



**ALARM CONTACT:** a low-load-capacity, non-safety-related relay contact within a perimeter guarding system, whose primary purpose is to control an alarm. After the system has been cleared for operation (brought into the RUN condition) by a reset, the alarm relay contact will close for either a *latch* or a *lockout condition*.

**ANTIREPEAT:** the part of the control system designed to limit the machine to a single stroke or cycle if the tripping or actuating means is held operated.

**ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE):** the American National Standards Institute, an association of industry representatives which develops technical standards which include safety standards. These standards comprise a consensus from a variety of industries on good practice and design. ANSI standards relevant to application of safety products include the ANSI B11 Series, and ANSI/RIA R15.06 (industrial robots and robot systems).

**AUXILIARY MONITOR CONTACT:** a low-load-capacity, non-safety-related relay contact that follows the action of the output relays and whose primary purpose is to communicate system status to a PLC.

**AUTO POWER-UP:** a feature of safety light screen systems which, when switched “ON”, enables the system to be powered up (and recover from a power interruption) without the necessity of a key reset. When *Auto Power-up* is “ON”, the safety light screen controller automatically begins internal diagnostics upon power-up, and automatically resets the system if it passes the diagnostic check. With *Auto Power-up* “OFF”, a manual reset is required.



**BG:** Berufsgenossenschaft – a German national insurance agency. The legislative division develops safety standards. The executive division collects premiums from employers and polices German industry for compliance with its safety standards.

**BLANKING:** a programmable feature of a safety light screen system which allows the light screen to ignore certain objects located within the defined area. See *exact blanking*, *fixed blanking*, and *floating blanking*.

**BRAKE:** a mechanism for stopping or preventing machine motion.



**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.

**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.

**CSA:** Canadian Standards Association, testing agency similar to Underwriters Laboratories, Inc. (UL) in the United States. A product that is “CSA certified” has been type-tested and approved by the Canadian Standards Association as meeting electrical and safety codes.



**DEFINED AREA:** the “screen of light” generated between the emitter and receiver of a safety 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 checkout procedure.

**DIVERSE REDUNDANCY:** in diverse redundancy, the redundant components are of different design, and any microprocessor programs used must run from different instruction sets.

**DOUBLE INSULATION:** complies with IEC 60947-5-1, Annex F. This symbol represents devices which meet the constructional requirements and tests for class II control circuit devices or parts of devices in which insulation of class II according to IEC 60536 is achieved by encapsulation.



**EMERGENCY STOP (E-STOP):** arrest of dangerous machine motion resulting from actuation of an emergency stop switch. The switch may be in the form of a safety switch, button, trip cable, or foot bar used in conjunction with an emergency stop safety module.

**EMITTER:** the light-emitting component of a safety light screen system, consisting of a row of synchronized modulated LEDs. The emitter, together with the receiver (placed opposite), creates a “screen of light” called the *defined area*.

**EXACT BLANKING:** a feature that allows a safety light screen system to be programmed to ignore objects (such as brackets or fixtures) which will always be present anywhere within the area of detection, so that the presence of these objects will not cause the *Final Switching Devices (FSDs)* of the system to *trip* or *latch*. In exact blanking, the safety light screen system is programmed to ignore a specified total number of light beams. If more than the specified number of beams are blocked, the FSDs will trip or latch. If fewer than the specified number of beams are blocked, a *lockout condition* will occur. Exact blanking is offered with MACHINE-GUARD and PERIMETER-GUARD Systems.

**EXTERNAL DEVICE MONITORING (EDM):** a means by which a safety device (such as a safety light screen) actively monitors the state (or status) of external devices that may be controlled by the safety device. A lockout of the safety device will result if an unsafe state is detected in the external device. External device (s) may include, but are not limited to: MPCEs, captive contact relays/contactors, and safety modules.

**FAILURE TO DANGER:** a failure which delays or prevents a machine safety system from arresting dangerous machine motion.

**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 BLANKING:** a feature that allows a safety light screen system to be programmed to ignore objects (such as brackets or fixtures) which will always be present at a specific location within the *defined area*, so that the presence of these objects will not cause the *Final Switching Devices (FSDs)* of the system to trip or latch. If any of the fixed objects are moved within or removed from the defined area, a *lockout condition* results.

**FLOATING BLANKING:** a feature that allows a safety light screen system to be programmed to produce an intentionally disabled light beam within the light screen, which appears to move up and down (“float”) in order to allow the feeding of an object through the screen (the *defined area*) at any point along its length without tripping the final switching devices and causing a *trip* or *latch condition*. MICRO-SCREEN, MINI-SCREEN and MULTI-SCREEN Systems offer floating blanking.

**FMEA (FAILURE MODE AND EFFECTS ANALYSIS):** a testing procedure by which potential failure modes in a system are analyzed 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 safety products are extensively FMEA tested.

**FORCED-GUIDED CONTACTS:** relay contacts that are mechanically linked together, 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”. All Banner safety modules and safety light screen systems use output modules with forced-guided contacts.

**FULL-REVOLUTION DEVICES:** a method 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. Banner safety light screen systems may **not** be used with full-revolution devices.

**HAND CONTROL:** a hand-operated mechanism or device used as an actuating control. Two normally open “input switches” are used as hand controls in a *two-hand-control system*.

**HARD GUARD:** screens, bars, or other mechanical barriers affixed to the frame of the machine intended to prevent entry by personnel into the hazardous area(s) of a machine, while allowing the point of operation to be viewed. The maximum size of openings is determined by Table O-10 of OSHA standard 1910.217. Also called a “fixed barrier guard”.

**HAZARDOUS AREA:** an area that poses an immediate or impending physical hazard.

**HAZARD POINT:** the closest reachable point of the *hazardous area*.

**HOSTAGE CONTROL DEVICE:** term used in ANSI standards to describe any actuating control device or mechanism that prevents the operator from reaching the hazard point during normal cycling of the machine. A *two-hand-control device* is an example of a hostage control device.

**INTERNAL LOCKOUT:** a *lockout condition* that is due to an internal safety light screen system problem. Indicated by the red Status Indicator LED (only) flashing. Requires the attention of a *Qualified Person*.

**KEY RESET:** a key-operated switch that is used to restore the *Final Switching Devices (FSDs)* and *Secondary Switching Device (SSD)* of a safety light screen system to the ON state following a *lockout condition*. Also refers to the act of using the switch to reset a Safety System from a *latch condition*.

**LATCH CONDITION:** the response of the *Final Switching Device (FSD)* relays when an object equal to or greater than the diameter of the specified test piece enters the *defined area*. In a *latch condition*, FSD1 and FSD2 simultaneously de-energize and open their contacts. The contacts are held (latched) open until the object is removed from the *defined area* and a reset is performed. A latching output is used most often in perimeter guarding applications.

**LOCKOUT CONDITION:** a condition of a safety light screen system that is automatically attained: (1) when its power is initially turned on or interrupted and restored (a power-up/power interrupt lockout), and (2) in response to certain failure signals (an *internal lockout*). When a lockout condition occurs, the safety light screen system’s FSD and SSD contacts open, and a key reset is required to return the system to the RUN condition.

**MACHINE OPERATOR:** an individual who performs production work and who controls operation of the machine.

**MACHINE PRIMARY CONTROL ELEMENT (MPCE):** an electrically-powered element which directly controls the machine’s normal operating motion in such a way that the element is last (in time) to operate when machine motion is either initiated or arrested.

**MACHINE RESPONSE TIME:** the time between the activation of a machine stopping device and the instant when the dangerous parts of the machine reach a safe state by being brought to rest.

**MACHINE SECONDARY CONTROL ELEMENT (MSCE):** a machine control element independent of the *Machine Primary Control Element(s) (MPCEs)*, capable of removing the source of power from the prime mover of the relevant dangerous machine parts.

**MASTER STOP CONTROL (MSC):** an electrically powered device, external to the E-stop Safety Module, which stops the machinery being controlled by immediately removing electrical power to the machine and (when necessary) by applying braking to dangerous motion (reference ANSI B11.19, section 5.2: “Stop Control”). This stopping action is accomplished by removing power to the actuator coil of either *Master Stop Control Element (MSCE)*.

**MINIMUM OBJECT SENSITIVITY:** the minimum-diameter object that a safety light screen system can reliably detect. Objects of this diameter or greater will be detected anywhere in the sensing field. A smaller object can pass undetected through the light if it passes exactly midway between two adjacent light beams. See also *Specified Test Piece*.

**MPCE MONITOR CONTACTS:** the normally open and normally closed contacts of a *guarded machine’s* MPCEs which are connected in series with the power supply of the safety light screen system. Any inconsistency of action between the two sets of monitor contacts will remove power from the safety light screen system and cause a *lockout condition*.

**MUTING:** the automatic suspension of the safeguarding function of a safety device during a non-hazardous portion of the machine cycle.

**OSHA (OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION):** a U.S. Federal agency, Division of the U.S. Department of Labor, that is responsible for the regulation of workplace safety. OSHA regulations often follow ANSI standards, including mechanical power press requirements (OSHA CFR 1910.217). These regulations become law when adopted by OSHA, and must be followed in the U.S..

**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.

**POINT OF OPERATION:** the location of a machine where material or a workpiece is positioned and a machine function is performed upon it.

**POINT-OF-OPERATION GUARDING:** machine guards, such as a hard guards or safety light screens, which are designed to protect personnel from hazardous machine motion when close to the machine’s point of operation.

**POSITIVE-OPENING SAFETY CONTACTS:** contacts of safety switches which are forced open when actuated, without reliance upon spring action, as per the requirements in IEC 60947-5-1, Annex K.

**POWER-UP/POWER-INTERRUPT LOCKOUT:** a *lockout condition* of a safety light screen system that, if *Auto Power-up* is “OFF”, occurs when the System is powered up (including upon power-up after a loss of power). Requires a key reset by a *Designated Person*.

**PROTECTIVE EARTH:** complies with the requirements of IEC 60947-1 for identification of the protective earthing terminal.

**PSDI (PRESENCE-SENSING DEVICE INITIATION):** an application in which a presence-sensing device is used to actually start the cycle of a machine. In a typical situation, an operator manually positions a part in the machine for the operation. When the operator moves out of the danger area, the presence-sensing device starts the machine (no start switch is used). The machine cycle runs to completion, and the operator can then insert a new part and start another cycle. The presence-sensing device continually guards the machine. Single-break mode is used when the part is automatically ejected after the



machine operation. Double-break mode is used when the part is both inserted (to begin the operation) and removed (after the operation) by the operator. PSDI is defined in OSHA CFR 1910.217. Banner safety light screen systems may **not** be used as PSDI devices on mechanical power presses, per OSHA regulation 29 CFR 1910.217.

**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 (ANSI B30.2-1983).

**RECEIVER:** the light-receiving component of a safety light screen system, consisting of a row of synchronized phototransistors. The *receiver*, together with the *emitter* (placed opposite), creates a “screen of light” called the defined area.

**SAFETY DISTANCE (TWO-HAND-CONTROL):** the minimum distance from each control actuating device of a two-hand control system to the hazard point such that the operator cannot reach the hazard point with a hand or other body part before cessation of motion of the hazardous portion of the machine cycle. See also *separation distance*.

**SAFETY RELAY:** an electromechanical relay with *forced-guided* contacts which allow the monitoring circuit of a safety device to check relay status. Also see *forced-guided contacts*.

**SAFETY INTERLOCK SWITCH:** a switch used on guard doors which is used to detect if the door is opened while the machine is running, and uses a coded actuator to prevent intentional defeat. Safety interlock switches use *positive opening contacts*, which ensure that the closed switching contact is forced open when the guard is opened, without reliance upon spring action.

**SECONDARY SWITCHING DEVICE (SSD):** A device which, in a lock-out condition, performs a back-up safety function by going to the OFF-state and initiating an appropriate machine control action, e.g., de-energizing the machine secondary control element (MSCE).

**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 safety light screen systems and safety modules are self-checking.

**SEPARATION DISTANCE (SAFETY LIGHT SCREEN):** the minimum distance from the midpoint of the *defined area* to the nearest hazard point that is required to allow the hazardous motion to come to a complete stop before a hand (or other object) can reach the nearest hazard point. Factors which influence the minimum separation distance include the machine stop time, the light screen system response time, and the light screen minimum object detection size.

**SINGLE-STROKE PRESS:** see *full-revolution devices*.

**SIMULTANEITY OF ACTUATION:** Simultaneous operation of the two actuating devices of a two-hand control system, where the time between the start of the two actuations is close to zero. *European standard prEN 574* requires simultaneity of the two actuations to be within 0.5 seconds.

**SINGLE-CYCLE MACHINE:** a machine which is limited by antirepeat control to one complete work-performing cycle for each machine actuation, even if the actuator is continuously operated.

**SPECIFIED TEST PIECE:** an opaque object of the minimum cross section required to place a safety light screen system into a *trip* or *latch condition* when inserted into any part of the defined area. Banner supplies specified test pieces with each controller. See also *minimum object sensitivity*.

**SUPPLEMENTAL GUARDING:** additional electrosensitive safety device(s) and hard guarding

measures, used for the purpose of preventing a person from reaching over, under, or around the *defined area* of an installed safety light screen system and into the *point of operation* of the *guarded machine*.

**TRIP CONDITION:** the response of the *Final Switching Device (FSD)* relays of a safety light screen system when an object equal to or greater than the diameter of the *specified test piece* enters the defined area. In a trip condition, FSD1 and FSD2 simultaneously de-energize and open their contacts. A trip condition clears automatically when the object is removed from the *defined area*.

**TWO-HAND-CONTROL DEVICE:** a control device that requires concurrent use of both of the machine operator’s hands to initiate and continue a machine cycle. A two-hand-control device protects only the hands of the machine operator, when used as a safeguarding device.

**TUV (TECHNISCHER ÜBERWACHUNGSVEREIN):** independent testing and certification organization providing EMC and Product Safety testing and certification and quality management systems registration.

**UL (UNDERWRITERS LABORATORY):** a third-party organization which tests a manufacturer’s products for compliance with appropriate standards, electrical codes, and safety codes. Compliance is indicated by their listing mark on the product.

**UL MARK OF CANADA:** identification of products listed by UL to Canadian requirements.

**UL 1998 (UNDERWRITERS LABORATORY #1998 CERTIFICATION):** complies with the requirements of UL #1998 Second Edition; “Standard for Safety for Software in Programmable Systems”

