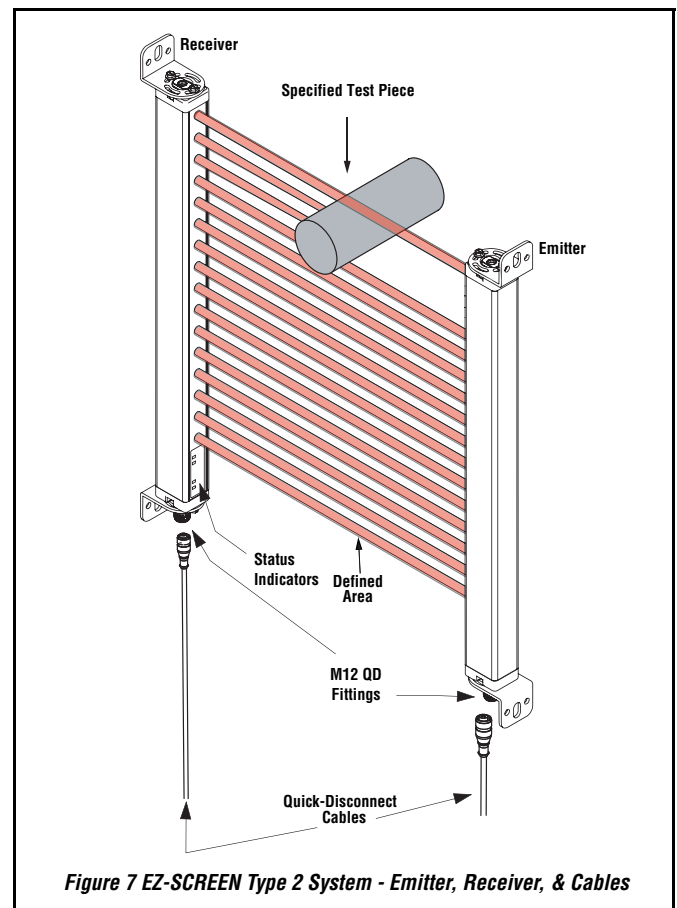


Figure 7 EZ-SCREEN Type 2 System - Emitter, Receiver, & Cables

2.4.2 Operating Features

The EZ-SCREEN Type 2 System described in this manual features several standard selectable functions:

- Trip Output (auto Reset and Test for Trip version Receivers only)
- Latch Output (manual Start/Restart for Latch version Receivers only)
- 30 mm resolution and operating distance up to 15 m

2.4.2.1 Trip Output

For EZ-SCREEN Type 2 System(s) with Trip type Receivers, the OSSD outputs turn ON after power is applied, and the Receiver passes its internal self-test/synchronization and recognizes that all beams are Clear. The Trip Output automatically resets to unblock beam(s). For timing diagram see Figure 33 on Page 63.

2.4.2.2 Latch Output

For EZ-SCREEN Type 2 System(s) with Latch type Receivers, the system requires a manual Reset for the OSSD outputs to turn ON, after power is applied and all beam(s) are clear (see Block 5.2 on Page 36).

A manual Reset is required to clear a Power-Up Lockout or Latch condition after clearing the defined area. This function is designed to provide a Monitored Manual Reset (that is, closed-open-closed action).

2.4.2.3 Lockout Conditions

A Lockout condition causes the system OSSD outputs to turn OFF.

Internal Lockout conditions require a manual Reset routine to return the system to normal operating after the failure has been corrected and the input has been correctly cycled. A description of possible lockouts, their causes, and troubleshooting hints are listed in [Block 6.2.1.2 on Page 46](#).

2.4.2.4 Remote Test Input



WARNING!

TEST FUNCTION

A MACHINE OR AUTOMATIC TEST (OR CHECK) OF THE EZ-SCREEN TYPE 2 SYSTEM AND ITS INTERFACE MAYBE REQUIRED AS DETERMINED BY RISK ASSESSMENT AND APPROPRIATE STANDARD (E.G. EN 954-1. FAILURE TO TEST OR CHECK THE SAFEGUARDING FUNCTION AT APPROPRIATE INTERVALS CAN LEAD TO THE LOSS OF THE SAFETY FUNCTION.

A Test function is incorporated into the Reset Input of the Receiver. See [Block 1.13.3 on Page 9](#) and [Figure 30 on Page 60](#).

2.4.2.5 Emitter/Receiver QD & Connection Options

Electrical connections are made through M12 quick-disconnects.

The Emitter has an 8-pin connector which is used as follows:

- Power Supply Pin 1
- Ground/PE Pin 7
- Common Pin 6

☛ *Pins 2, 3, 4, 5 & 8 not normally connected.*

See [Figure 29 on Page 59](#) for wiring information.

The Receiver also has an 8-pin connector which is used as follows:

- Power Supply Pin 1
- Ground/PE Pin 7
- Common Pin 6
- OSSD 1 Pin 5
- OSSD 2 Pin 4
- Test/Reset Input Facility Pin 8

☛ *Pins 2 and 3, not normally connected.*

See [Figure 30 on Page 60](#) for wiring information.

EZ-SCREEN Emitter/Receivers with 8-pin connectors can be connected to their own power supply or to the Receiver cable using colour for colour connection. The colour for colour connection allows the user to interchange Emitter and Receiver positions without rewiring (See [Figure 32 on Page 62](#) for further information).

3 GENERAL INFORMATION

This Chapter details information of a general nature on the equipment.

3.1 PRODUCT

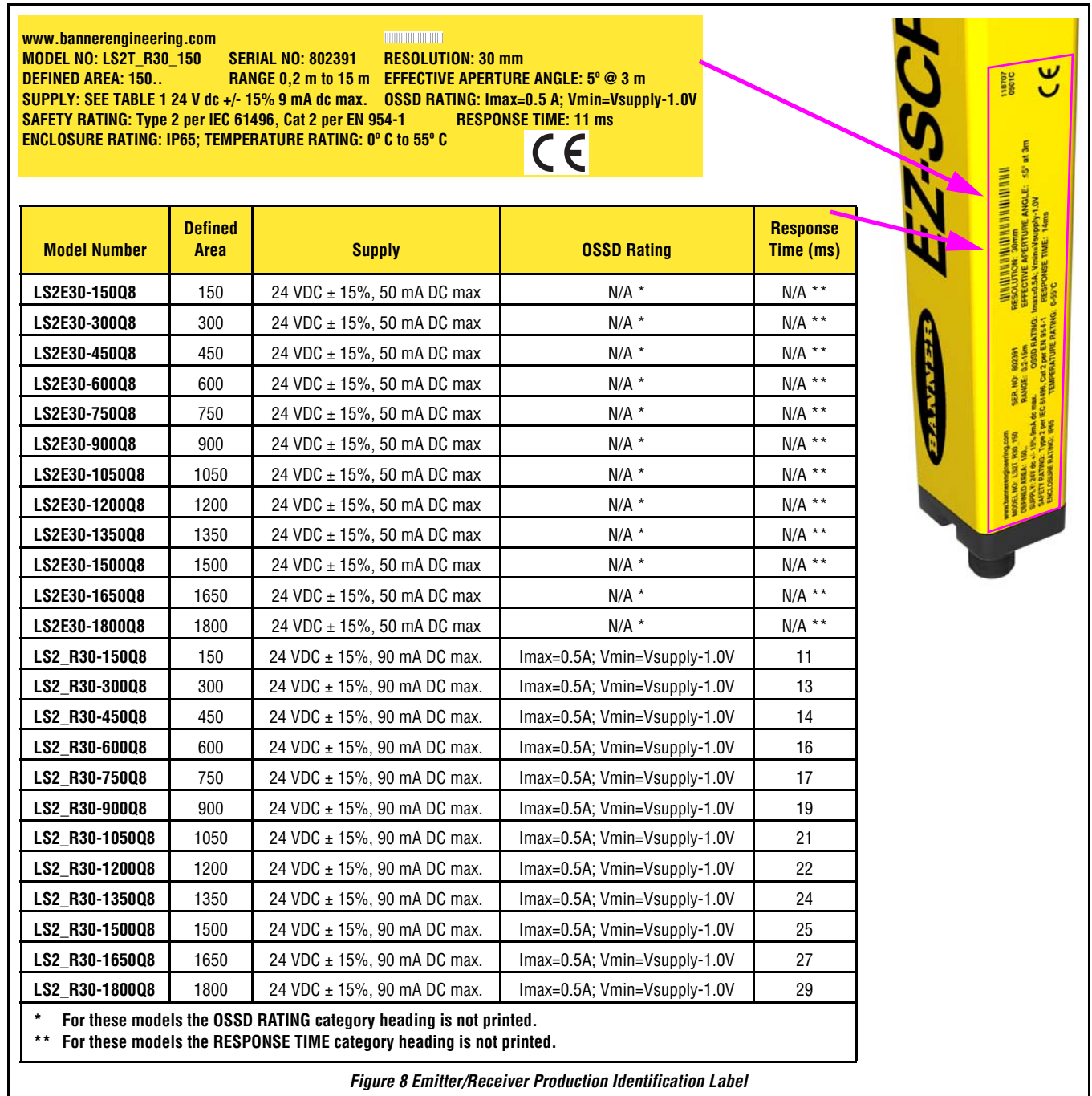
This block details product information such as CE and Product Identification Label together with their location.

3.1.1 CE Marking

The CE information is combined with Product Identification information as shown in [Figure 8 on Page 15](#).

3.1.2 Product Identification Label

This label is located on the Emitter and Receiver as shown in [Figure 8 on Page 15](#) and is personalised with the information applicable to a specific model as listed in the table below.



3.1.3 Certificate of Adequacy

The EZ-SCREEN Type 2 System Instruction Manual (119240 dated 29-11-2006) satisfies the requirements of Machine Directive 98/37/EC (2000), Safety of Machinery, Section 1.7.4 - Instructions.

3.1.4 Declaration of Conformity

The EZ-SCREEN Type 2 System is delivered with a Declaration of Conformity as shown in Figure 9 on Page 16. This declaration is delivered to the Customer to certify that the product complies with the CE-Norm.

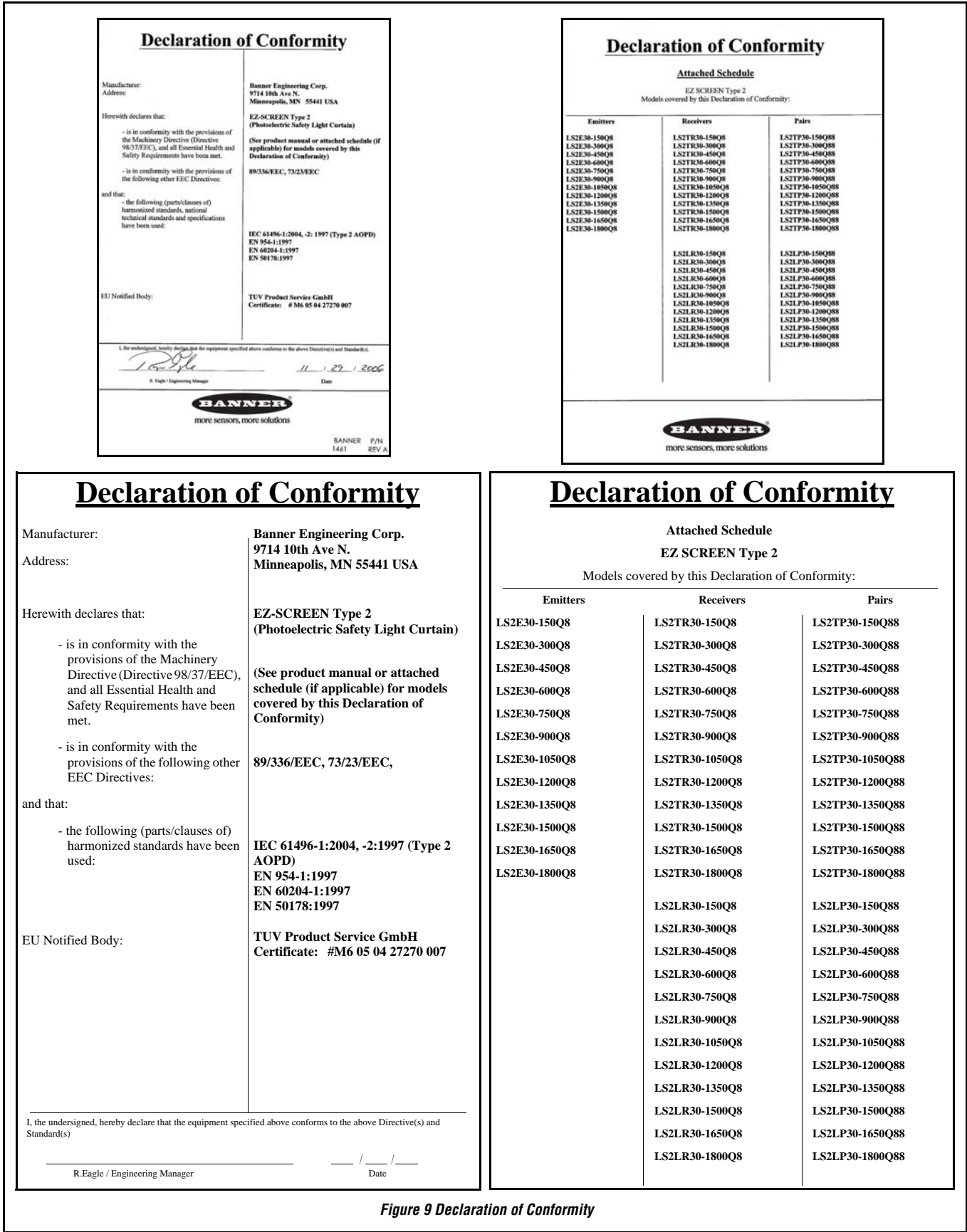


Figure 9 Declaration of Conformity


3.2 TECHNICAL DATA

This block details the most important technical data for the product.

3.2.1 Specifications

Table 2 on Page 17 lists the specifications for the EZ-SCREEN Type 2 System.

Table 2 EZ-SCREEN Type 2 System Specifications

Nomenclature	Value/Meaning												
Sensor Available Types	Emitter - Standard Receiver - Trip Receiver - Latch												
Supply Voltage (Vin)*	24 VDC ±20%, (PELV) Emitter: 50 mA max. Receiver: 90 mA max.												
Short Circuit Protection	1,4 A @ 55° C max. 1,2 A @ 0° C min.												
Response Time	Dependent on number of sensing beams (see Table 3 on Page 18 for models and number of beams): <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">8 beams – 11 ms</td> <td style="width: 33%;">40 beams – 17 ms</td> <td style="width: 33%;">72 beams – 24 ms</td> </tr> <tr> <td>16 beams – 13 ms</td> <td>48 beams – 19 ms</td> <td>80 beams – 25 ms</td> </tr> <tr> <td>24 beams – 14 ms</td> <td>56 beams – 21 ms</td> <td>88 beams – 27 ms</td> </tr> <tr> <td>32 beams – 16 ms</td> <td>64 beams – 22 ms</td> <td>96 beams – 29 ms</td> </tr> </table>	8 beams – 11 ms	40 beams – 17 ms	72 beams – 24 ms	16 beams – 13 ms	48 beams – 19 ms	80 beams – 25 ms	24 beams – 14 ms	56 beams – 21 ms	88 beams – 27 ms	32 beams – 16 ms	64 beams – 22 ms	96 beams – 29 ms
8 beams – 11 ms	40 beams – 17 ms	72 beams – 24 ms											
16 beams – 13 ms	48 beams – 19 ms	80 beams – 25 ms											
24 beams – 14 ms	56 beams – 21 ms	88 beams – 27 ms											
32 beams – 16 ms	64 beams – 22 ms	96 beams – 29 ms											
Safety Rating	Type 2 per IEC 61496-1, IEC 61496-2; Category 2 as per EN 954-1												
Reset Input Remote Test Input	Connect to +24 VDC via a N.C. Reset Switch Automatic Start Version** TEST/RESET Manual Start Version** TEST/START/RESET ** Model dependant												
Outputs (see Warning on Page 33, Warning on Page 33 and Warning on Page 33)	Two solid-state 24 VDC, 0.5 A max. sourcing OSSD (Output Signal Switching Device) outputs. Not compatible with Banner Safety Handshake. ON-State voltage: >Vin-1,5 VDC OSSD test pulse width: 0,25 ms OFF-State voltage: 0,2 VDC max. OSSD test pulse period: 500 ms Min. load resistance: 48 Ω Max. load capacitance: 100 nF												
Emitter/Receiver Operating Range	0,2 m to 15 m Range decreases with use of mirrors and/or lens shields: <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Lens shields</td> <td style="width: 50%;">Approximately 10% less range per shield.</td> </tr> <tr> <td>Glass-surface mirrors</td> <td>Approximately 8% less range per mirror.</td> </tr> </table> See specific mirror data sheet or Banner Safety Catalogue for further information.	Lens shields	Approximately 10% less range per shield.	Glass-surface mirrors	Approximately 8% less range per mirror.								
Lens shields	Approximately 10% less range per shield.												
Glass-surface mirrors	Approximately 8% less range per mirror.												
Ambient Light Immunity	> 10,000 lux at 5° angle of incidence												
Strobe Light Immunity	Immune as per IEC 61496-2												
Emitter Element	Infrared LED, 950 nm at peak emission												
Effective Aperture Angle (EAA)	Meets Type 2 requirements per IEC 61496-2 ± 5° @ 3 m												
*The external voltage supply must be capable of buffering brief mains interruptions of 20 ms, as specified in IEC/EN 60204-1.													
Enclosure	Size: See Figure 10 on Page 20 Materials: Extruded aluminium housings with yellow polyester powder finish and well-sealed; rugged die-cast zinc end caps and acrylic lens cover Rating: Body - IEC IP65 Connector - IEC IP67												
Operating Conditions	Temperature: 0° C to +55° C Max. Relative Humidity: 95% maximum relative humidity (non-condensing)												
Shock and Vibration	EZ-SCREEN Type 2 System has passed vibration and shock tests according to IEC 61496-1. This includes vibration (10 cycles) of 10 Hz to 55 Hz at 0,35 mm single amplitude (0,70 mm peak-to-peak) and shock of 10 g for 16 ms (6,000 cycles).												
Status Indicators	See Block 5.1.1 on Page 35 and Block 5.1.2 on Page 35.												
Mounting Hardware	Emitter and Receiver each are supplied with a pair of swivel end mounting brackets. Models 600 mm to 900 mm include one swivel centre-mount bracket. Models 1050 mm to 1800 mm include one swivel centre-mount bracket. Mounting brackets are 2,3 mm thickness cold-rolled steel, black zinc finish.												
Cables and Connections	See Table 11 on Page 52 for recommended QD cables. If other cables are used with this system, the user must verify suitability of these cables for each application.												
Certifications													

3.2.2 Model Type Numbering

An EZ-SCREEN Type 2 System comprises the following:

- Emitter
- Receiver (Trip or Latch version)

- Two M12 cables, 8 pin standard for Emitter and Receiver
- Mounting hardware
- *Emitters and Receivers may be ordered separately or in pairs.*

Table 3 Emitter/Receiver Pairs

30 mm Resolution Models - Range 0,2 m to 15 m					
	Model No.	Part No.	Defined Area Height (mm)	No. of Beams	Response Time (ms)
Emitter	LS2E30-150Q8	30 735 24	150	8	n/a
	LS2E30-300Q8	30 735 25	300	16	
	LS2E30-450Q8	30 735 26	450	24	
	LS2E30-600Q8	30 735 27	600	32	
	LS2E30-750Q8	30 735 28	750	40	
	LS2E30-900Q8	30 735 29	900	48	
	LS2E30-1050Q8	30 735 30	1050	56	
	LS2E30-1200Q8	30 735 31	1200	64	
	LS2E30-1350Q8	30 735 32	1350	72	
	LS2E30-1500Q8	30 735 33	1500	80	
	LS2E30-1650Q8	30 772 48	1650	88	
	LS2E30-1800Q8	30 772 49	1650	96	
Receiver - Trip Version	LS2TR30-150Q8	30 735 34	150	8	11
	LS2TR30-300Q8	30 735 35	300	16	13
	LS2TR30-450Q8	30 735 36	450	24	14
	LS2TR30-600Q8	30 735 37	600	32	16
	LS2TR30-750Q8	30 735 38	750	40	17
	LS2TR30-900Q8	30 735 39	900	48	19
	LS2TR30-1050Q8	30 735 40	1050	56	21
	LS2TR30-1200Q8	30 735 41	1200	64	22
	LS2TR30-1350Q8	30 735 42	1350	72	24
	LS2TR30-1500Q8	30 735 43	1500	80	25
	LS2TR30-1650Q8	30 772 50	1650	88	27
	LS2TR30-1800Q8	30 772 51	1800	96	29

Table 3 Emitter/Receiver Pairs

30 mm Resolution Models - Range 0,2 m to 15 m					
	Model No.	Part No.	Defined Area Height (mm)	No. of Beams	Response Time (ms)
Receiver - Latch Version	LS2LR30-150Q8	30 735 54	150	8	11
	LS2LR30-300Q8	30 735 55	300	16	13
	LS2LR30-450Q8	30 735 56	450	24	14
	LS2LR30-600Q8	30 735 57	600	32	16
	LS2LR30-750Q8	30 735 58	750	40	17
	LS2LR30-900Q8	30 735 59	900	48	19
	LS2LR30-1050Q8	30 735 60	1050	56	21
	LS2LR30-1200Q8	30 735 61	1200	64	22
	LS2LR30-1350Q8	30 735 62	1350	72	24
	LS2LR30-1500Q8	30 735 63	1500	80	25
	LS2LR30-1650Q8	30 772 52	1650	88	27
	LS2LR30-1800Q8	30 772 53	1800	96	29
	Emitter/Receiver Pairs - Latch Version	LS2LP30-150Q88	30 735 64	150	8
LS2LP30-300Q88		30 735 65	300	16	13
LS2LP30-450Q88		30 735 66	450	24	14
LS2LP30-600Q88		30 735 67	600	32	16
LS2LP30-750Q88		30 735 68	750	40	17
LS2LP30-900Q88		30 735 69	900	48	19
LS2LP30-1050Q88		30 735 70	1050	56	21
LS2LP30-1200Q88		30 735 71	1200	64	22
LS2LP30-1350Q88		30 735 72	1350	72	24
LS2LP30-1500Q88		30 735 73	1500	80	25
LS2LP30-1650Q88		30 772 56	1650	88	27
LS2LP30-1800Q88		30 772 57	1800	96	29

Table 3 Emitter/Receiver Pairs

30 mm Resolution Models - Range 0,2 m to 15 m					
	Model No.	Part No.	Defined Area Height (mm)	No. of Beams	Response Time (ms)
Emitter/Receiver Pairs - Trip Version	LS2TP30-150Q88	30 735 44	150	8	11
	LS2TP30-300Q88	30 735 45	300	16	13
	LS2TP30-450Q88	30 735 46	450	24	14
	LS2TP30-600Q88	30 735 47	600	32	16
	LS2TP30-750Q88	30 735 48	750	40	17
	LS2TP30-900Q88	30 735 49	900	48	19
	LS2TP30-1050Q88	30 735 50	1050	56	21
	LS2TP30-1200Q88	30 735 51	1200	64	22
	LS2TP30-1350Q88	30 735 52	1350	72	24
	LS2TP30-1500Q88	30 735 53	1500	80	25
	LS2TP30-1650Q88	30 772 54	1650	88	27
	LS2TP30-1800Q88	30 772 55	1800	96	29

3.2.3 EZ-SCREEN Type 2 System Dimensions

Refer to [Figure 10 on Page 20](#).

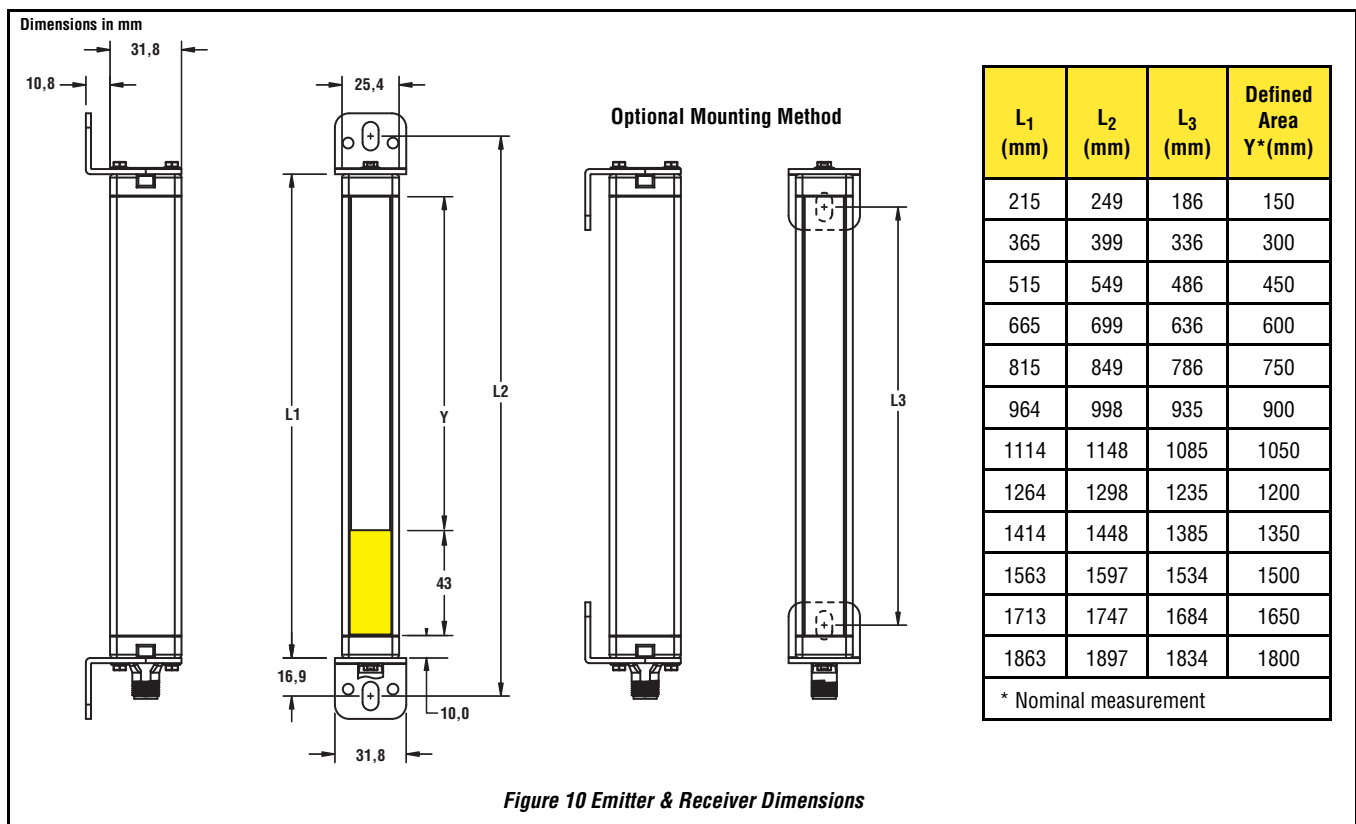


Figure 10 Emitter & Receiver Dimensions

3.3 CUSTOMER SERVICE INFORMATION

For Customer service information refer to [Banner Customer Information as listed on page 69](#).

4 INSTALLATION INFORMATION

! WARNINGS!

BEFORE INSTALLING THE EQUIPMENT

READ THE [Safety Information](#) in chapter 1 on page 1.

READ THIS CHAPTER CAREFULLY BEFORE INSTALLING THE SYSTEM

THE USER IS RESPONSIBLE FOR SATISFYING ALL LOCAL, STATE, AND NATIONAL LAWS, RULES, CODES, OR REGULATIONS RELATING TO THE INSTALLATION AND USE OF THIS CONTROL SYSTEM IN ANY PARTICULAR APPLICATION. EXTREME CARE SHOULD BE TAKEN TO MEET ALL LEGAL REQUIREMENTS AND FOLLOW ALL TECHNICAL INSTALLATION AND MAINTENANCE INSTRUCTIONS CONTAINED IN THIS MANUAL. THE USER HAS THE SOLE RESPONSIBILITY TO ENSURE THAT THE BANNER EZ-SCREEN TYPE 2 SYSTEM(S) IS INSTALLED AND INTERFACED TO THE GUARDED MACHINE BY QUALIFIED PERSONS IN ACCORDANCE WITH THIS MANUAL AND APPLICABLE SAFETY REGULATIONS. READ ALL OF CHAPTER 4 OF THIS MANUAL CAREFULLY BEFORE INSTALLING THE SYSTEM. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

4.1 INSTALLATION CONSIDERATIONS

! WARNING!

POSITION COMPONENTS CAREFULLY

THE EMITTER AND RECEIVER MUST BE POSITIONED SUCH THAT THE HAZARD CAN NOT BE ACCESSED BY REACHING OVER, UNDER, AROUND OR THROUGH THE SENSING FIELD. ADDITIONAL GUARDING MAY BE REQUIRED; SEE MINIMUM SAFETY DISTANCE, [Block 1.8 on Page 3](#), AND PASS-THROUGH HAZARDS, [Block 1.8.3 on Page 5](#), AND SUPPLEMENTARY GUARDING, [Block 1.10 on Page 6](#).

The factors having the greatest influence on the installation of the EZ-SCREEN Type 2 System are as follows:

- The required Minimum Safety Distance
- The presence of supplementary guarding

Other considerations include:

- Emitter/Receiver orientation
- Adjacent reflective surfaces
- Use of corner mirrors
- Electrical and optical noise
- Multi-system applications

4.1.1 Minimum Safety Distance

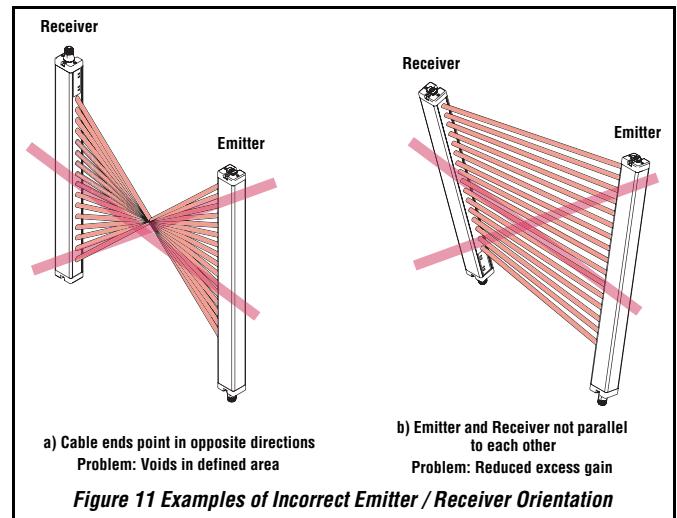
Refer to [Block 1.8 on Page 3](#).

4.1.2 Supplementary Guarding

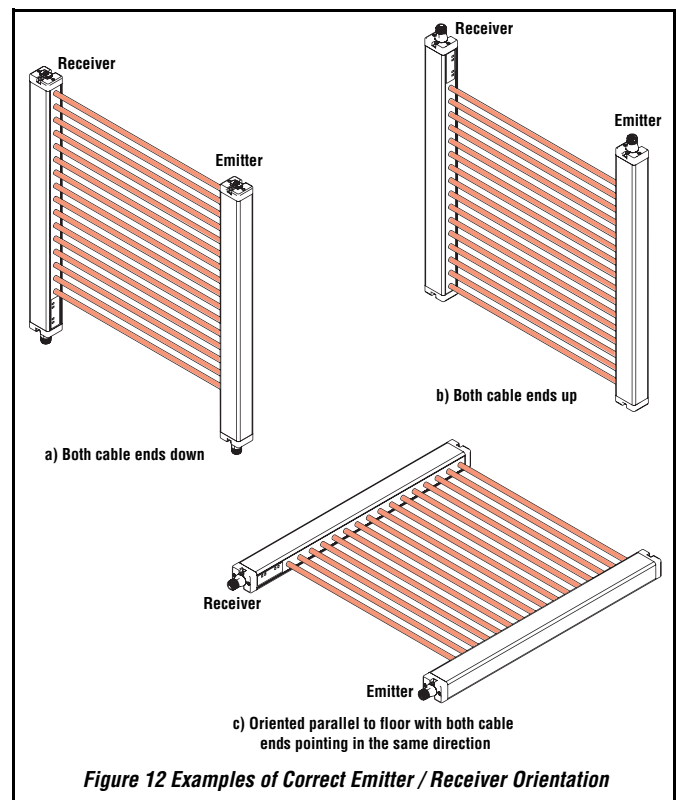
Refer to [Block 1.10 on Page 6](#).

4.1.3 Emitter & Receiver Orientation

The Emitter and Receiver must be mounted parallel to each other and aligned in a common plane with both cable ends pointing in the same direction. The Emitter should never be mounted with its cable end oriented opposite the cable end of the Receiver ([Figure 11 on Page 21](#) refers). If this occurs, voids in the Light Screen may allow objects or personnel to pass through the defined area undetected.



The Emitter and Receiver may be oriented in a vertical or horizontal plane, or at any angle between horizontal and vertical, as long as they are parallel and their cable ends point in the same direction ([Figure 12 on Page 21](#) refers). It should be verified that the Light Screen completely covers all access to the hazard point that is not already protected by fixed guarding or other supplementary guarding.



4.1.4 Adjacent Reflective Surfaces

Refer to [Block 1.9 on Page 5](#).

4.1.5 Use of Corner Mirrors

! WARNING!

AVOID RETROREFLECTIVE INSTALLATION

DO NOT INSTALL EMITTERS AND RECEIVERS IN RETRO-REFLECTIVE MODE, WITH LESS THAN A 45° ANGLE OF INCIDENCE, AS SHOWN IN [Figure 11 on Page 21](#). SENSING COULD BE UNRELIABLE IN THIS CONFIGURATION; SERIOUS BODILY INJURY OR DEATH COULD RESULT.

EZ-SCREEN Type 2 System may be used with one or more corner mirrors (see [Block 6.3.2.6 on Page 55](#) and [Block 6.3.2.7 on Page 56](#)). The use of glass-surface corner mirrors reduces the maximum specified Emitter/Receiver separation by approximately 8% per mirror, as shown in [Table 4 on Page 22](#).

Table 4 SSM Series Glass Surface Mirrors - Maximum Emitter & Receiver Separation

Number of Corner Mirrors			
1	2	3	4
13,8	12,7	11,7	10,8

For further information see the specific mirror data sheet or the Banner Safety Catalogue.

☛ *Mirrors are not permitted for applications that would allow personnel undetected access into the guarded area.*

If mirrors are used, the difference between the angle of incidence from the Emitter to the mirror and from the mirror to the Receiver must be between 45° and 120° (see [Figure 13 on Page 22](#)). If placed at a sharper angle, as shown in the example, an object in the Light Screen may deflect beam(s) to the Receiver, preventing the object from being detected (that is, false proxing). Angles greater than 120° result in difficult alignment and possible optical short circuits.

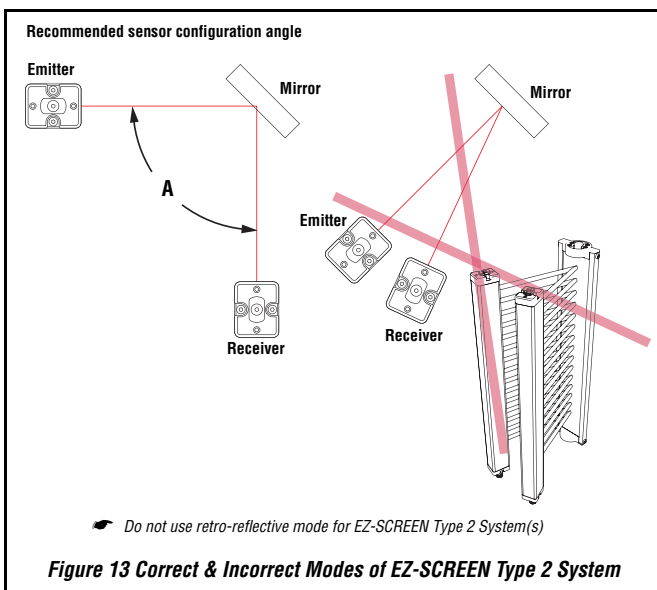


Figure 13 Correct & Incorrect Modes of EZ-SCREEN Type 2 System

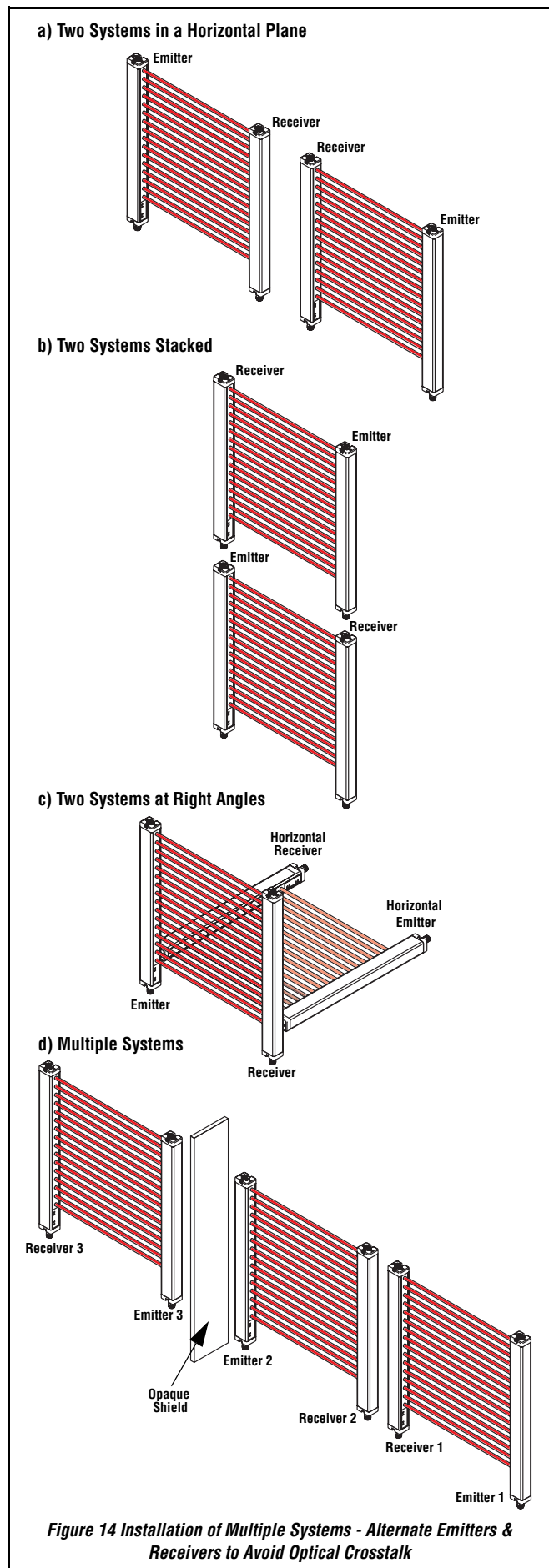
4.1.6 Multi-System Applications

! WARNING!**MULTIPLE PAIRS OF SENSORS**

DO NOT CONNECT MULTIPLE PAIRS OF SENSORS TO ONE INTERFACE MODULE (FOR EXAMPLE, IM-T-9A/-11A) OR OTHERWISE PARALLEL OSSD OUTPUTS. CONNECTION OF MULTIPLE OSSD OUTPUTS TO A SINGLE DEVICE CAN RESULT IN SERIOUS INJURY OR DEATH, AND IS PROHIBITED.

Whenever two or more EZ-SCREEN Type 2 System Emitter and Receiver pairs are adjacent to one another, optical crosstalk may potentially take place between systems. To minimize optical crosstalk, the positions of the Emitters and Receivers should be alternated (see [Figure 14 on Page 23](#)).

When three or more systems are installed in the same plane (as shown for two pairs in [Figure 14 on Page 23](#)), optical crosstalk may occur between sensor pairs whose Emitter and Receiver lenses are oriented in the same direction. In this situation, optical crosstalk can be eliminated by mounting these sensor pairs exactly in line with each other within one plane, or by adding a mechanical barrier between the pairs.



4.2 SYSTEM MOUNTING

4.2.1 GENERAL

Emitters and Receiver brackets are supplied as follows (see [Figure 15 on Page 24](#)):

Between 150 mm & 450 mm length: One pair End Brackets each.

Between 600 mm & 900 mm length: One pair End Brackets + quantity 1 Centre Bracket each.

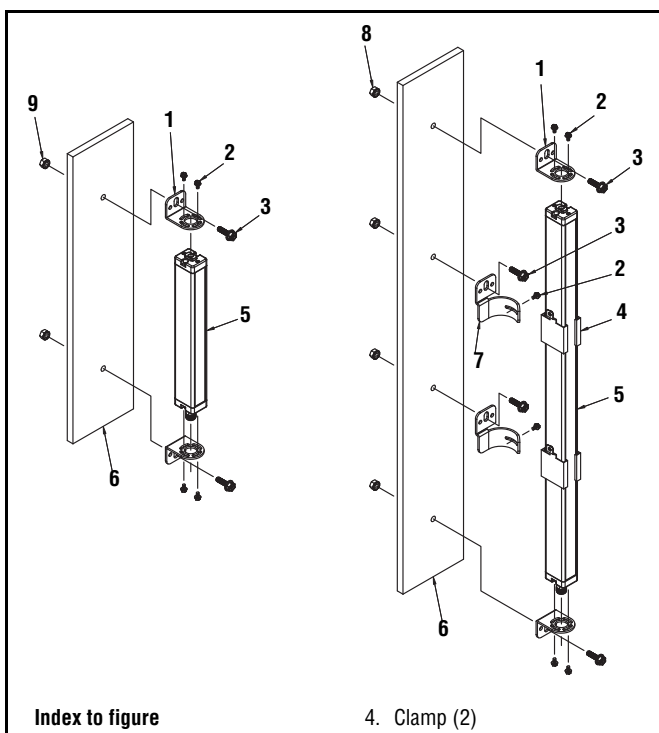
Between 1050 mm & 1800 mm length: One pair End Brackets each + two Centre Brackets each.

Emitter/Receiver pairs may be spaced from 0,2 m to 15 m apart.

The brackets (when mounted to the sensor) allow for $\pm 30^\circ$ rotation.

Centre mounting brackets must be used with longer sensors, whenever the sensors are subject to shock or vibration. In such situations, the sensors are designed to be mounted with up to 450 mm unsupported distance (between brackets).

The maximum distance between an Emitter and its Receiver is reduced if corner mirrors are used (see [Block 4.1.5 on Page 22](#)).



Index to figure

- | | |
|--|---------------------------------|
| 1. Bracket (2) | 4. Clamp (2) |
| 2. M3 x 7 mm slotted hex head with compression washer (4) (tighten to 0,9 to 1,7 Nm) | 5. Emitter/Receiver |
| 3. M6 x 19 mm Philips/slotted hex with washer head (2) | 6. Mounting surface |
| | 7. Centre mounting brackets (2) |
| | 8. M6 Keps nut (4) |
| | 9. M6 Keps nut (2) |

Figure 15 Emitter & Receiver Mounting Hardware

4.2.2 Mounting Instructions

- 1) From a common point of reference and ensuring the Minimum Safety Distance has been previously calculated as stated in [Block 1.8 on Page 3](#), take measurements to ensure Emitter and Receiver are located in same plane with their midpoints directly opposite each other.

⚡ **Important:** The connector ends of both Emitter and Receiver must point in the same direction (see [Figure 12 on Page 21](#) and [Warning on Page 6](#)).

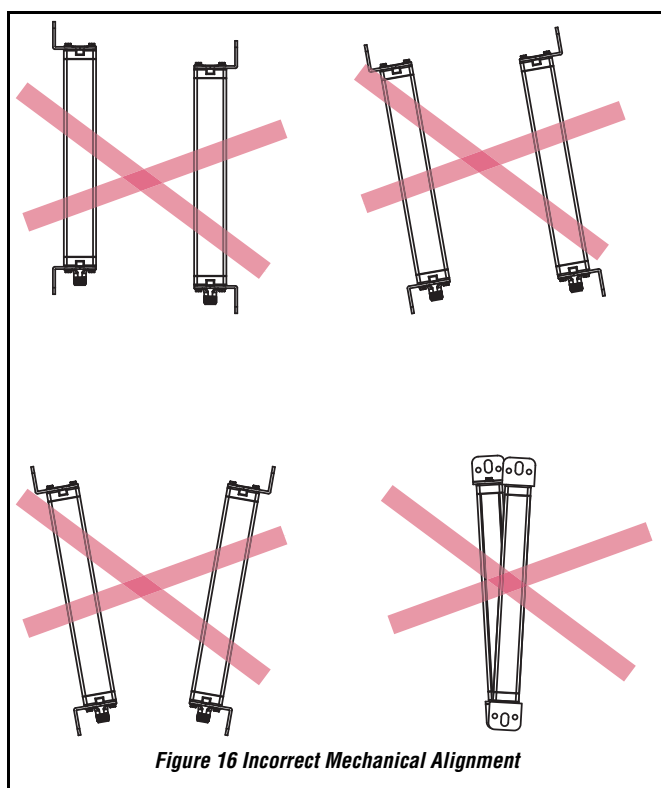
- 2) Mount Emitter and Receiver brackets (see below) using supplied M6 bolts and Kep nuts ([Figure 15 on Page 24](#) refers). Alternatively, approved user supplied hardware may be used (see [Table 10 on Page 49](#)).
- 3) Fit Emitter and Receivers in their brackets so that their lenses are directly facing each other.

Centre Mounting Brackets (one for Emitter/Receiver lengths 650 mm to 900 mm & two for 1050 mm to 1800 mm lengths)

- 4) Referring to [Figure 15 on Page 24](#), temporarily remove sensor from top and bottom Mounting Brackets.
- 5) Slide centre Clamp(s) (one or two depending on sensor length) into position centrally or equidistant as appropriate with supplied M3 screws.
- 6) Temporarily secure Centre Mounting Bracket(s) to clamps with supplied M3 screw(s).
- 7) Mark position of Centre Mounting Bracket(s) on mounting surface and remove Centre Mounting Bracket(s).
- 8) Remove sensor from top and bottom Mounting Brackets.
- 9) Secure Centre Mounting Bracket(s) to mounting surface at marked position(s).
- 10) Secure sensor to top, bottom and centre Mounting Brackets.
- 11) Repeat [Step 4](#)) thru' to [Step 10](#)) for other sensor.
- 12) Loosen all mounting screws to sensors and roughly align sensors.
- 13) Tighten top and bottom Mounting Brackets screws then M3 Screw(s) securing clamp to centre mounting bracket(s).

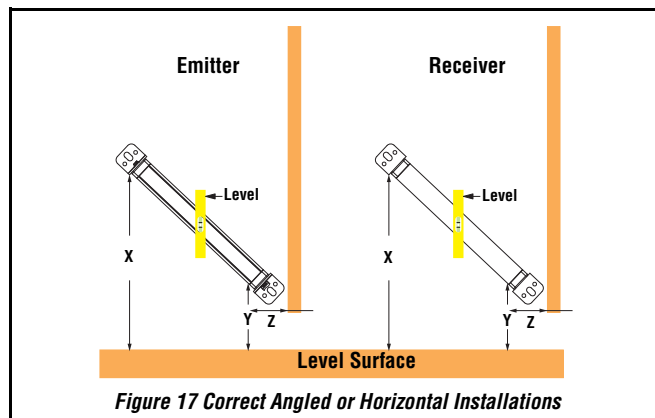
4.2.2.1 Mechanical Alignment

- 1) Measure from a reference plane (for example, a level building floor) to same point(s) on Emitter and Receiver to verify their mechanical alignment. Use a carpenter's level or a plumb bob. Alternatively, check the diagonal distances between the sensors, to achieve mechanical alignment.
- 2) Referring to [Figure 16 on Page 25](#) verify that:
 - Emitter and Receiver are directly opposite to each other
 - Nothing is interrupting the defined area
 - Defined area (marked on Emitter & Receiver) is same distance from a common reference plane for each sensor
 - Emitter and Receiver are in same plane and are level/plumb and square to each other (vertical, horizontal, or inclined at the same angle, and not tilted front-to-back or side-to-side)



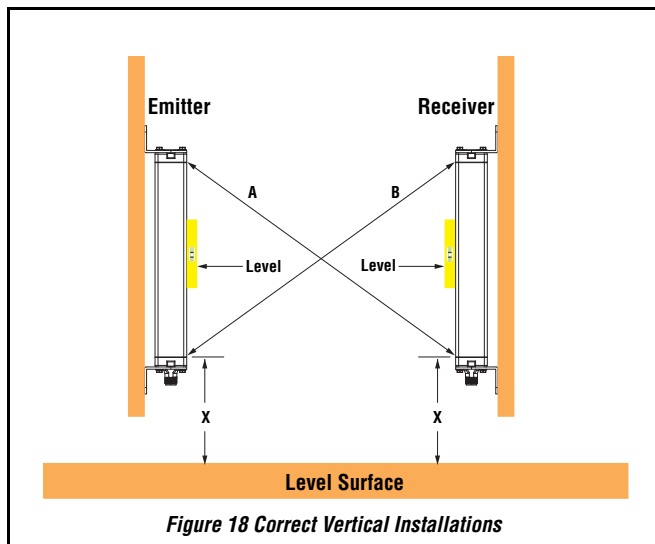
Angled or Horizontal Installations

- 3) Referring to [Figure 17 on Page 25](#) verify that:
 - Distance X,Y and Z at Emitter and Receiver are equal
 - Vertical face (that is, lens) is level/plumb
 - Defined area is square; check diagonal measurements if possible (see [Figure 18 on Page 25](#))



Vertical Installations

- 4) Referring to [Figure 18 on Page 25](#) verify that:
 - Distance X at Emitter and Receiver are equal
 - Both sensors are level/plumb (check both side and face)
 - Defined area is square. Check diagonal measurements if possible (Diagonal A = Diagonal B)



☛ Final alignment procedures are detailed in [Block 4.4 on Page 28](#).

4.2.3 Mounting Emitter & Receivers on Stands

When using Banner MSA series stands and bases to mount the EZ-SCREEN Type 2 System(s) Emitter and Receiver, proceed as follows:

- 1) Position bases at desired locations and loosely mount using bolt locations in four corners as described in MSA literature. Do **not** tighten mounting nuts at this stage, because stand and Emitter/Receiver must still be levelled.

Other stands and bases may be used to mount the EZ-SCREEN Type 2 System(s), but must allow the Emitter/Receivers to tilt (both front-to-back and side-to-side) to accommodate sloping floor surfaces and the alignment procedure.

When fixed stands and bases are used, the type USMB-1 and USCMB-1 brackets that are supplied with Light Screen may be used to provide the necessary adjustability for alignment.

☛ *Refer to the appropriate standards for specifics on the correct beam configuration and mounting of EZ-SCREEN Type 2 System(s).*

- 2) Mount Emitters and Receivers, using supplied EZ-SCREEN Type 2 System mounting brackets, so that beam closest to reference plane; that is, floor, is at correct height with respect to reference plane. Do **not** fully tighten screws until sensors are aligned.
- 3) Position Emitter and Receiver housings so that they are perpendicular to reference plane, in all dimensions, with their access covers facing each other (see [Figure 11 on Page 21](#) or [Figure 12 on Page 21](#)). If necessary use spirit level to check for plumb of reference plane.

4.2.4 Mounting Corner Mirrors



WARNING!

AVOID RETROREFLECTIVE INSTALLATION

DO NOT INSTALL EMITTERS AND RECEIVERS IN RETRO-REFLECTIVE MODE, WITH LESS THAN A 45° ANGLE OF INCIDENCE, AS SHOWN IN [Figure 11 on Page 21](#). SENSING COULD BE UNRELIABLE IN THIS CONFIGURATION; SERIOUS BODILY INJURY OR DEATH COULD RESULT.

If corner mirrors are used in the application, measure and position them as for the Emitter/Receivers. Refer to the data sheet packed with the mirrors for specific installation instructions.

- 1) Referring to [Block 4.2.3 on Page 26](#), carry out [Step 1\) on page 26](#), [Step 2\) on page 26](#), and [Step 3\) on page 26](#).
- 2) Mount mirror(s) at desired locations, parallel to Emitter and Receiver. If necessary, use a spirit level to verify plumb, if reference plane surface is level).
- 3) Measure up from reference plane to position centre of mirror's reflective surface at vertical centre of beam grid, using beam location marks on Emitter as a guide. Allow additional reflective area above top beam and below bottom beam.

- 4) Angle mirror(s) relative to Emitter/Receiver, so that one Emitter/Receiver's front surface can be seen in first mirror when standing directly in front of other Emitter/Receiver, looking into mirror (see [Block 4.1.5 on Page 22](#) and [Figure 13 on Page 22](#)).

For situations where alignment is difficult, a LAT-1-LS Laser Alignment Tool can be used to assist or confirm alignment by providing a visible red dot along the sensor's optical axis (see [Block 4.4.2.4 on Page 31](#) and [Table 18 on Page 56](#)).

4.2.5 Mounting Reset Switch

See [Block 1.13.3 on Page 9](#).

4.3 INITIAL ELECTRICAL CONNECTIONS



WARNING!

PROPER ELECTRICAL CONNECTION

ELECTRICAL CONNECTION MUST BE MADE BY A **Qualified Person** as specified in Block 1.13.2 on Page 8 AND MUST COMPLY WITH NATIONAL STANDARDS. **Do NOT** CONNECT OTHER WIRING OR EQUIPMENT TO THE EZ-SCREEN TYPE 2 SYSTEM(S) OTHER THAN THOSE DESCRIBED IN THIS MANUAL. **DOING SO COULD RESULT IN SERIOUS INJURY OR DEATH.**

Lockout procedures may be required as specified in ISO 14118 Safety of Machinery - Prevention of Unexpected Start-up.

The earth/ground (green/yellow wire) must always be connected to comply with relevant electrical standards and wiring codes.

☛ **Do not operate the EZ-SCREEN Type 2 System without an earth ground connection. See Warning above.**

Electrical connections should be made strictly in the order that they are written.

Do not remove end-caps.

No internal connections are to be made.

All connections are made through the 8-pin Emitter and Receiver QD (M12 or Euro-style).

4.3.1 Routing Cables

The EZ-SCREEN Type 2 System is designed and manufactured to be highly resistant to electrical noise and to operate reliably in industrial settings. However, extreme electrical noise may cause a random Trip or Latch condition and in extreme cases, a Lockout is possible.

☛ *Emitter and Receiver wiring is low voltage, therefore routing the Emitter/Receiver wiring adjacent to power wiring, motor/servo wiring, or other high-voltage wiring may inject noise into the EZ-SCREEN Type 2 System. It is good wiring practice (and may be compulsory for certain wiring codes of practise) to isolate Emitter and Receiver cables from high-voltage wiring. Routing cables close to noisy wiring should also be avoided and a good earth ground connection should also be provided.*

Emitter/Receiver Quick Disconnect (QD) cabling and any interconnect wiring should meet the following specifications:

- Wiring used should have an insulation temperature rating of at least 90°C.
- ☛ *Cable length includes power (+24 VDC) and return (0 VDC) wires at +25°C. It is intended to ensure that adequate power is available to the EZ-SCREEN Type 2 System when the supply is operating at +24 VDC - 20%.*

Connection should be made in accordance with local wiring regulations for low-voltage DC control cables and may require installation of electrical conduit. Refer to Table 5 on Page 27 and Table 11 on Page 52 for selection of Banner-supplied cables.

Table 5 Max. Cable Length Versus Total Current Draw - Including both OSSD Loads

Cable Size (mm ²)	Current Draw (A)					
	0,5	0,75	1,0	1,25	1,5	1,75
0,823	114,3 m	76,2 m	57,3 m	45,1 m	38,1 m	33,2 m
0,518	73 m	48,8 m	36,6 m	29 m	24,4 m	21,3 m
0,326 *	45,7 m	30,5 m	22,9 m	18 m	15,2 m	13,4 m

* For type QDE-...D cables, see Table 11 on Page 52.

Connect as follows:

- 1) Connect 8-pin Emitter and 8-pin Receiver QD connectors.
- 2) Route cables to junction box, electrical panel, or other enclosure in which redundant mechanically linked interposing relays, FSDs, or other parts of control system are located.

4.3.2 Cables

Emitter and Receiver Quick Disconnect cables are available in various lengths (see Table 11 on Page 52, Table 12 on Page 52 and Table 13 on Page 53 for Identification).

4.3.2.1 Emitter Connection

EZ-SCREEN Type 2 System Emitters have an 8-pin cable but only three wires are used as follows:

Pin 1 Brown +24 VDC

Pin 6 Blue 0 VDC

Pin 7 Green/Yellow GND

The remaining wires may be used for an optional (colour for colour) parallel connection to the Receiver cable which provides for sensor interchangeability thus allowing installation of either sensor at either QD connection. This is also advantageous for troubleshooting.

Connect EZ-SCREEN Type 2 System Emitters as follows:

- 1) Referring to Figure 29 on Page 59, connect as locally required.

4.3.2.2 Receiver Output Connection

EZ-SCREEN Type 2 System Receivers have an 8-pin cable but only six wires are used:

Pin 1	Brown	+24 VDC
Pin 6	Blue	0 VDC
Pin 7	Green/Yellow	GND
Pin 5	Black	OSSD 1
Pin 4	White	OSSD 2
Pin 8	Violet	Test/Reset (Trip systems) Test/Start/Restart/Reset (Latch systems)

The remaining wires, Pins 2 and 3, may be used for optional (colour for colour) parallel connection to the Emitter cable which provides for sensor interchangeability thus allowing installation of either sensor at either QD connection. This is also advantageous for troubleshooting.

☛ **Do not connect wiring to the machine control circuits (i.e. OSSD outputs) at this stage.**

- 1) Jumper unterminated orange and orange/black wires together (**do not connect to machine at this time**). Prevent wires from shorting to ground or to other sources of energy (for example, by jumpering with an insulated terminal block).
- 2) Referring to [Figure 30 on Page 60](#) or [Figure 31 on Page 61](#) connect unterminated power and earth/ground connections of Receiver cables.

☛ *For Trip version Receivers, connection of pin 8 to a Reset Switch is only necessary if error detection is required on Start-Up.*

- 3) Connect external Reset Switch to Reset wire (colour violet) on Receiver cable and to 24 VDC (see [Figure 30 on Page 60](#) or [Figure 31 on Page 61](#)) (see [Warning on Page 9](#) on the physical location of the external Reset Switch).

4.4 INITIAL CHECKOUT

The Initial Check-out procedure must be performed by a [Qualified Person as specified in Block 1.13.2 on Page 8](#). It must be performed only after connecting the Emitter and Receiver and after the system has been connected as detailed in [Block 4.3 on Page 27](#) and without power being available to the guarded machine.

This procedure should be carried out:

- When the system is first installed to ensure proper installation
- Whenever any maintenance or modification is performed on the system or on the machinery being guarded by the system to ensure proper system functioning (see [Block 6.1.1 on Page 39](#) for a schedule of required check-outs).

The Final Interface should not be connected to the guarded machine before the EZ-SCREEN Type 2 System has been successfully checked out. This may require performing lockout procedures as specified in ISO 14118.

4.4.1 Initial Power-Up

☛ *For information on LED indication refer to [Block 5.1 on Page 35](#).*

- 1) **Inspect area near EZ-SCREEN Type 2 System for reflective surfaces**, including work pieces and guarded machine.

Reflective surfaces may cause light beams to reflect around a person in the Light Screen, preventing person from being detected and not stopping machine motion ([Block 4.1.4 on Page 22](#) refers).

- 2) **Verify that power is removed from EZ-SCREEN Type 2 System and from guarded machine and that OSSD outputs are not connected.**

- 3) Verify all obstructions have been removed from area of Light Screen.

- 4) Apply power only to EZ-SCREEN Type 2 System at this stage.

Check:

- Emitter Power ON LED is steady green ●. If not, refer to [Block 5.1.1 on Page 35](#)
 - Receiver Status CLEAR LED is steady green ●. For systems with Latch output Receivers, first perform a Reset as detailed in [Block 5.2.2.2 on Page 36](#), then check Receiver Status CLEAR LED goes steady green ●. If not, see [Step 5\) on page 28](#)
- 5) Observe System Receiver Alignment and Status LEDs to determine Light Screen alignment as follows:

TEST Condition - Alignment indicators OFF ○, Receiver Status BLOCKED, LED shows steady ● and Receiver Status CLEAR LED shows flashing green ●.

BLOCKED Condition – Alignment indicators OFF ○ or ON yellow ● and Receiver Status BLOCKED LED shows steady red ● (for optical alignment procedure refer to [Block 4.4.2 on Page 29](#)).

CLEAR Condition – Receiver System Status CLEAR LED steady green ● and Alignment indicators both ON yellow ● ●.

Power ON (Emitter) – LED ON steady green ●.

If a CLEAR condition cannot be achieved, determine cause before proceeding further.

Latch Condition (Receivers with Latch output only), all optical beams CLEAR – Receiver Status BLOCKED LED steady red ● and both Alignment indicators flashing ● ●.

☛ *Outputs are ON only when all beams are CLEAR and after a manual Reset (see [Block 5.2.2.2 on Page 36](#)).*

If a manual Reset causes a CLEAR condition, alignment should be optimized as detailed in [Block 4.4.2 on Page 29](#).

Proceed to [Block 4.4.2 on Page 29](#).

4.4.2 Optical Alignment

WARNING!

EXPOSURE TO HAZARD
ENSURE THAT NO INDIVIDUALS ARE EXPOSED TO ANY HAZARD IF THE EZ-SCREEN TYPE 2 SYSTEM RECEIVER TURNS ON THE OSSD OUTPUTS WHEN THE SYSTEM BECOMES ALIGNED.

WARNING!

LAT-1-LS ALIGNMENT TOOL
THE LAT-1-LS ALIGNMENT TOOL IS FITTED WITH A CLASS 2 LASER DIODE. LASER LIGHT IS EMITTED FROM THE APERTURE. AVOID EXPOSURE AND DO NOT STARE INTO THE BEAM.

The alignment between the Emitter and the Receiver is necessary to obtain the correct functioning of the Light Screen.

The alignment is correct if the optic axes of the top and bottom Emitter beams align with the optic axes of the corresponding elements of the Receiver. To facilitate the alignment procedure, two steady yellow LED indicators (TOP and BOTTOM) are located on the Receiver (refer to Block 5.1.2 on Page 35).

4.4.2.1 System Alignment for Trip Output Receivers

During normal operation, the LEDs show the alignment state as detailed in Table 6 on Page 29.

1) Verify that mechanical and electrical installation is complete (Block 4.2 on Page 24 and Block 4.3 on Page 27).

Emitter/Receiver face must be perpendicular to the optical axis.

2) Using a straight edge (for example, spirit level), check Emitter and Receiver are aligned with each other.

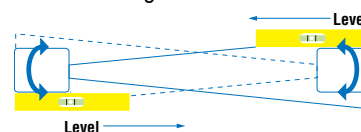


Table 6 System with Receiver Trip Output Alignment Status

Receiver Display	LED OFF/ON & Meaning for	LED OFF/ON & Meaning for BLOCKED Condition		
	ON yellow	OFF <input type="checkbox"/>	ON yellow	ON yellow
	ON yellow	OFF <input type="checkbox"/>	OFF <input type="checkbox"/>	ON yellow
	OFF <input type="checkbox"/>	ON red	ON red	ON red
	ON green	OFF <input type="checkbox"/>	OFF <input type="checkbox"/>	OFF <input type="checkbox"/>
-	Normal operating mode (no beam interruption)	- Light Screen not aligned - Top side misaligned - Top beam interrupted	- Bottom side misaligned - Bottom beam interrupted	- Light Screen aligned but slight interruption on one beam (except for top and bottom beams)

- On Emitter, verify POWER ON LED is ON steady green ●. This indicates Emitter is operating correctly.
- Verify that Light Screen guarded area is free from reflective objects.
- Verify that **one** of following conditions is present on Trip Output Receiver:

CLEAR Condition

- Status CLEAR LED is ON steady green ●
- Status BLOCKED LED is OFF ○
- Alignment TOP and Alignment BOTTOM LEDs are both ON yellow ● ●

BLOCKED Condition

- Status CLEAR LED is OFF ○
- Status BLOCKED LED is ON steady red ●
- Alignment TOP and Alignment BOTTOM LEDs are both OFF ○○

To change from BLOCKED Condition to CLEAR Condition, proceed as follows:

6) Keeping Receiver in a steady position, adjust Emitter until Alignment TOP LED goes ON yellow ●.

This condition shows the effective alignment of the TOP beam.

7) Rotate Emitter until also Alignment BOTTOM LED goes ON yellow ●.

In this condition Status CLEAR LED goes steady green ●.

☛ Ensure that Status CLEAR LED is ON steady green ● before proceeding further.

8) Fine tune Emitter and Receiver adjustment in turn as detailed in Block 4.4.2.3 on Page 31.

9) Carefully secure Emitter and Receiver mounting in position taking care not to disturb the alignment.

10) Carry out Trip Test as detailed in Block 6.1.4.1 on Page 42.

11) If EZ-SCREEN Type 2 System passes all three checks during Trip test, go on to Block 4.5 on Page 33.

☛ Once the installation has passed the Trip Test, the outputs may be connected and the commissioning Check-out may be performed (for initial installations only).

For situations where alignment is difficult, an LAT-1-LS Laser Alignment Tool can be used to assist or confirm alignment by providing a visible red dot along the sensor's optical axis (see Block 4.4.2.4 on Page 31 for instructions).

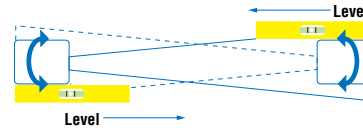
4.4.2.2 System Alignment for Latch Output Receivers

During normal operation, the LEDs show the alignment state as detailed in Table 7 on Page 30.

1) Verify that mechanical and electrical installation is complete (Block 4.2 on Page 24 and Block 4.3 on Page 27).

☛ Emitter/Receiver face must be perpendicular to optical axis.

2) Using a straight edge or spirit level, check Emitter and Receiver are aligned with each other.



3) On Emitter, verify POWER ON LED is ON steady green ●. This indicates Emitter is operating correctly.

4) Verify that Light Screen guarded area is free from reflective objects.

5) Verify that **one** of following conditions is present on Latch Output Receiver:

Waiting for Reset

- Status CLEAR LED is OFF ○
- Status BLOCKED LED is ON steady red ●
- Alignment LEDs are both flashing yellow ●✕
- Light Screen aligned and waiting for Reset

Press Reset to go to CLEAR Condition (Status CLEAR LED shows green ●, Alignment TOP and BOTTOM LEDs show OFF).

Table 7 System with Receiver Latch Output Alignment Status

Receiver Display	LED OFF/ON & Meaning for CLEAR Condition		LED OFF/ON & Meaning for BLOCKED Condition		
	LED OFF/ON & Meaning for CLEAR Condition	LED OFF/ON & Meaning for RESET Condition	LED OFF/ON & Meaning for BLOCKED Condition	LED OFF/ON & Meaning for BLOCKED Condition	LED OFF/ON & Meaning for BLOCKED Condition
<p>LATCH</p> <p>TOP ■</p> <p>BOTTOM ■</p> <p>Alignment</p> <p>Status</p> <p>BLOCKED ■</p> <p>CLEAR ■</p>	<p>ON yellow ■</p> <p>ON yellow ■</p> <p>OFF </p> <p>ON green ■</p>	<p>Flashing yellow ■ ✕</p> <p>Flashing yellow ■ ✕</p> <p>ON red ■</p> <p>OFF </p>	<p>OFF </p> <p>OFF </p> <p>ON red ■</p> <p>OFF </p>	<p>ON yellow ■</p> <p>OFF </p> <p>ON red ■</p> <p>OFF </p>	<p>ON yellow ■</p> <p>ON yellow ■</p> <p>ON red ■</p> <p>OFF </p>
	Normal operating mode (no beam interruption)	Light Screen aligned. Reset required	- Light Screen mis-aligned - TOP side misaligned - TOP beam interrupted	- BOTTOM side mis-aligned - BOTTOM interrupted	- Light Screen aligned but one or more beams interrupted except TOP and BOTTOM and lowest one

BLOCKED Condition

- Status CLEAR LED is OFF ○
- Status BLOCKED LED is ON steady red ●
- Alignment TOP and Alignment BOTTOM LEDs indicate both yellow ON ●●, TOP yellow ON only ● or both OFF ○○
- Light Screen interrupted (BLOCKED) or misaligned

To change from BLOCKED condition to Waiting for Reset Condition, proceed as follows:

- 6) Keeping Receiver in a steady position, adjust Emitter until TOP Alignment LED goes steady yellow ●.
- 7) Rotate Emitter until both Receiver Alignment LEDs begin to flash yellow ●●.

In this condition Alignment TOP LED comes ON steady ●.

- 8) Fine tune Emitter and Receiver adjustment in turn as detailed in [Block 4.4.2.3 on Page 31](#).
- 9) Carefully secure Emitter and Receiver mounting in position taking care not to disturb the alignment.

System is now ready for normal operating mode.

- 10) Carry out Trip Test as detailed in [Block 6.1.4.1 on Page 42](#).
- 11) If EZ-SCREEN Type 2 System passes all three checks during Trip test, go on to [Block 4.5 on Page 33](#).

☛ *Once the installation has passed the Trip Test, the outputs may be connected and the commissioning Check-out may be performed (for initial installations only).*

For situations where alignment is difficult, an LAT-1-LS Laser Alignment Tool can be used to assist or confirm alignment by providing a visible red dot along the sensor's optical axis (see [Block 4.4.2.4 on Page 31](#) for instructions).

4.4.2.3 Optimising Alignment to Maximize Excess Gain

- 1) Slightly loosen Emitter/Receiver mounting screws (quantity 4) and rotate one sensor left and right, noting the positions where status indicators turn steady red ● (BLOCKED condition).
 - 2) Centre the sensor between the two positions, and tighten the end cap mounting screws, making sure the positioning does not drift as the screws are tightened.
 - 3) Repeat with other sensor.
- ☛ *The sensor lenses should directly face each other.*

4.4.2.4 Using Laser Alignment Tool**WARNING!****LAT-1-LS ALIGNMENT TOOL**

THE LAT-1-LS IS FITTED WITH A CLASS 2 LASER DIODE. LASER LIGHT IS EMITTED FROM THE APERTURE AVOID EXPOSURE AND DO NOT STARE INTO THE BEAM.

The battery powered Laser Alignment Tool (LAT-1-LS) (see [Figure 19 on Page 31](#)) is used for initial Optical Alignment and is especially useful in long-range applications and also when corner mirrors are used.



Figure 19 Laser Alignment Tool (LAT-1-LS)

The useable range of the Laser Alignment Tool (LAT-1-LS) (the red dot viewed at the target) depends on the following factors:

- The colour and reflectance of target
- Level of ambient light present
- Presence of airborne contaminants.

With a 90% reflectance white test card, under average lighting and with no airborne contaminants, the red dot is viewable at approximately 45 m or more. For longer ranges, the lighting should be dimmed or retro-reflective targets should be used.

The optional clip-on retro-reflective target (LSA-LAT-1) can increase target area and visibility of red dot created by laser beam (see [Figure 20 on Page 31](#)).

☛ *The LAT-1-LS should only be used at beam 1 location to align Emitter with Receiver. Do not slide LAT-1-LS along length of either sensor. Housing twist may deflect laser beam, resulting in misalignment. Any twist in housing (a normal occurrence) is compensated for within EZ-SCREEN Type 2 System optic components.*

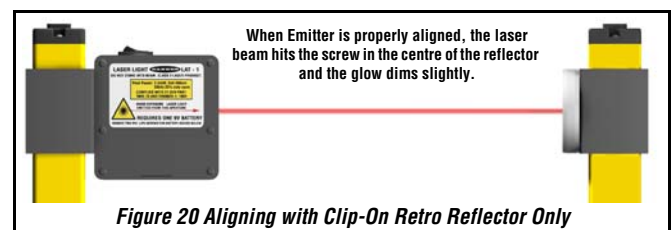


Figure 20 Aligning with Clip-On Retro Reflector Only

Perform initial Optical Alignment as follows:

- 1) Attach Laser Alignment Tool to housing of Emitter over beam location, using EZ-SCREEN Type 2 System(s) bracket clip included with tool.

To find the general direction laser beam is pointing:

- 2) Place a target at arm's reach, look alongside Laser Alignment Tool, and slowly raise target until red dot appears on it.

Using this method and rotating Emitter sends beam in approximate direction of Receiver.

- 3) If dot still cannot be located at Receiver (or mirror), walk target down path of beam, while keeping dot centred on target, until desired range is reached.
- 4) If no corner mirrors are used in application, attach or hold a piece of reflective material, such as white paper, reflective tape included with Laser Alignment Tool, or optional clip-on reflective target, to Receiver at beam location (see [Figure 21 on Page 32](#)).

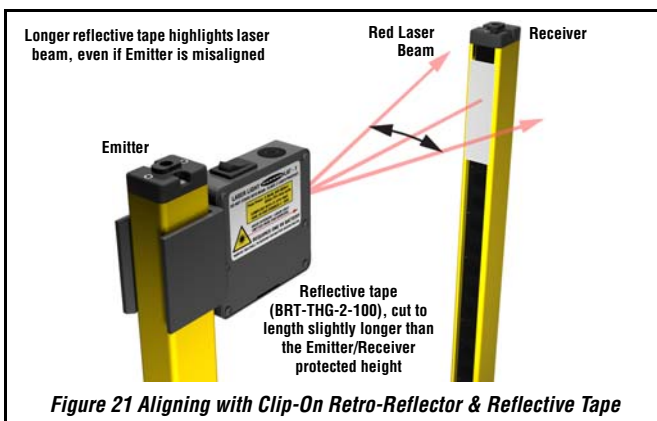


Figure 21 Aligning with Clip-On Retro-Reflector & Reflective Tape

⚠ Do not affix self-adhesive backing of reflective material to sensor windows or to mirror surfaces as adhesive residue may not be easy to remove.

- 5) If corner mirrors are used attach or hold reflective material at beam height in the approximate centre of mirror 1. Laser Alignment Tool emits a bright red pinpoint of light along same path as Beam 1 (see [Figure 22 on Page 32](#)).
- 6) Adjust Emitter tilt and rotation until Laser Alignment Tool beam is entered over Receiver (or mirror) beam location.
- 7) Partially tighten Emitter mounting hardware to prevent misalignment when Laser Alignment Tool is later removed.

If mirrors are used, proceed to [Step 8\) on page 32](#). If no mirrors are used, proceed to [Step 9\) on page 32](#).

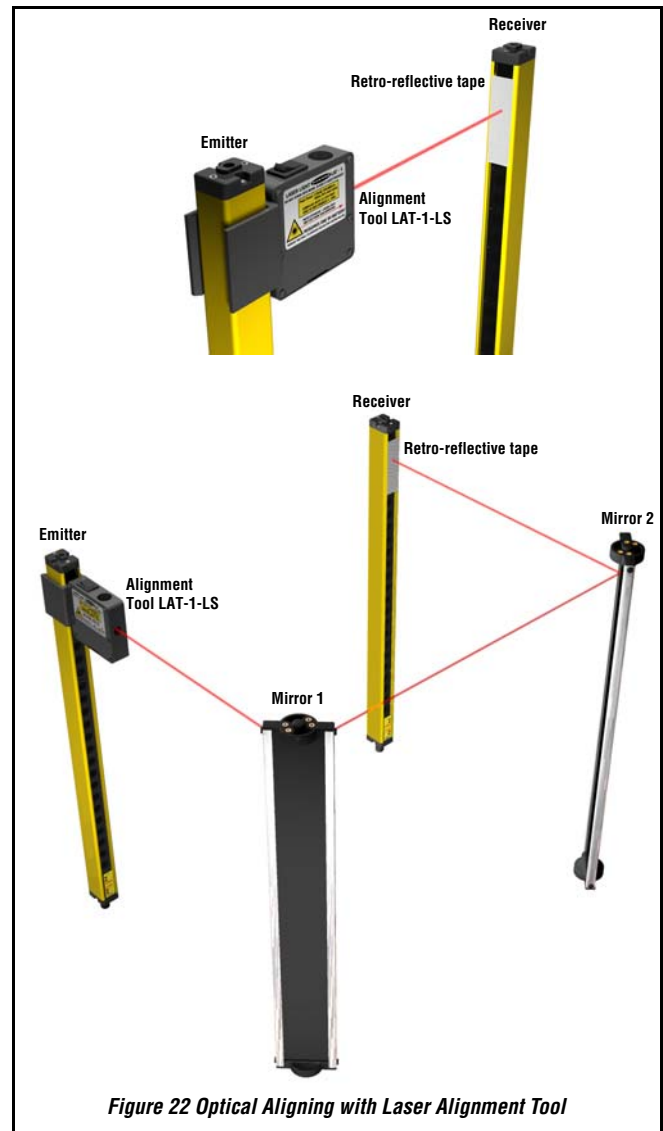


Figure 22 Optical Aligning with Laser Alignment Tool

- 8) After Emitter Beam 1 is aligned on first mirror, remove reflective material from that mirror and repeat process on second mirror. Repeat process for each mirror in succession, until laser beam shines on reflective material positioned at Receiver Beam1 location.
 - 9) Position Laser Alignment Tool on Receiver housing, entered over Beam 1 location.
 - 10) Align Receiver beam as described in [Step 6\) on page 32](#) for Emitter. (Mirrors, if used, normally should not require re-alignment.)
 - 11) Partially tighten Receiver mounting hardware to prevent misalignment when Laser Alignment Tool is removed.
 - 12) Remove Laser Alignment Tool, reflective target or tape.
 - 13) Carry out Trip Test as detailed in [Block 6.1.4.1 on Page 42](#).
 - 14) If EZ-SCREEN Type 2 System passes all three checks during Trip test, go on to [Block 4.5 on Page 33](#).
- ⚠ Once the installation has passed the Trip Test, the outputs may be connected and the commissioning Check-out may be performed (for initial installations only).

4.5 ELECTRICAL MACHINE INTERFACE CONNECTION

WARNINGS!

INTERFACING OF BOTH OUTPUT SIGNAL SWITCHING DEVICES
BOTH OF THE OSSD'S (OUTPUT SIGNAL SWITCHING DEVICE) OUTPUTS MUST BE CONNECTED TO THE MACHINE CONTROL SO THAT THE MACHINE'S CONTROL SYSTEM INTERRUPTS THE CIRCUIT TO THE MACHINE PRIMARY CONTROL ELEMENT(S), RESULTING IN A NON-HAZARDOUS CONDITION. NEVER WIRE AN INTERMEDIATE DEVICE(S) IN SUCH A MANNER THAT THE SAFETY FUNCTION CAN BE SUSPENDED, OVERRIDDEN, OR DEFEATED, UNLESS ACCOMPLISHED IN A MANNER AT THE SAME OR GREATER DEGREE OF SAFETY.

OSSD INTERFACING

TO ENSURE PROPER OPERATION, THE EZ-SCREEN TYPE 2 SYSTEM OSSD OUTPUT PARAMETERS AND MACHINE INPUT PARAMETERS MUST BE CONSIDERED WHEN INTERFACING THE EZ-SCREEN TYPE 2 SYSTEM SOLID-STATE OSSD OUTPUTS TO MACHINE INPUTS. MACHINE CONTROL CIRCUITRY MUST BE DESIGNED SO THAT THE MAXIMUM LOAD RESISTANCE VALUE IS NOT EXCEEDED AND THAT THE MAXIMUM SPECIFIED OSSD OFF-STATE VOLTAGE DOES NOT RESULT IN AN ON CONDITION. FAILURE TO PROPERLY INTERFACE THE OSSD OUTPUTS TO THE GUARDED MACHINE COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

USE OF TRANSIENT SUPPRESSORS

IF TRANSIENT SUPPRESSORS ARE USED, THEY MUST BE INSTALLED ACROSS THE COILS OF THE MACHINE CONTROL ELEMENTS.

WARNINGS!

PROPER ELECTRICAL CONNECTION

ELECTRICAL CONNECTION MUST BE MADE BY A **Qualified Person** as specified in [Block 1.13.2 on Page 8](#) AND MUST COMPLY WITH NATIONAL STANDARDS. DO NOT CONNECT OTHER WIRING OR EQUIPMENT TO THE EZ-SCREEN TYPE 2 SYSTEM(S) OTHER THAN THOSE DESCRIBED IN THIS MANUAL. DOING SO COULD RESULT IN SERIOUS INJURY OR DEATH.

SHOCK HAZARD

ELECTRICAL SHOCK HAZARD EXISTS WHEN THE EZ-SCREEN TYPE 2 SYSTEM IS CONNECTED TO THE GUARDED MACHINE. USE EXTREME CAUTION TO AVOID ELECTRICAL SHOCK AT ALL TIMES. ALWAYS DISCONNECT ALL POWER FROM THE EZ-SCREEN TYPE 2 SYSTEM AND THE GUARDED MACHINE BEFORE MAKING ANY CONNECTIONS OR REPLACING ANY COMPONENT.

Electrical connection should be carried out in strict order as described in [Block 4.5 on Page 33](#) as applicable to the specific application.

Lockout procedures may be required as specified in ISO 14118 Safety of Machinery - Prevention of Unexpected Start-up.

Electrical standards and wiring codes, such as IEC 60204-1 should always be observed. See [Warning on Page 33](#).

Supply power and the external Reset Switch should have previously been connected.

The EZ-SCREEN Type 2 System must also have been previously aligned and passed the Initial Check-out.

Final connections to be made are:

- [OSSD outputs \(Block 4.5.1 refers\)](#)
- [FSD interfacing \(Block 4.5.2 refers\)](#)
- [MPCE \(Block 4.5.3 refers\)](#)

4.5.1 OSSD Output Connection

WARNING!

OSSD 1 & OSSD 2 CONNECTION

THE OSSD 1 & OSSD 2 SHOULD BE CONNECTED AS SHOWN IN [Figure 30 on Page 60](#). THE OSSD 1 & OSSD 2 SHOULD NOT BE CONNECTED IN SERIES OR PARALLEL.

➤ *Before making OSSD output connections and interfacing EZ-SCREEN Type 2 System to machine, refer to Output Specifications in [Block 3.2.1 on Page 17](#).*

Before connecting OSSDs read [Block 1.12.1 on Page 7](#).

It should be noted that the EZ-SCREEN Type 2 System is not capable of the Banner Safety Handshake and consequently cannot be interfaced with an USSI.

Proceed as follows:

- 1) Connect OSSD (Output Signal Switching Device) outputs to machine control as shown in [Figure 30 on Page 60](#) so that machine's control system interrupts circuit or power to MPCEs (Machine Primary Control Elements), resulting in a non-hazardous condition.

4.5.2 FSD Interfacing Connection

➤ *Before connecting FSDs read [Block 1.12.2 on Page 7](#).*

Proceed as follows:

- 1) Referring to [Figure 30 on Page 60](#) connect FSD(s).

4.5.3 MPCE Connection

➤ *Before connecting MPCEs read [Block 1.12.3 on Page 8](#).*

- 1) Referring to [Figure 31 on Page 61](#) or connect to MPCE 1 and MPCE 2 as necessary.

4.6 SYSTEM OPERATION PREPARATION

Providing the initial Trip test has been successfully carried out and the OSSD outputs have been connected to the machine to be controlled, the EZ-SCREEN Type 2 System is ready for testing in combination with the guarded machine.


The operation of the EZ-SCREEN Type 2 System with the guarded machine must be verified before the combined system and machine may be put into service. To do this, a **Qualified Person as specified in [Block 1.13.2 on Page 8](#)** must perform the Commissioning Check-out Procedure described in [Block 4.7 on Page 33](#).

4.7 COMMISSIONING CHECKOUT

- 1) Carry out procedure as detailed in [Block 6.1.5 on Page 43, Step 1\) on page 43 thru' to Step 19\) on page 44](#).

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5 OPERATING INSTRUCTIONS

 **WARNING!**

BEFORE OPERATING THE EQUIPMENT
 READ [Safety Information](#) in chapter 1 on page 1.

5.1 EQUIPMENT CONTROL & INDICATION

5.1.1 Emitter

Figure 23 on Page 35

Power/Fault Indicator

A steady green  LED indicates power is applied.

A flashing green  LED indicates a fault situation.

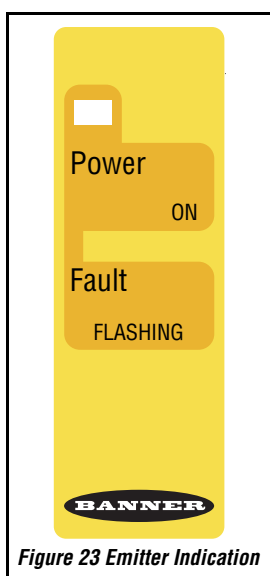


Figure 23 Emitter Indication

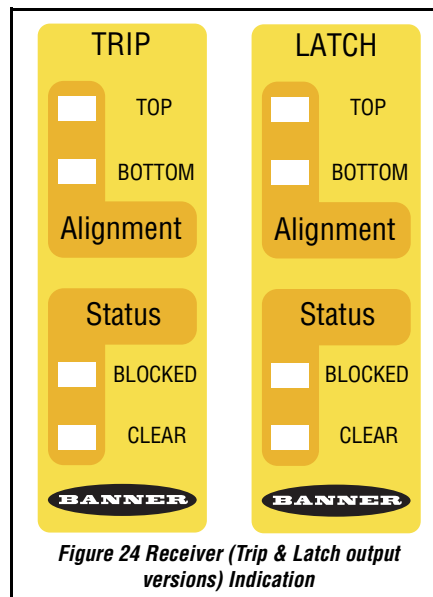


Figure 24 Receiver (Trip & Latch output versions) Indication

5.1.3 Reset Switch


See [Block 1.13.3](#) on Page 9.





5.1.2 Receiver (Trip & Latch output versions)

Figure 24 on Page 35

Alignment Indicators


Quantity 2 LED indicators for Alignment TOP and Alignment BOTTOM beam alignment.


When one or both LEDs show OFF , Emitter and Receiver are misaligned and realignment is required for TOP and/or BOTTOM beams.

When both LEDs show steady yellow ON   or are both flashing yellow (latch systems)  , alignment is correct.

Status Indicator

Quantity 2 LED indicators for Status BLOCKED steady red  and Status CLEAR steady green .

When BLOCKED LED shows steady red , this indicates that the Light Screen has been interrupted and the outputs have been automatically switched OFF.

When CLEAR LED shows steady green , this indicates system is normal with no interruptions and the outputs are ON.

5.2 NORMAL OPERATION



5.2.1 System Power-Up

WARNING!

EZ-SCREEN TYPE 2 SYSTEM MISUSE

THE EZ-SCREEN TYPE 2 SYSTEM CAN ONLY DO THE JOB FOR WHICH IT WAS DESIGNED IF IT AND THE GUARDED MACHINE ARE OPERATING PROPERLY, BOTH SEPARATELY AND TOGETHER. IT IS THE USER'S RESPONSIBILITY TO VERIFY THIS, ON A REGULAR BASIS, AS INSTRUCTED IN [Block 4.4 on Page 28](#) AND [Block 6.1.1 on Page 39](#). FAILURE TO CORRECT SUCH PROBLEMS CAN RESULT IN SERIOUS BODILY INJURY OR DEATH. BEFORE THE SYSTEM IS PUT BACK INTO SERVICE, IT MUST BE ENSURED THAT THE EZ-SCREEN TYPE 2 SYSTEM AND THE GUARDED MACHINE PERFORM EXACTLY AS OUTLINED IN THE CHECK-OUT PROCEDURES AND ANY PROBLEM(S) FOUND AND CORRECTED.

The system powers up and resets automatically.

- 1) Apply power to EZ-SCREEN Type 2 System.
 - 2) Verify that Status BLOCKED LED is OFF  and Status CLEAR LED is steady green  ON.
 - 3) For systems with Receiver Latch output, carry out Reset procedure as detailed in [Block 5.2.2.2 on Page 36](#).
- ☛ *For systems with Latch Output Receivers a Manual Reset is also required in the event of an interruption in the defined area of the Light Screen.*

5.2.2 During ON Mode (normal operation)

See [Figure 25 on Page 37](#).

5.2.2.1 Systems with Receiver Trip Output

If any beam(s) is/are blocked while system is running, Receiver outputs are disabled (OFF) within maximum system response time (see [Table 2 on Page 17](#) for details).

If any beam unblocks, Receiver outputs come ON.

No reset(s) of any kind are needed.

All necessary machine control resets are provided by machine control circuit.

For START/RESET timing refer to [Figure 35 on Page 63](#).

5.2.2.2 Systems with Receiver Latch Output

The EZ-SCREEN Type 2 System requires a manual Reset to clear a Latch condition and resume operation following an interruption (system blocked). Internal Lockout conditions also require a manual Reset to return the system to Normal mode after the failure has been corrected and the input correctly cycled.

Latch Output Receiver manual resets are required in the following situations:


- At power-up
- After each Latch condition occurs.

For START/RESTART timing refer to [Figure 35 on Page 63](#).

To perform a manual Reset:

- 1) Press Reset for at least 0,5 s minimum then release again.

5.2.3 Emitter Reset Routine

Emitter resets are needed in the event of a fault indication Power LED flashing green .

In the rare occurrence that an Emitter requires a Reset:

- 1) Power down Emitter, then power it up.

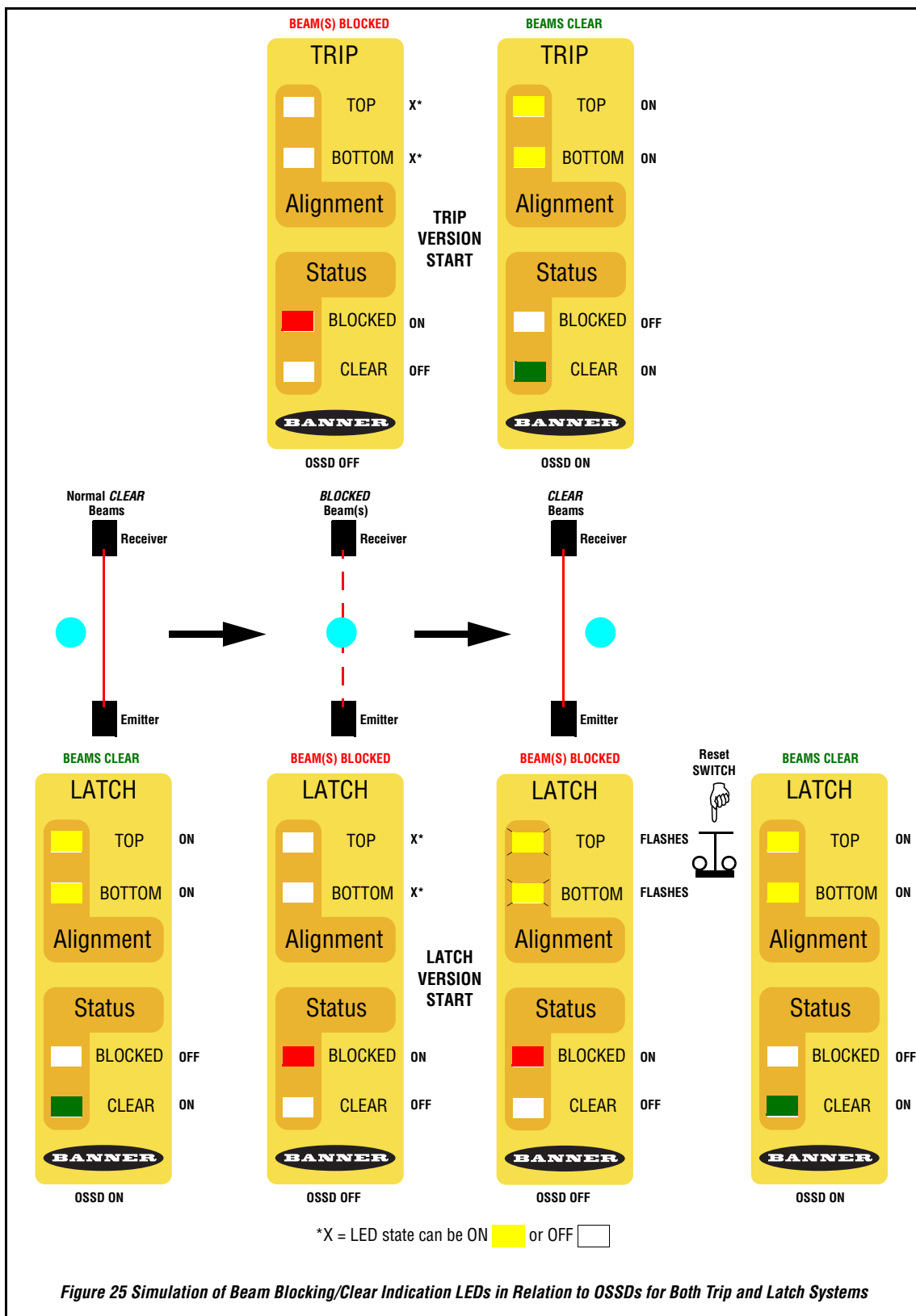
5.2.4 Lockouts (Internal Faults)

See [Block 6.2.1.2 on Page 46](#).

5.2.5 Normal Shutdown

To shutdown EZ-SCREEN Type 2 System:

- 1) Switch **OFF** power supply to guarded machine.



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6 MAINTENANCE

WARNINGS!

BEFORE CARRYING OUT MAINTENANCE ON THE EQUIPMENT
READ [Safety Information in chapter 1 on page 1](#).

SHUT DOWN MACHINERY BEFORE SERVICING

THE MACHINERY TO WHICH THE EZ-SCREEN TYPE 2 SYSTEM IS CONNECTED MUST NOT BE OPERATING AT ANY TIME DURING MAJOR SERVICE OR MAINTENANCE. THIS MAY REQUIRE LOCKOUT PROCEDURES (REFER TO EN 954-1 CATEGORY 2 FOR CONTROLLING HAZARDOUS ENERGY). SERVICING THE EZ-SCREEN TYPE 2 SYSTEM WHILE THE HAZARDOUS MACHINERY IS OPERATIONAL COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

WARNINGS!

PROPER ELECTRICAL CONNECTION

ELECTRICAL CONNECTION MUST BE MADE BY A [Qualified Person as specified in Block 1.13.2 on Page 8](#) AND MUST COMPLY WITH NATIONAL STANDARDS. Do NOT CONNECT OTHER WIRING OR EQUIPMENT TO THE EZ-SCREEN TYPE 2 SYSTEM OTHER THAN THOSE DESCRIBED IN [Block 5.2.2.2 on Page 36](#) OF THIS MANUAL. DOING SO COULD RESULT IN SERIOUS INJURY OR DEATH.

SHOCK HAZARD

ELECTRICAL SHOCK HAZARD EXISTS WHEN THE EZ-SCREEN TYPE 2 SYSTEM IS CONNECTED TO THE GUARDED MACHINE. USE EXTREME CAUTION TO AVOID ELECTRICAL SHOCK AT ALL TIMES. ALWAYS DISCONNECT ALL POWER FROM THE EZ-SCREEN TYPE 2 SYSTEM AND THE GUARDED MACHINE BEFORE MAKING ANY CONNECTIONS OR REPLACING ANY COMPONENT.

6.1 PREVENTIVE MAINTENANCE

6.1.1 Periodic Check-out Requirements

WARNING!

FUNCTIONING OF THE EZ-SCREEN TYPE 2 SYSTEM

THE FUNCTIONING OF THE EZ-SCREEN TYPE 2 SYSTEM AND THE GUARDED MACHINE MUST BE VERIFIED ON A REGULAR, PERIODIC BASIS TO ENSURE PROPER OPERATION. THIS IS ABSOLUTELY VITAL. FAILURE TO DO SO MAY LEAD TO SERIOUS INJURY OR DEATH. BEFORE OPERATING MACHINE/EQUIPMENT, PERIODIC VERIFICATION SHOULD BE UP-TO-DATE.

To ensure continued reliable operation, the EZ-SCREEN Type 2 System must be checked periodically.

☛ *A copy of the Check-out results should be kept on or near the machine/equipment as detailed in European Safety Standard IEC/EN 61496-1.*

Check-outs must be performed as follows:

- **Initial Check-out** by a [Qualified Person as specified in Block 1.13.2 on Page 8](#) at installation, and at any time the system, the guarded machine, or any part of the application is installed or altered
- **Trip Test** by a [Designated Person as specified in Block 1.13.1 on Page 8](#) at installation and at any time the system, the guarded machine, or any part of the application is installed or altered.
- **Commissioning Check-out** by a [Qualified Person as specified in Block 1.13.2 on Page 8](#) whenever changes are made to the system (new configuration or changes to the machine)
- **Daily Check-out** by a [Designated Person as specified in Block 1.13.1 on Page 8](#) at every shift change, power-up and machine setup change
- **Six Monthly Check-out** (see [Block 6.1.5 on Page 43](#)) by a [Qualified Person as specified in Block 1.13.2 on Page 8](#).

6.1.2 Initial Check-out

Refer to [Block 4.4 on Page 28](#).

6.1.3 Commissioning Check-out

[Block 6.1.5 on Page 43, Step 1\) on page 43 thru' to Step 19\) on page 44](#).

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6.1.4 Daily/Shift Change Check-out

THIS CHECKOUT PROCEDURE SHOULD BE PERFORMED AT EVERY POWER-UP, SHIFT CHANGE AND MACHINE/EQUIPMENT SETUP.

☛ *Daily Check-out and Check-outs after tooling and machine changes must be performed by a **Designated Person** as specified in [Block 1.13.1 on Page 8](#) (appointed and identified in writing by the employer). During continuous machine/equipment running periods, this Check-out must be performed at intervals not exceeding 24 hours. A copy of the Check-out results should be kept on or near the machine/equipment as detailed in *European Safety Standard IEC/EN 61496-1*.*

The Designated Person should perform the following checks:

- 1) Verify that:
 - Access to guarded area is not possible from any area not protected by the EZ-SCREEN Type 2 System
 - Fixed guarding or supplementary presence sensing devices are installed as necessary to prevent any person from reaching over, under or around defined area or entering into hazard area
 - All fixed and supplementary guarding devices are in place and operating properly ☐
- 2) Verify that Minimum Safety Distance from closest hazard point of guarded machine to defined area is not less than Minimum Safety Distance calculated in [Block 1.8 on Page 3](#) of Instruction manual and recorded here: _____ ☐
- 3) Verify that it is not possible for a person to stand inside the guarded (dangerous) area, undetected by EZ-SCREEN Type 2 System or other supplementary guarding. ☐
- 4) Perform Trip Test as detailed in [Block 6.1.4.1 on Page 42](#). ☐

If Trip Test fails, do not continue with this Check-out procedure or operate guarded machine until situation is corrected and indicators respond properly.

- 5) Observe following notes with regard to reflective surfaces:

Eliminating Problems With Reflective Surfaces

If possible, relocate Emitter and/or Receiver to move light beam away from reflective surface(s), being careful to maintain adequate Minimum Safety Distance. See [Step 2\) on page 41](#). Otherwise, if possible, paint, mask or roughen the surface to reduce the reflectivity. Where this is not possible (as with a shiny workpiece), include means of restricting the Receiver's field of view or Emitter's spread of light in sensor mounting.

Trip Test should be repeated to verify that these changes have eliminated problem reflection(s). If workpiece is especially reflective and comes close to beam, perform Trip Test with workpiece in place.

- 6) Initiate machine motion of guarded machine, and while it is moving, insert supplied test piece into defined area. **Do not attempt to insert test piece into dangerous parts of machine.** ☐
- 7) Verify that, whenever test piece is in defined area, dangerous parts of machine come to a stop with no apparent delay. ☐

- 8) Remove test piece from defined area and verify that:
 - Machine does not automatically restart
 - Initiation devices must be engaged to restart machine ☐
- 9) With guarded machine at rest, insert Specified Test Piece into defined area and verify guarded machine cannot be put into motion while Specified Test Piece is in defined area. ☐
- 10) Check carefully for external signs of damage or changes to EZ-SCREEN Type 2 System guarded machine and the electrical wiring. Any damage or changes found should be immediately reported to management. ☐

6.1.4.1 Trip Test

! WARNINGS!

IF TRIP TEST INDICATES A PROBLEM

IF THE EZ-SCREEN TYPE 2 SYSTEM DOES NOT RESPOND PROPERLY TO THE TRIP TEST, DO NOT ATTEMPT TO USE THE SYSTEM. IF THIS OCCURS, THE SYSTEM CANNOT BE RELIED ON TO STOP DANGEROUS MACHINE MOTION WHEN A PERSON OR OBJECT ENTERS THE DEFINED AREA. SERIOUS BODILY INJURY OR DEATH COULD RESULT.

BEFORE APPLYING POWER TO THE MACHINE

VERIFY THAT THE GUARDED AREA IS CLEAR OF PERSONNEL AND UNWANTED MATERIALS (SUCH AS TOOLS) BEFORE APPLYING POWER TO THE GUARDED MACHINE. FAILURE TO DO SO COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

TRIP TEST

THE TRIP TEST SHOULD BE PERFORMED BY A Designated Person as specified in Block 1.13.1 on Page 8 TO VERIFY THE DETECTION CAPABILITY OF THE EZ-SCREEN TYPE 2 SYSTEM. THIS TEST ALSO VERIFIES CORRECT EMITTER/RECEIVER ORIENTATION (Block 4.1.3 on Page 21 REFERS) AND IDENTIFYING OF ADJACENT REFLECTIVE SURFACES (Block 4.1.4 on Page 22 REFERS).

☛ The Trip Test is required for both systems (TRIP and LATCH output Receivers).

- 1) Select appropriate test piece (type STP-14 Ø 30 mm) as supplied with Receiver. ☐
- 2) Verify that Status CLEAR LED is steady green ●. ☐
- 3) For Trip versions only, pass Specified Test Piece in defined area of beams in three separate paths as shown in Figure 26 on Page 42. Verify that Receiver Status CLEAR LED goes OFF ○. ☐
- 4) For Latch versions only, pass Specified Test Piece in defined area of beams in three separate paths as shown in Figure 26 on Page 42. Verify that Receiver Status CLEAR LED goes OFF ○ and Receiver Status BLOCKED LED goes ON steady red ● and remains ON even when Specified Test Piece is removed from defined area. If the Yellow Alignment indicators begin to flash (i.e. requesting a Reset) at any time while the test piece is interrupting the defined area, the installation has failed the trip test. A Reset is then required to reactivate the System (and outputs when connected for normal operation). ☐

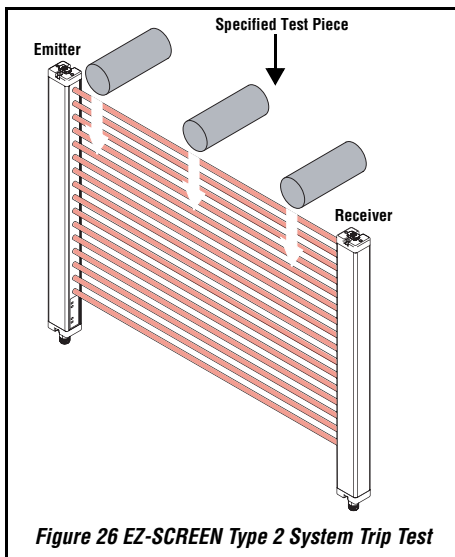


Figure 26 EZ-SCREEN Type 2 System Trip Test

- 5) Verify also that Status BLOCKED Indicator turns steady red ● and remains red for as long as the specified test piece remains in the defined area. If not, the installation has failed the Trip Test. ☐
- 6) Check for correct sensor orientation, reflective surfaces and unguarded areas. ☐

Do not continue with this Check-out procedure or operate guarded machine until situation is corrected and indicators respond properly as described above.

- 7) Remove Specified Test Piece from defined area and verify that:

For Systems with Trip Output Receivers: Status CLEAR LED turns steady green ●.

For Systems with Latch Output Receivers: A manual Reset is required first before system is return to normal and Status CLEAR LED goes steady green ●. ☐

If mirrors are used in the application:

- 8) Test defined area on each leg of sensing path (for example, Emitter to mirror, between mirror and Receiver, Figure 27 on Page 42 refers). ☐

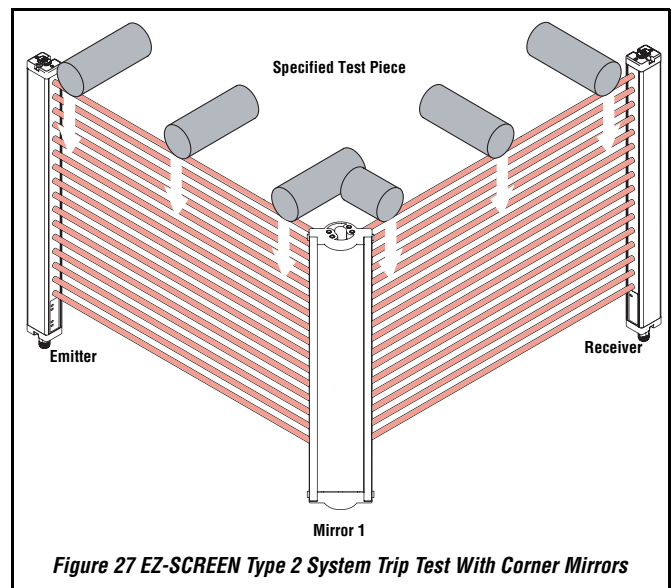


Figure 27 EZ-SCREEN Type 2 System Trip Test With Corner Mirrors

! WARNING!

DO NOT USE MACHINE UNTIL SYSTEM IS WORKING PROPERLY
 IF ALL OF THESE CHECKS CANNOT BE VERIFIED, DO NOT ATTEMPT TO USE THE EZ-SCREEN TYPE 2 SYSTEM/GUARDED MACHINE UNTIL THE DEFECT OR PROBLEM HAS BEEN CORRECTED (SEE Chapter 6). ATTEMPTS TO USE THE GUARDED MACHINE UNDER SUCH CONDITIONS COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

6.1.5 Six Monthly Check-out

THIS CHECKOUT PROCEDURE SHOULD BE PERFORMED EVERY SIX MONTHS FOLLOWING SYSTEM INSTALLATION OR WHENEVER CHANGES ARE MADE TO THE SYSTEM (EITHER A NEW CONFIGURATION OF THE EZ-SCREEN TYPE 2 SYSTEM OR CHANGES TO THE MACHINE) AS DESCRIBED IN [Block 4.5 on Page 33](#).

☛ *Check-outs must be performed by a [Qualified Person as specified in Block 1.13.2 on Page 8 in Instruction Manual](#) (appointed and identified in writing by the employer). A copy of the Check-out results should be kept on or near the machine/equipment as detailed in [European Safety Standard IEC/EN 61496-1](#).*

WARNING!

BEFORE APPLYING POWER TO THE MACHINE

VERIFY THAT THE GUARDED AREA IS CLEAR OF PERSONNEL AND UNWANTED MATERIALS (SUCH AS TOOLS) BEFORE APPLYING POWER TO THE GUARDED MACHINE. FAILURE TO DO SO COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

This procedure must be carried out in strict order as follows:

- 1) Examine guarded machine to verify that it is of a type and design compatible with EZ-SCREEN Type 2 System (see [Block 1.11 on Page 6](#) for a list of mis-applications). ☐
 - 2) **Verify that** Minimum Safety Distance from closest danger point of guarded machine to defined area is not less than calculated distance, as specified in [Block 1.8 on Page 3](#). ☐
 - 3) Verify that:
 - **Access to any dangerous parts of guarded machine** is not possible from any direction not protected by EZ-SCREEN Type 2 System, fixed guarding or supplementary guarding
 - It is not possible for a person to stand between defined area and dangerous parts of machine
 - Supplementary guarding and fixed guarding is in place and functioning properly in any space (between defined area and any hazard) which is large enough to allow a person to stand undetected by EZ-SCREEN Type 2 System (see [Block 1.8.3 on Page 5](#) and [Block 1.10 on Page 6](#)). ☐
 - 4) For Systems with Latch output Receivers, verify that **Reset Switch is mounted outside and in full view of guarded area**, out of reach of anyone inside guarded area and that **other means of preventing inadvertent use is in place** (see [Block 1.13.3 on Page 9](#)). ☐
 - 5) **Examine electrical wiring connections** between EZ-SCREEN Type 2 System OSSD outputs and guarded machine's control elements to verify that wiring meets requirements stated in [Block 4.5 on Page 33](#). ☐
 - 6) **Inspect area near defined area** (including work pieces and guarded machine) for reflective surfaces (see [Block 4.1.4 on Page 22](#)). If necessary remove reflective surfaces if possible by relocating them, painting, masking or roughening them. Remaining problem reflections are apparent during [Step 13](#)) on page 43 (Trip Test as detailed in [Block 6.1.4.1](#)). ☐
 - 7) Verify that power to Guarded Machine is OFF. ☐
 - 8) Check for any obstructions in defined area. ☐
 - 9) Apply power to EZ-SCREEN Type 2 System only. ☐
 - 10) **For Systems with Latch Output Receivers only**, If Status BLOCKED LED shows steady red ●, perform a manual Reset by pressing Reset for minimum 0,25 s, then release again ([Block 5.2.2.2 on Page 36](#) refers) to return system to a **CLEAR Condition** (Status CLEAR LED goes steady green ●). ☐
 - 11) Observe Status indicators are in a **CLEAR Condition** as follows:
 - Status CLEAR LED goes steady green ●
 - Status BLOCKED LED goes OFF ○ ☐
 - 12) **If in a CLEAR Condition** go to [Step 13](#)) on page 43. **If in a BLOCKED Condition**, this means one or more of the beams has been, or is interrupted (blocked) in the defined area. To correct this situation:
 - Check carefully for any obstruction in beam path and remove as necessary. For systems with Latch output Receivers, perform [Step 10](#)) on page 43
 - Check if TOP and/or BOTTOM Alignment LEDs are ON. If necessary, realign Emitter/Receiver ([Block 4.4.2 on Page 29](#) refers)
 - Check for contamination. If necessary, clean Emitter/Receiver windows ([Block 6.1.6 on Page 44](#) refers) ☐
 - 13) **Perform Trip Test** as detailed in [Block 6.1.4.1 on Page 42](#), to verify proper system operation and to detect possible optical short circuits or reflection problems. ☐
- Do not continue until the EZ-SCREEN Type 2 System passes all the tests.**
- During the following checks, take care not to expose individual(s) to any hazard.**
- 14) **Apply power to guarded machine and verify that machine does not start up.** Interrupt (block) defined area with appropriate Specified Test Piece and verify that it is not possible for guarded machine to be put into motion while beam(s) is blocked. ☐
 - 15) **Initiate motion of guarded machine** and while it is moving, use supplied test piece to block defined area. Do not attempt to insert test piece into dangerous parts of machine. Upon blocking any beam, dangerous parts of machine should come to a stop with no apparent delay. ☐
 - 16) Remove test piece from beam. Verify that **machine does not automatically restart** and that initiation devices must be engaged to restart machine. ☐

- 17) **Remove electrical power** to EZ-SCREEN Type 2 System. Check that both OSSD outputs immediately trip (switch OFF) and ensure machine is not capable of starting until power is re-applied to EZ-SCREEN Type 2 System. ☐
- 18) **For Systems with Latch Output Receivers only**, perform a manual Reset by pressing Reset for minimum 0,25 s, then releasing again ([Block 5.2.2.2 on Page 36](#) refers). ☐
- 19) **Test machine stopping response time**, using an instrument designed for that purpose, to verify that it is same or less than overall system response time specified by machine manufacturer ([Banner Customer Information as listed on page 69](#) can recommend a suitable instrument). ☐

Do not continue operation until the entire Check-out procedure is complete and all problems are corrected.

- 20) **If any decrease in machine braking ability has occurred**, make necessary clutch/brake repairs, readjust Minimum Safety Distance (S) appropriately, record new (S) calculation on Daily Check-out card and/or in manual, and re-perform Daily Check-out procedure ([Block 6.1.4 on Page 41](#) refers). ☐
- 21) **Examine and test machine primary control elements** (MPCEs) and any intermediary controls (such as interface modules) to verify that they are functioning correctly and are not in need of maintenance or replacement. ☐
- 22) **Inspect guarded machine to verify that no other mechanical or structural problems could prevent machine from stopping** or assuming an otherwise safe condition when signal LED to do so by EZ-SCREEN Type 2 System. ☐
- 23) **Examine and inspect machine controls and connections** to EZ-SCREEN Type 2 System to verify that no modifications have been made which adversely affect system. ☐

 **WARNING!**

DO NOT USE MACHINE UNTIL SYSTEM IS WORKING PROPERLY
IF ALL OF THESE CHECKS CANNOT BE VERIFIED, DO NOT ATTEMPT TO USE THE EZ-SCREEN TYPE 2 SYSTEM/GUARDED MACHINE UNTIL THE DEFECT OR PROBLEM HAS BEEN CORRECTED (SEE [Chapter 6](#)). ATTEMPTS TO USE THE GUARDED MACHINE UNDER SUCH CONDITIONS COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

6.1.6 Cleaning

EZ-SCREEN Type 2 System Emitters and Receivers are constructed of aluminium with a yellow painted finish and are rated IP65.

Lens covers are acrylic.

Emitters and Receivers are best cleaned using mild detergent or window cleaner and a soft lint free cloth. Avoid cleaners containing alcohol, as they may damage the acrylic lens covers.

6.2 CORRECTIVE MAINTENANCE

6.2.1 Troubleshooting

⚠ WARNING!

SHUT DOWN MACHINERY BEFORE SERVICING

THE MACHINERY TO WHICH THE EZ-SCREEN TYPE 2 SYSTEM IS CONNECTED MUST NOT BE OPERATING AT ANY TIME DURING MAJOR SERVICE OR MAINTENANCE. SERVICING THE EZ-SCREEN TYPE 2 SYSTEM WHILE THE HAZARDOUS MACHINERY IS OPERATIONAL COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

6.2.1.1 Emitter & Receiver Error Codes

Troubleshooting is possible by monitoring the indicator LEDs on the Emitter and the Receiver. Refer to [Table 8 on Page 45](#) for breakdown.

Table 8 Emitter and Receiver Error Indications







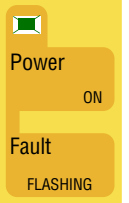
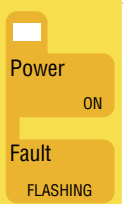
Display	LED Status	Possible Cause & Remedy
Receiver		
	<p>TOP Yellow flashing</p> <p>BOTTOM Yellow flashing</p> <p>BLOCKED Red flashing</p> <p>CLEAR Green OFF</p>	<p>Output Fault</p> <ul style="list-style-type: none"> - Check output connections. - In the event of connection to a capacitive load of > 0,1µF, contact Banner Customer Information as listed on page 69 - Press Reset for at least 0,25 s and release again (see Timing Diagram Figure 35 on Page 63) <p>If condition continues, contact Banner Customer Information as listed on page 69</p>
	<p>TOP Yellow flashing</p> <p>BOTTOM Yellow OFF</p> <p>BLOCKED Red flashing</p> <p>CLEAR Green OFF</p>	<p>Optical Fault</p> <ul style="list-style-type: none"> - Press Reset/Test for at least 0,25 s and release again (see Timing Diagrams Figure 33 on Page 63 & Figure 34 on Page 63) <p>If condition continues contact Banner Customer Information as listed on page 69</p>
	<p>TOP Yellow OFF</p> <p>BOTTOM Yellow OFF</p> <p>BLOCKED Red flashing</p> <p>CLEAR Green OFF</p>	<p>Internal Fault</p> <ul style="list-style-type: none"> - Press Reset for at least 0,25 s and release again (see Timing Diagram Figure 35 on Page 63) - Verify Supply Voltage meets specifications listed Block 3.2 on Page 17. <p>If condition continues contact Banner Customer Information as listed on page 69</p>

Table 8 Emitter and Receiver Error Indications


Display	LED Status	Possible Cause & Remedy
	<p>TOP Yellow OFF</p> <p>BOTTOM Yellow OFF</p> <p>BLOCKED Red ON</p> <p>CLEAR Green ON</p>	<p>Reset/Test Input Fault</p> <ul style="list-style-type: none"> - Reset/Test input open at power up - Switch device OFF, ensure Reset/Test input is connected to +24 VDC and then reapply power
	<p>TOP Yellow OFF</p> <p>BOTTOM Yellow OFF</p> <p>BLOCKED Red ON</p> <p>CLEAR Green flashing</p>	<p>Test Mode</p> <ul style="list-style-type: none"> - Reset/Test input is open
	<p>TOP Yellow OFF</p> <p>BOTTOM Yellow OFF</p> <p>BLOCKED Red OFF</p> <p>CLEAR Green OFF</p>	<ul style="list-style-type: none"> - Power supply failure, check power supply
Emitter		
	<p>Green flashing</p>	<ul style="list-style-type: none"> - Transmission failure, check power supply. If the condition continues contact Banner Customer Information as listed on page 69
	<p>Green OFF</p>	<ul style="list-style-type: none"> - Power supply failure, check power supply

6.2.1.2 Lockouts (internal faults)

WARNING!

LOCKOUTS AND POWER FAILURES

A LOCKOUT IS A DEFINITE INDICATION OF A PROBLEM AND SHOULD BE INVESTIGATED AT ONCE, BY A Qualified Person as specified in Block 1.13.2 on Page 8. ATTEMPTS TO CONTINUE TO OPERATE MACHINERY BY BYPASSING THE EZ-SCREEN TYPE 2 SYSTEM ARE HAZARDOUS AND COULD RESULT IN SERIOUS BODILY INJURY OR DEATH.

After power is applied, Emitter and Receivers self-test to detect any critical internal faults. If either Emitter or Receiver detects a critical fault, Receiver outputs remain OFF and visual indication is given by the Receiver LEDs. If a fault occurs in the Emitter, the Emitter Power LED also flashes green . If no faults are detected, system automatically enters normal operating mode with Receiver looking for an optical sync. pattern from Emitter. See Table 8 on Page 45 for resolving of error/fault conditions.

Recovery Procedures

To recover from a Lockout condition:

- 1) Correct all errors.

TRIP OUTPUT RECEIVER RESET

- 1) Carry out Reset procedure as detailed in Block 5.2.2.1 on Page 36.

LATCH OUTPUT RECEIVER RESET

- 1) Carry out Reset procedure as detailed in Block 5.2.2.2 on Page 36.

☛ *If the power down/up method is used and the system is set for Latch Output, a manual Reset, as described in Block 5.2.2.2 on Page 36, is required to resume full operation.*

EMITTER RESET

☛ *An Emitter Reset is required only if the Emitter is in a Lockout condition.*

- 2) Power sensor down, wait a second or two, and then power it up.

6.2.1.3 Eliminating Reflections

WARNING!

AVOID INSTALLATION NEAR REFLECTIVE SURFACES

AVOID MOUNTING THE EZ-SCREEN TYPE 2 SYSTEM NEAR ANY REFLECTIVE SURFACES. A REFLECTIVE SURFACE LOCATED NEARBY MAY REFLECT LIGHT AROUND AN OBJECT OR PERSON, PREVENTING ITS DETECTION BY THE RECEIVER. THIS POSSIBILITY IS DETECTED DURING THE TRIP TEST. FAILURE TO PREVENT REFLECTION PROBLEMS RESULTS IN INCOMPLETE GUARDING; SERIOUS BODILY INJURY OR DEATH COULD RESULT.

A reflective surface located adjacent to the defined area may deflect one or more beams around an object in the defined area. In the worst case, an optical short circuit may occur, allowing an object to pass undetected through the defined area (see Figure 2 on Page 5).

This reflective surface may result from shiny surfaces or glossy paint on the machine, the workpiece, the work surface, the floor or the walls. Beams deflected by reflective surfaces are discovered by performing the trip test (Block 6.1.4.1 on Page 42) portion of the final alignment procedure and the periodic Check-out procedures (Block 6.1.1 on Page 39).

To eliminate problem reflections:

- If possible, relocate the sensors to move the beams away from the reflective surface(s), being careful to maintain adequate Minimum Safety Distance (see Figure 2 on Page 5)
- Otherwise, if possible, paint, mask or roughen the shiny surface to reduce its reflectivity
- Where these are not possible (as with a shiny workpiece), mount the sensors in such a way that the Receiver's field of view and/or the Emitter's spread of light are restricted

Repeat the trip test to verify that these changes have eliminated the problem reflection(s). If the workpiece is especially reflective and comes close to the defined area, perform the trip test with the workpiece in place.

6.2.1.4 Electrical & Optical Noise

The EZ-SCREEN Type 2 System(s) are designed and manufactured to be highly resistant to electrical and optical noise and to operate reliably in industrial settings. However, serious electrical and/or optical noise may cause a random trip or latch condition. In very extreme electrical noise cases, a lockout is possible. In order to minimize the effects of transitory noise, the EZ-SCREEN Type 2 System(s) respond to noise only if the noise is detected on multiple consecutive scans.

If random nuisance trips occur, check the following:

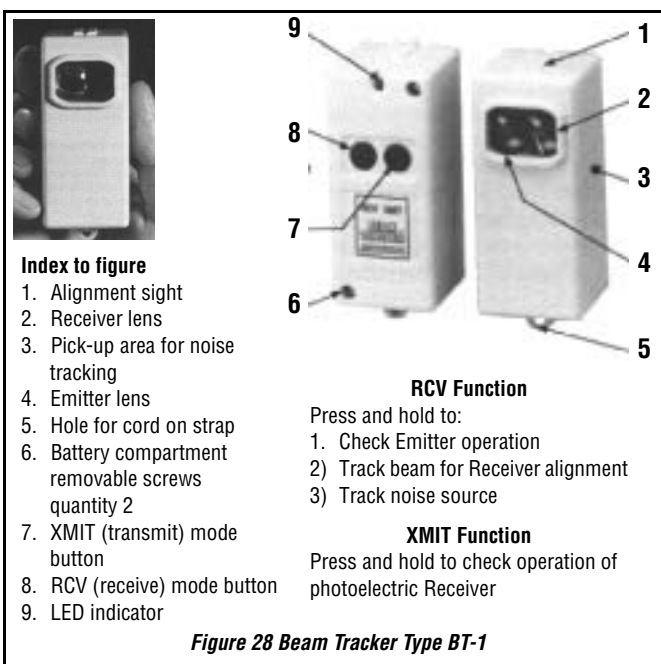
- Poor connection between Emitter/Receiver and earth ground
- Optical interference from adjacent Light Screens or other photoelectrics
- Emitter/Receiver input or output wires routed too close to noisy wiring

Checking for Sources of Electrical Noise

It is very important that the EZ-SCREEN Type 2 System Emitters and Receivers have a good earth ground. Without this, the system can act like an antenna causing random trips and lockouts to occur.

All EZ-SCREEN Type 2 System wiring is low voltage. Running these wires alongside power wires, motor/servo wires, or other high-voltage wiring, can inject noise into the EZ-SCREEN Type 2 System. It is good wiring practice (and may be required by code) to isolate EZ-SCREEN Type 2 System wiring from high-voltage wiring.

The Banner Beam Tracker (type BT-1) is the recommended tool for detecting electrical noise. It can be used to detect electrical transient spikes and surges ([Figure 28 on Page 47](#)).



To use tool proceed as follows:

- 1) Cover lens of Beam Tracker with electrical tape to block optical light from getting into Receiver lens.
- 2) Press RCV button on Beam Tracker and position it on wires leading to EZ-SCREEN Type 2 System or any other nearby wires.

☛ *Noise caused by switching of inductive loads should be addressed by installing proper transient suppression across the load.*

Checking for Sources of Optical Noise

- 1) Remove power from Emitter.
- 2) Completely block Emitter beam, or open Test input.
- 3) Using Beam Tracker (type BT-1), check for light at Receiver.
- 4) Press RCV button on the Beam Tracker and move it across the full length of the Receiver's sensing window.

If Beam Tracker's indicator light comes ON, indicating sources of optical noise (such as other Light Screens, or standard photoelectric sensors), check for light from these sources by tracking emitted light from them.

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6.3 SPARE PARTS, SPECIAL TOOLS & MATERIAL

6.3.1 Warranty Service

Banner Engineering Corp. warrants its products to be free from defects for a period of one year. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty is necessarily limited to the quality of materials and workmanship in EZ-SCREEN Type 2 System(s) as they are supplied to the original purchaser. Proper

installation, operation and maintenance of the EZ-SCREEN Type 2 System(s) becomes the responsibility of the User upon receipt of the system. This warranty does not cover damage or liability for the improper application of the EZ-SCREEN Type 2 System(s). This warranty is in lieu of any other warranty either expressed or implied.

6.3.2 Spare Parts

6.3.2.1 General

See [Table 9 on Page 49](#) for breakdown.

Table 9 General Spare Parts

Type No.	Description	Model	Order Part No.
SMA-MBK-1	SSM series mirror bracket kit	Not illustrated	30 619 33
Interface Modules			
IM-T-9A*	Interface module (quantity 3 N/O redundant output contacts)	Not illustrated	30 614 25
IM-T-11A*	Interface module (2 N/O redundant-output contacts, plus 1 N/C auxiliary contact)		30 614 24
* Provides forced-guided, mechanically-linked relay outputs for the EZ-SCREEN Type 2 System (see Figure 31 on Page 61).			
Contactors			
If used, two contactors per EZ-SCREEN Type 2 System are required (see Figure 30 on Page 60).			
11-BG00-31-D-024	10 amp positive-guided contactor 3 N/O, 1 NC	Not illustrated	30 696 82
11-BF16C01-024	16 amp positive-guided contactor 3 N/O, 1 NC		30 696 87

6.3.2.2 Emitter/Receiver Mounting Brackets

See [Table 10 on Page 49](#) for breakdown.

Table 10 Emitter/Receiver Mounting Brackets

Type No.	Description	Model	Order Part No.
USMB-1	<ul style="list-style-type: none"> Standard end cap bracket kit with hardware (quantity 2 end brackets) 2,3 mm thickness, black zinc plated, chromate dip finish Mounting hardware included Quantity 1 kit required per Emitter or Receiver 	<p>Dimensions in mm</p> <p>Material: Cold Rolled Steel Finish: Black, Zinc Plated, Chromate Dip</p>	30 500 00

Table 10 Emitter/Receiver Mounting Brackets

Type No.	Description	Model	Order Part No.
<p>USCMB-1</p>	<ul style="list-style-type: none"> • Centre support mounting hardware kit quantity 1 per Emitter or Receiver between 750 mm and 900 mm in length (contains quantity 1 bracket) • 2,3 mm thickness, black zinc plated, chromate dip finish • Mounting hardware included • Quantity 1 kit required per Emitter or Receiver 	<p>Dimensions in mm</p>	<p>30 516 51</p>
<p>USCMB-2</p>	<ul style="list-style-type: none"> • Centre support mounting hardware kit quantity. 1 per Emitter or Receiver between 1050 mm and 1800 mm in length (contains quantity 2 brackets) • 2,3 mm thickness, black zinc plated, chromate dip finish • Mounting hardware included • Quantity 1 kit required per Emitter or Receiver 	<p>Dimensions in mm</p>	<p>30 549 76</p>

Table 10 Emitter/Receiver Mounting Brackets

Type No.	Description	Model	Order Part No.
<p>USMB-5</p>	<ul style="list-style-type: none"> • Retrofit mounting bracket kit for STI MP21 • 2,3 mm thickness, black zinc plated, chromate dip finish • Mounting hardware included • Quantity 1 kit required per Emitter or Receiver 	<p>Dimensions in mm</p>	<p>30 556 69</p>
<p>USMB-6</p>	<ul style="list-style-type: none"> • Universal mounting bracket kit • 2,3 mm thickness, black zinc plated, chromate dip finish • Mounting hardware included • Quantity 1 kit required per Emitter or Receiver 	<p>Dimensions in mm</p>	<p>30 571 40</p>

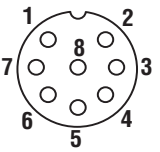
6.3.2.3 Cables

Machine interface cables provide power to the first Emitter/Receiver pair. Sensor interface cables provide power to subsequent Emitters and Receivers.

Single-Ended Machine Interface Cables (one cable for each Emitter and Receiver)

Sleeving and cables are PVC-jacketed. Cables are unterminated on one end to interface with guarded machine.

Table 11 Quick Disconnect Cables

Type No.	Order Part No.	Length (m)	Wire (mm²)	Termination*	Banner Cable Pin Out/Colour Code	Connector (female face view)																																				
QDE-815D	30 708 83	5	0,38	8-pin Euro-style female connector on one end cut-to-length.	<table border="1"> <thead> <tr> <th>Pin</th> <th>Colour</th> <th>Receiver Function</th> <th>Emitter Function</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Bn</td> <td>+24 VDC</td> <td>+24 VDC</td> </tr> <tr> <td>2</td> <td>Or/Bk</td> <td>**</td> <td>**</td> </tr> <tr> <td>3</td> <td>Or</td> <td>**</td> <td>**</td> </tr> <tr> <td>4</td> <td>Wh</td> <td>OSSD 2</td> <td>**</td> </tr> <tr> <td>5</td> <td>Bk</td> <td>OSSD 1</td> <td>**</td> </tr> <tr> <td>6</td> <td>Bu</td> <td>0 VDC</td> <td>0 VDC</td> </tr> <tr> <td>7</td> <td>Gn/Ye</td> <td>Gnd/Chassis</td> <td>Gnd/Chassis</td> </tr> <tr> <td>8</td> <td>Vi</td> <td>Test/Reset</td> <td>**</td> </tr> </tbody> </table>	Pin	Colour	Receiver Function	Emitter Function	1	Bn	+24 VDC	+24 VDC	2	Or/Bk	**	**	3	Or	**	**	4	Wh	OSSD 2	**	5	Bk	OSSD 1	**	6	Bu	0 VDC	0 VDC	7	Gn/Ye	Gnd/Chassis	Gnd/Chassis	8	Vi	Test/Reset	**	
Pin	Colour	Receiver Function			Emitter Function																																					
1	Bn	+24 VDC			+24 VDC																																					
2	Or/Bk	**			**																																					
3	Or	**			**																																					
4	Wh	OSSD 2	**																																							
5	Bk	OSSD 1	**																																							
6	Bu	0 VDC	0 VDC																																							
7	Gn/Ye	Gnd/Chassis	Gnd/Chassis																																							
8	Vi	Test/Reset	**																																							
QDE-825D	30 708 84	8																																								
QDE-850D	30 708 85	15																																								
QDE-875D	30 714 66	23																																								
QDE-8100D	30 714 67	30																																								

* Systems require two 8-pin QD cables.

** Pins not connected

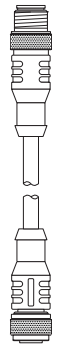
For connection information refer to [Figure 29 on Page 59](#), [Figure 30 on Page 60](#) and [Figure 31 on Page 61](#).

Double-Ended Sensor Interconnect Cables

Double-ended cables are generally used to interconnect multiple Emitters or Receivers within a cascaded system (see

[Table 12 on Page 52](#)). They are also useful for extending either the branch or trunk cables of a model CSB splitter cordset (see [Table 13 on Page 53](#)).

Table 12 Double-Ended Sensor Interconnect Cables

Type No.	Order Part No.	Length (m)	Wire (mm²)	Termination	Cable
For 8-Pin Emitters & Receivers					
DEE2R-81D	30 722 05	0,5	0,38	8-pin Double-ended cables, M12/ Euro-style connectors, female to male (rotatable)	
DEE2R-83D	30 722 06	1			
DEE2R-88D	30 726 35	2,4			
DEE2R-815D	30 722 07	4,5			
DEE2R-825D	30 722 08	8			
DEE2R-850D	30 722 09	15			
DEE2R-875D	30 722 10	23			
DEE2R-8100D	30 722 11	30			

Splitter Cordsets

Model CSB splitter cordsets allow easy interconnection between an EZ-SCREEN 8-pin Receiver and its 8-pin Emitter, providing a single cable for the optional swappable connection (see Figure 32 on Page 62). The model DEE2R-.. double-ended cables as described in Table 12 on Page 52 may be used to extend

the lengths of the QD trunk, branch 1 or branch 2 (Branch 1 and branch 2 cable sections are 300 mm long). The model QDE-8..D single-ended cables may be used to extend the QD trunk for cut-to-length applications.

Table 13 Splitter Cord Sets

Type No.	Order Part No.	Length (m)	Wire (mm ²)	Pin-Out	Cable
For 8-Pin Emitters & Receivers					
CSB-M1281M1281	30 732 52	3 trunk	0,38		
CSB-M1288M1281	30 732 53	2,5 trunk			
CSB-M12815M1281	30 732 54	5 trunk			
CSB-M12825M1281	30 732 55	8 trunk			
CSB-UNT825M1281	30 732 56	8 trunk (unterminated)			

6.3.2.4 Type MSA Series Stands

See Table 14 on Page 53 for breakdown.

Table 14 Type MSA Series Stands

Type No.	Mirror Length (mm) (Brackets Inwards)	Mirror Length (mm) (Brackets Outwards)	Emitter/Receiver Length (mm) (Brackets Inwards)	Emitter/Receiver Length (mm) (Brackets Outwards)	Height (mm)	Model	Order Part No.
MSA-S24-1	102 to 203	102 to 305	102 to 305	102 to 406	610		30 431 74
MSA-S42-1	102 to 610	102 to 711	102 to 813	102 to 914	1067		30 431 75
MSA-S66-1	102 to 1219	102 to 1219	102 to 1219	102 to 1219	1676		30 431 76
MSA-S84-1	102 to 1219	102 to 1219	102 to 1829	102 to 1829	2134		30 523 97

6.3.2.5 Emitter/Receiver Lens Shields


Model LSSxx series are replaceable protective covers for the lens of EZ-SCREEN Emitters or Receivers. The shield is made of 1,5 mm clear polycarbonate.

The shields attach to the sensor using two adhesive-backed Neoprene foam strips.

☛ *The total range decreases by approximately 10% per shield*

Shield models are available in every length of sensor (150 mm to 1800 mm. See [Table 15 on Page 54](#) for breakdown.

Table 15 Emitter/Receiver Lens Shields

Type No.	Emitter/Receiver Defined Area Height (mm)	Lens Shield Length (mm)	Model	Order Part No.
LSS-150	150	210		30 737 48
LSS-300	300	360		30 737 49
LSS-450	450	510		30 737 50
LSS-600	600	660		30 737 51
LSS-750	750	810		30 737 52
LSS-900	900	959		30 737 53
LSS-1050	1050	1109		30 737 54
LSS-1200	1200	1259		30 737 55
LSS-1350	1350	1409		30 737 56
LSS-1500	1500	1558		30 737 57
LSS-1650	1650	1708		30 772 47
LSS-1800	1800	1858		30 772 46

6.3.2.6 Type SSM Series Corner Mirrors

Type SSM series corner mirrors have the following features:

- Rear-surface glass mirrors rated at 85% efficiency
- Robust construction, two mounting brackets and hardware included
- Stainless steel reflective surface models also available. See data sheet 67200

See the specific mirror data sheet or the Banner Safety Catalogue for further information.

☛ *When using SSM series mirrors with MSA series stands, an adapter bracket type EZA-MBK-2 is required.*

See [Table 16 on Page 55](#) for breakdown.

Table 16 Type SSM Series Corner Mirrors

Type No.	Measurements			Defined Area Length	Model	Order Part No.	
	Y (mm)	L1 (mm)	L2 (mm)				
☛ <i>Total range decreases by approximately 8% per mirror</i>							
SSM-200	200	278	311	150	<p>Dimensions in mm</p> <p>Screws quantity 4, M6</p> <p>Screws quantity 4, M5</p> <p>101,2</p> <p>100</p> <p>115</p> <p>L1</p> <p>L2</p> <p>L3</p> <p>Y</p>	30 714 50	
SSM-375	375	486	453	300		30 618 93	
SSM-550	550	661	628	450		30 618 95	
SSM-675	675	786	753	600		30 618 96	
SSM-825	825	936	903	750		30 618 97	
SSM-975	975	1086	1053	900		30 618 98	
SSM-1100	1100	1211	1178	1050		30 716 16	
SSM-1275	1275	1386	1353	1200		30 619 00	
SSM-1400	1400	1511	1478	1350		30 716 17	
SSM-1550	1550	1661	1628	1500		30 716 18	
SSM-1750	1750	1861	1828	1650		30 716 20	
SSM-1900	1900	2011	1978	1800		☛ <i>Brackets may be inverted from the positions shown above, decreasing dimension L1 by 58 mm.</i>	30 619 03

6.3.2.7 MSM Series Corner Mirrors

See Table 17 on Page 56 for breakdown.

Table 17 MSM Series Corner Mirrors

Type No.	Measurements			Defined Area Length (mm)	Model	Order Part No.
	Y (mm)	L1 (mm)	L2 (mm)			
⚠ Total sensing range decreases by approximately 8% per mirror						
MSM8A	267	323	292	150		30 431 63
MSM12A	356	411	381	300		30 431 64
MSM20A	559	615	584	450		30 431 66
MSM24A	660	716	686	600		30 431 67
MSM32A	864	919	889	750		30 431 69
MSM36A	965	1021	991	900		30 431 70
MSM44A	1168	1224	1194	1050		30 431 72
MSM48A	1270	1326	1295	1200		30 431 73

6.3.3 Special Tools & Material

⚠ WARNING!

LAT-1-LS ALIGNMENT TOOL

THE LAT-1-LS ALIGNMENT TOOL IS FITTED WITH A CLASS 2 LASER DIODE. LASER LIGHT IS EMITTED FROM APERTURE. AVOID EXPOSURE AND DO NOT STARE INTO THE BEAM.

This block details special tools and material information for the EZ-SCREEN Type 2 System. Refer to Table 18 on Page 56.

Table 18 Laser Alignment Tool

Type No.	Part Description	Order Part No.	Item
LAT-1-LS	Self-contained visible-beam laser tool for alignment of any EZ-SCREEN Type 2 System Emitter/Receiver pair. Includes retro-reflective target material and two mounting clips.	30 737 45	
LSA-LAT-1	Clip-on retro reflective LAT target	30 737 46	Not illustrated
BRT-THG-2-100	50 mm wide reflective tape, 2,5 m long	37 135 00	
BT-1	Beam Tracker	37 777 00	
STP-14	30 mm Specified Test Piece (for 30 mm resolution systems)	30 719 30	

6.3.3.1 Documentation

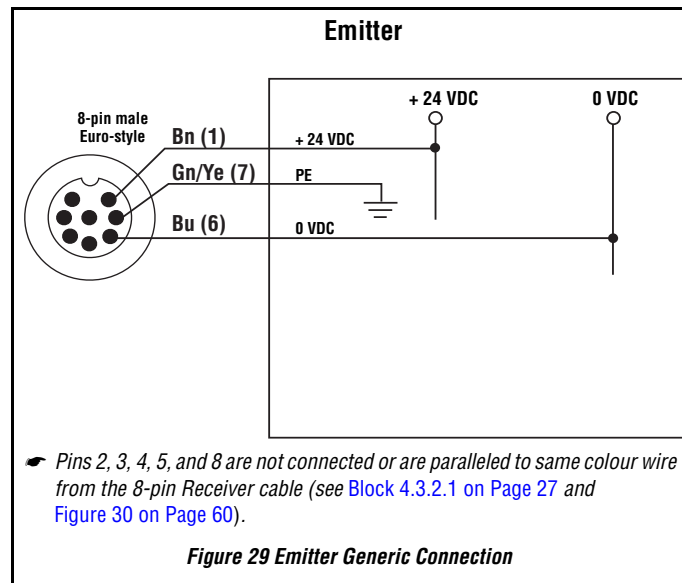
The following documentation detailed in [Table 19 on Page 57](#) is supplied with each EZ-SCREEN Type 2 System. Additional copies are available at no charge.

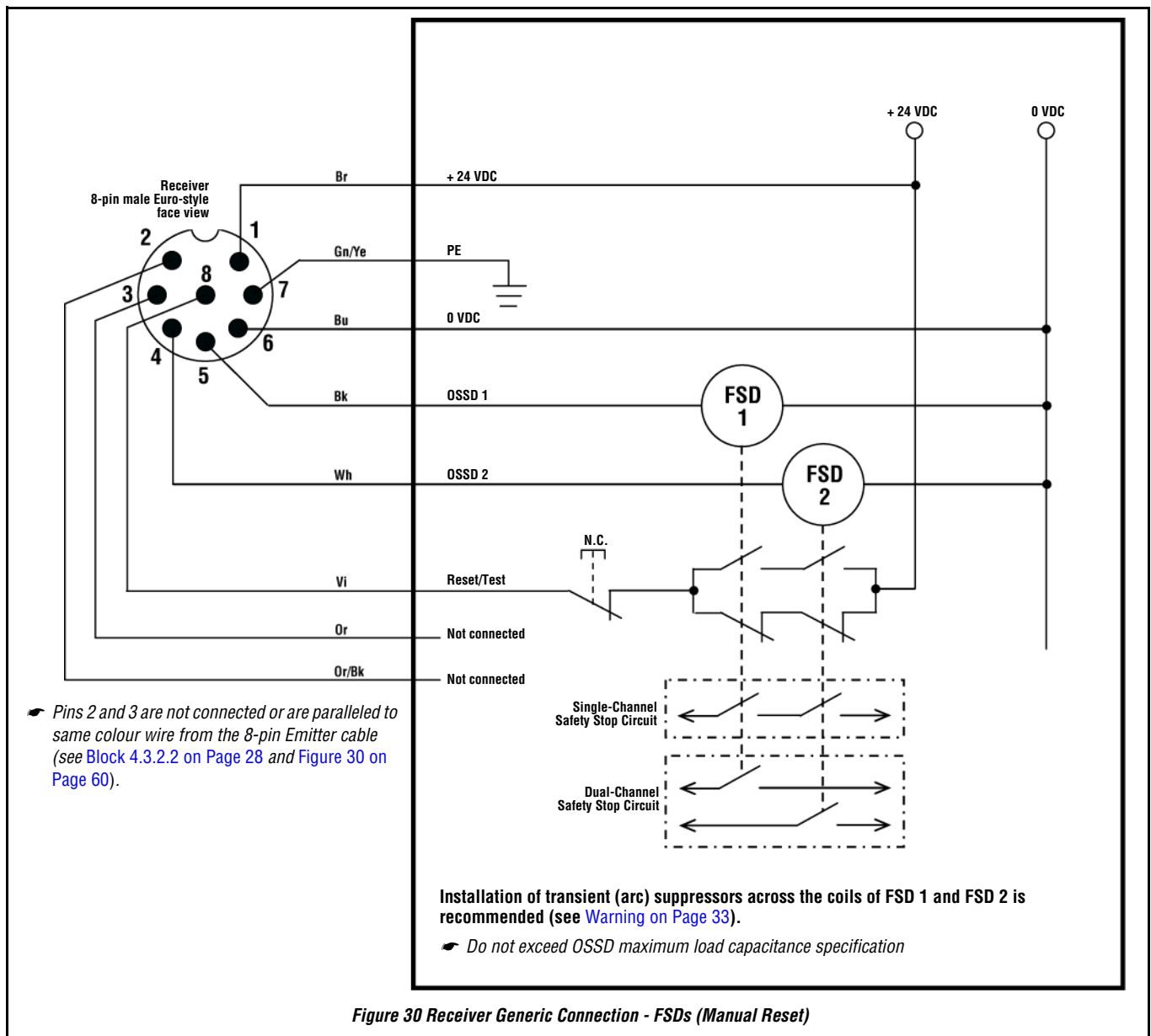
Table 19 Documentation

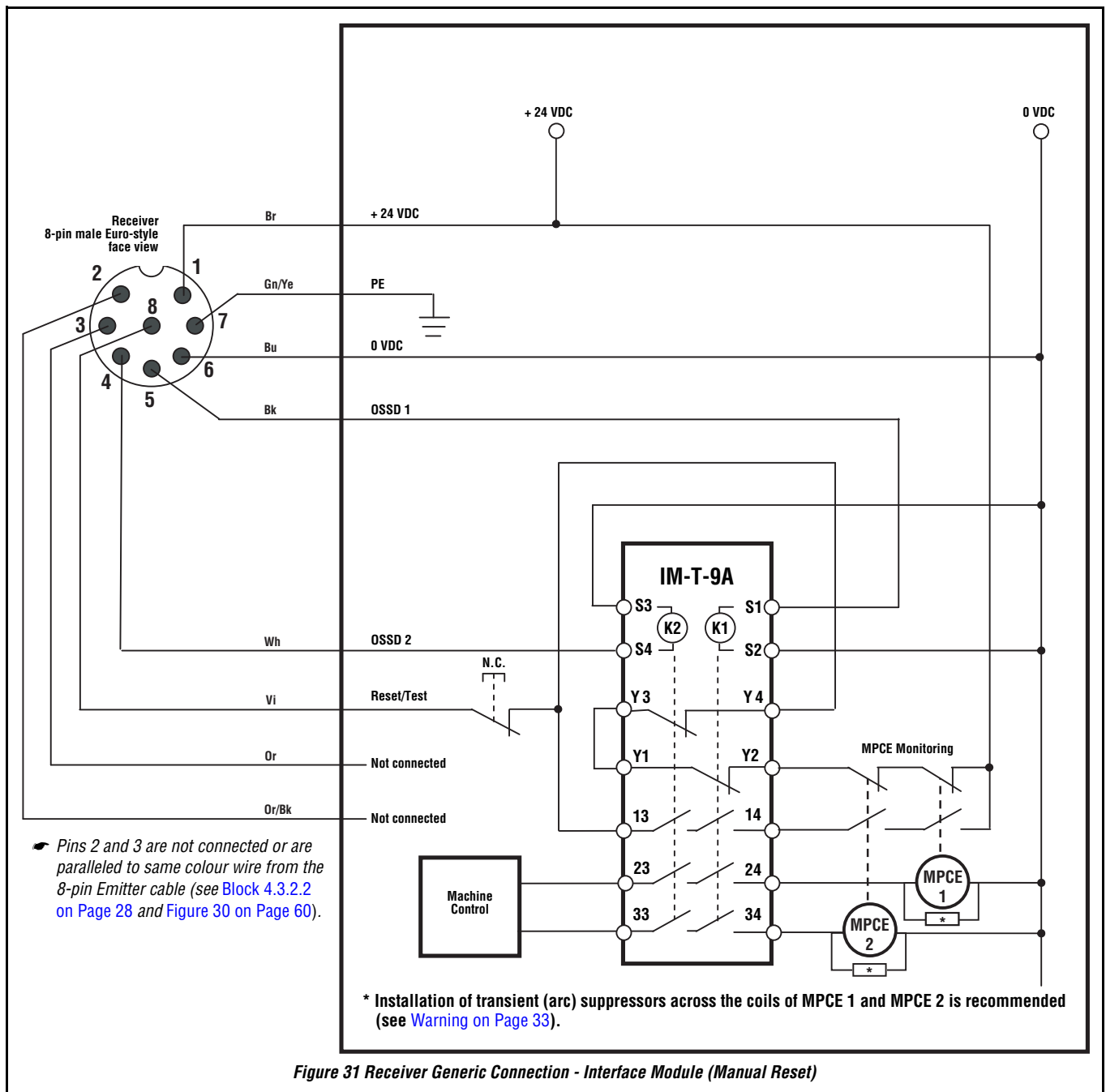
Order Part No.	Description
119240	Instruction Manual (European English version)
119242	Daily Checkout Card (European English version)
119241	Six Monthly Checkout Card (European English version)
119246	Instruction Manual (European French version)
119248	Daily Checkout Card (European French version)
119247	Six Monthly Checkout Card (European French version)
119243	Instruction Manual (European German version)
119245	Daily Checkout Card (European German version)
119244	Six Monthly Checkout Card (European German version)
119249	Instruction Manual (European Italian version)
119251	Daily Checkout Card (European Italian version)
119250	Six Monthly Checkout Card (European Italian version)

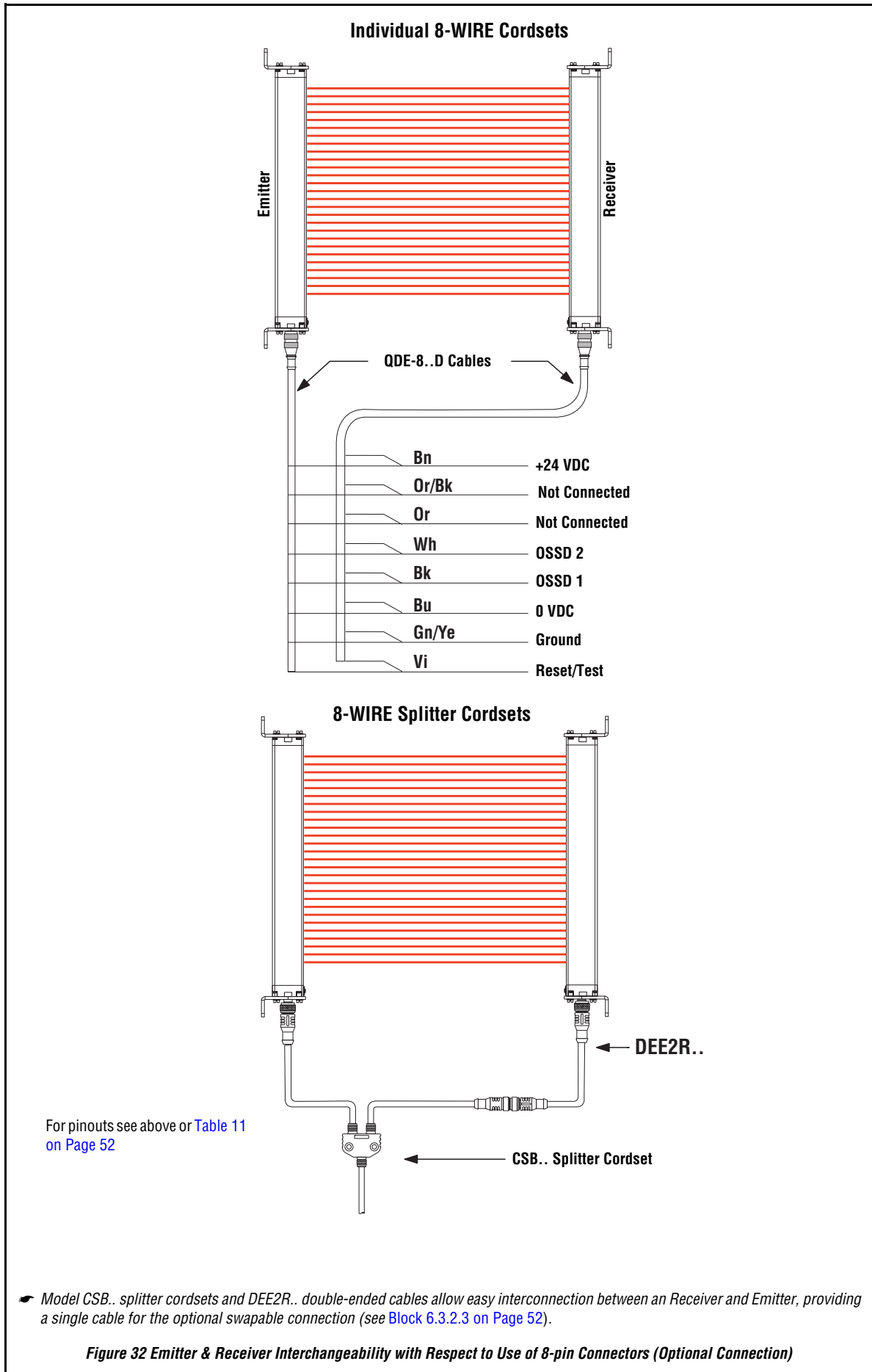
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A1 WIRING DIAGRAMS





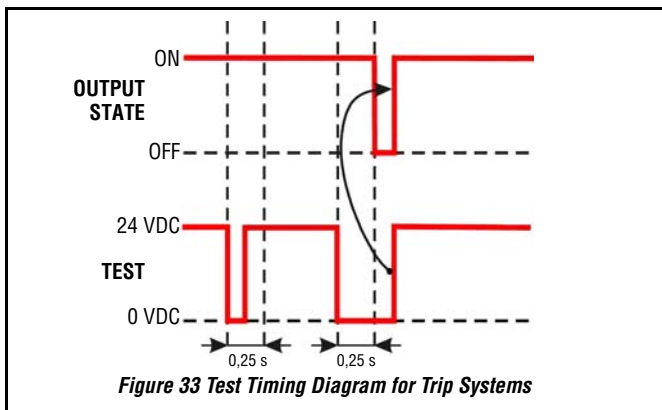




A2 TIMING DIAGRAMS

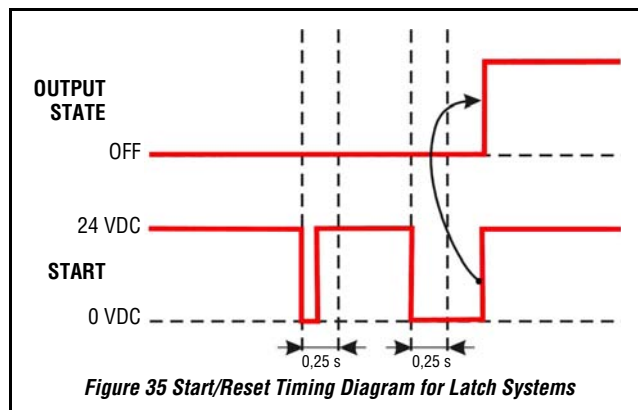
A.2.1 TRIP SYSTEMS TIMING

To reliably generate a test [check] of the EZ-SCREEN Type 2 System configured for Trip Output and its interface, the TEST/RESET input (pin 8) must be opened for longer than 0,25 s. Shorter than 0,25 s periods should be ignored. Once the TEST/RESET input (pin 8) has re-closed and the defined area is clear, the OSSD outputs turn ON (see [Figure 33 on Page 63](#)).



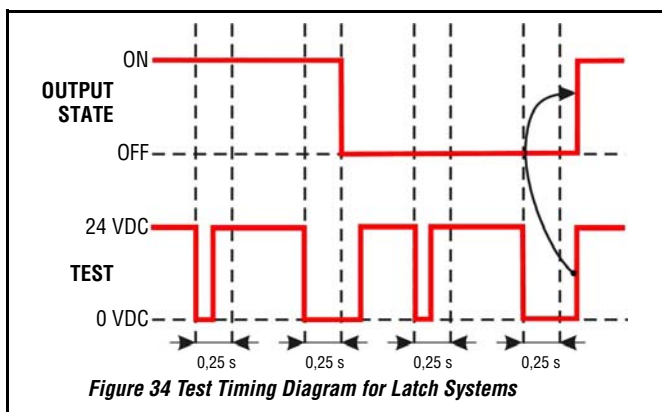
A.2.3 TRIP-LOCKOUT/RESET & LATCH-START/RESTART SYSTEMS TIMING

To clear a power-up lockout (start), a latch condition (restart), or a fault lockout condition (reset), the defined area should be cleared and the TEST/RESET input (pin 8) opened for more than 0,25 s then re-closed. Assuming the Defined Area is clear, the OSSD outputs turn ON (see [Figure 35 on Page 63](#)).



A.2.2 LATCH SYSTEMS TEST TIMING

To reliably generate a test [check] of the EZ-SCREEN Type 2 System configured for Latch Output and its interface, the TEST/RESET input (pin 8) must be opened for longer than 0,25 s. Shorter than 0,25 s periods should be ignored. To clear a power-up lockout (start), a latch condition (restart) or a fault lockout condition (reset), the defined area should be cleared and the TEST/RESET input (pin 8) opened for more than 0,25 s then re-closed. Assuming the Defined Area is clear, the OSSD outputs turn ON (see [Figure 34 on Page 63](#)).



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A3 GLOSSARY & ABBREVIATIONS

List of Abbreviations

CE	Conformité Européenne (French translation of European Conformity)
DIS	Development Information System
EN	European Norm
ESPE	Electro-sensitive Protective Equipment
FMEA	Failure Mode & Effects Analysis
FSD	Final Switching Device
IEC	International Electro technical Commission
IP...	Ingress Protection (Class)
ISO	International Organisation for Standardisation
LED	Light Emitting Diode
MPCE	Machine Primary Control Element
OSSD	Output Signal Switching Device
PLC	Programmable Logic Controller
QD	Quick Disconnect
VDC	Voltage Direct Current

Glossary of Terms

Blocked Condition A condition of the System when an opaque object of sufficient size blocks/interrupts one or more beams of the light grid. When a Blocked condition occurs, OSSD 1 and OSSD 2 outputs simultaneously turn off within the system response time.

Brake A mechanism for stopping or preventing motion.

Control Reliability A method of ensuring the performance integrity of a control system. Control circuits are designed and constructed so that a single failure or fault within the system does not prevent the normal stopping action from being applied to the machine when required, or does not create unintended machine action, but does prevent initiation of successive machine action until the failure is corrected.

CE Conformité Européenne (French translation of European Conformity). The CE mark on a product or machine establishes its compliance with all relevant European Union (EU) Directives and the associated safety standards.

Clutch A mechanism that, when engaged, transmits torque to impart motion from a driving member to a driven member.

Defined Area The screen of light generated between the Emitter and Receiver of a Light Screen system. When the defined area is interrupted by an opaque object of a specified cross section, a Trip or Latch condition results.

Designated Person A person or persons identified and designated in writing, by the employer, as being appropriately trained and qualified to perform a specified check-out procedure (see [Designated Person as specified in Block 1.13.1 on Page 8](#)).

Detection Zone The Light Screen generated by the System. When the detection zone is interrupted by an opaque object of a specified cross section or larger, a trip condition (or latch condition, depending on the Controller) results.

Emitter The light-emitting component of the System, consisting of a synchronized modulated infrared LED. The Emitter, together with the Receiver, creates a vertical light grid used to detect a body or torso as a person enters a hazardous area.

External Device Monitoring This feature allows the System to monitor the status of external devices, such as MPCEs.

Failure Mode and Effects Analysis (FMEA) A testing procedure by which potential failure modes in a system are analysed to determine their results or effects on the system. Component failure modes that produce either no effect or a lockout condition are permitted; failures which cause an unsafe condition (a failure to danger) are not. Banner EZ-SCREEN Type 2 System(s) are extensively FMEA tested.

Failure to Danger A failure which delays or prevents a machine safety system from arresting dangerous machine motion.

False Proxing Sensor activation due to shiny or reflective surfaces.

Final Switching Device (FSD) The component of the machine's safety-related control system that interrupts the circuit to the machine primary control element (MPCE) when the output signal switching device (OSSD) goes to the OFF-state.

Fixed Guarding/Hard Guarding Screens, bars, or other mechanical barriers that prevent a person from entering or remaining in the hazard area undetected.

Forced-Guided Contacts Relay contacts that are mechanically linked, so that when the relay coil is energized or de-energized, all of the linked contacts move together. If one set of contacts in the relay becomes immobilized, no other contact of the same relay will be able to move. The function of forced-guided contacts is to enable the safety circuit to check the status of the relay. Forced-guided contacts are also known as positive-guided contacts, captive contacts, locked contacts or safety relays.

Full Revolution Devices A type of machine drive arranged such that, once started, the machine can only be stopped when the full cycle is complete. Examples include positive key clutches and similar mechanisms. System may not be used with full-revolution devices.

Guarded Machine The machine whose point of operation is guarded by the Light Screen system.

Hard Guarding See [Fixed Guarding on page 66](#).

Hazardous Area An area that poses an immediate or impending physical hazard.

Internal Lockout A lockout condition that occurs due to an internal System problem. Indicated by the red Status indicator (only) flashing. Requires the attention of a Qualified Person.

Key Reset A key-operated switch used to restore the FSDs and SSD to the ON state from a lockout condition. Also refers to the act of using the switch to Reset the System.

Latch Condition The response of the OSSD outputs (they turn OFF) when an object blocks/interrupts a light beam of the System operating in Latch mode. A manual Reset must be performed after all objects are removed (beam(s) clear) to Reset the output latch and allow the outputs to turn ON.

Lockout condition A condition of the System that is automatically attained when it detects internal or certain external errors. A lockout condition causes all of the System OSSD outputs to turn or remain OFF, sending a stop signal to the guarded machine. To restore the System to Run mode, all errors must be corrected and a manual Reset must be performed.

Machine Operator An individual who performs production work and who controls operation of the machine.

Machine Primary Control Element (MPCE) An electrically powered element, external to the System which directly controls the machine's normal operating motion in such a way that it is last (in time) to operate when motion is either initiated or arrested.

Machine Response Time The time between the interruption by the System OSSD's and the instant when the dangerous parts of the machine reach a safe state by being brought to rest.

Minimum Safety Distance That distance, along the direction of approach, between the outermost position at which the appropriate test piece is just detected and the nearest dangerous machine part(s). Also called Separation Distance.

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

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

Opposed Mode The Emitter and Receiver are positioned opposite each other so that the light from the Emitter is aimed directly at the Receiver. An object is detected when it interrupts the sensing path established between the Emitter and Receiver.

Optical Crosstalk Whenever two or more Emitter and Receiver pairs are adjacent to one another, optical interference may potentially take place between systems. To minimize this, positions of Emitters and Receivers should be alternated.

Optical Short Circuits An unintentional deflection of a beam(s) around an object in the defined area caused by a reflective surface located adjacent to the defined area.

Output Signal Switching Device (OSSD) The component of the electro-sensitive protective equipment (ESPE) connected to the control system of the machine which, when the sensing device is actuated during normal operation, responds by going to the OFF-state.

Part-Revolution Clutch A type of clutch that may be engaged or disengaged during the machine cycle. Part-revolution clutched machines use a clutch/brake mechanism, which can arrest machine motion at any point in the stroke or cycle.

Pass-through hazard A pass-through hazard occurs when an individual is allowed to cross the safeguard (which issues a stop command to remove the hazard). Subsequently, the person may cross into the hazardous area but their presence is no longer detected. A danger arises because the machine's hazardous motion may resume while personnel are within the safeguarded area.

Point Of Operation The area of the guarded machine where a workpiece is positioned and a machine function (for example, shearing, forming, punching, assembling, welding) is performed upon it.

Point-of-Operation Guarding Safeguards, such as fixed guards or Light Screens, which are designed to protect personnel from hazardous machine motion when close to the machine's point of operation.

Protected Height The distance between the centre of the top beam and the centre of the bottom beam of a light grid.

Qualified Person A person or persons who, by possession of a recognized degree or certificate of professional training, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve problems relating to the subject matter and work (see [Qualified Person as specified in Block 1.13.2 on Page 8](#)).

Receiver The light-receiving component of the System, consisting of a synchronized photo transistor.

The light-receiving component of the System, consisting of a grid of synchronized photo transistors. The Receiver, together with the Emitter, creates a vertical light grid used to detect a body or torso as a person enters a hazardous area.

Reference Plane A known plumbed level surface or object from which to measure from (for example, a level building floor) to the same point(s) on an Emitter and Receiver to verify their mechanical alignment.

Reset The use of a manually operated switch to restore the OSSD's to the ON state from a lockout or a latch condition.

Resolution (as per TUV) The minimum diameter object that a Light Screen can reliably detect. Objects of this diameter or greater are detected anywhere in the sensing field. A smaller object can pass undetected through the Light Screen if it passes exactly midway between two adjacent light beams. See also [Specified Test Piece on page 67](#).

Response Time The time between the physical initiation of the safety device and the machine coming to a stop or the risk being removed.

Self Checking (circuitry) A circuit with the capability to electronically verify that all of its own critical circuit components, along with their redundant backups, are operating properly. Banner System(s) are self-checking.

Single Stroke Press See [Full-revolution Device on page 66](#).

Specified Test Piece: An opaque object of the minimum cross section required to place the EZ-SCREEN Type 2 System into a trip or latch condition when inserted into any part of the detection zone. See also [Object Detection Capability on page 66](#).

Supplementary Guarding Additional electro-sensitive safety device(s), and/or hard guarding measures, used for the purpose of preventing a person from entering or remaining in the hazard area undetected.

Test Piece An opaque object of sufficient size used to block a light grid beam to test the operation of the System.

Trip Condition In trip output models, the response of the FSD relays when an object equal to or greater than the diameter of the specified test piece enters the detection zone. In a trip condition, FSD 1 and FSD 2 simultaneously de-energise and open their contacts. A trip condition clears automatically when the object is removed from the detection zone. See also [Latch Condition on page 66](#).

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A4 CUSTOMER SERVICE INFORMATION

The following is a list of addresses for Banner Representatives and Distributors in Europe:



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