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DUO-TOUCH® Run Bar with STB Buttons

Self-Checking Ergonomic Actuating Devices

Features

- Ergonomic design for reduced hand, wrist, and arm stresses associated with repeated switch operation; requires no physical pressure to operate
- Designed to minimize the possibility of defeat and accidental actuation
- Designed to comply with ANSI B11.19 and ISO 13851 (EN 574)
- Robust 13 gauge (0.090") cold-rolled steel construction
- Two diverse-redundant microcontroller-based photoelectric STB self-checking touch buttons:
  - Continuous internal self-checking operation
  - Immunity to ambient light, EMI and RFI interference
  - High excess gain to cut through heavy contamination
  - LED power, output, and fault indicators
- Emergency stop button on some models
- Designed to be interfaced with DUO-TOUCH SG two-hand control modules or other control systems that comply, at minimum, with ANSI NFPA 79 or IEC 60204-1 two-hand control requirements (e.g., anti-tie down)
- Accessory EZ-LIGHT™ with blue, red, green, and amber LEDs available
- Accessory brackets and telescoping floor-mounted stands available

Models

Model	Run Bar Description	Touch Button Description	E-Stop Button	Connections
STBVP6-RB1	DUO-TOUCH Run Bar, metal construction	Two model **STBVP6** optical touch buttons (solid-state complementary PNP outputs, polysulfone upper housing)	Not included	Terminal strip connection
STBVP6-RB1E02			Model **SSA-EBM-02L** E-stop button (two NC safety contacts)	
STBVP6-RB1Q8			Not included	8-pin Mini-style QD
DUO-TOUCH® Run Bar Kits	Call for assistance and availability			

* See page 12 for brackets and stand options.

WARNING . . . Not a Stand-Alone Safety Device

STB Series Touch Buttons are self-checking ergonomic actuating devices, but are not, by themselves, safety devices. To be used in a safety application, two STBs must be interfaced with a type IIIC two-hand-control module or system, such as the Banner AT-FM-10K, in order to meet all relevant safety requirements of the appropriate standards.

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Important ... read this page before proceeding!

In the United States, the functions that a Banner DUO-TOUCH Two-Hand Control System is intended to perform are regulated by the Occupational Safety and Health Administration (OSHA). Whether or not any particular DUO-TOUCH SG Two-Hand Control installation meets all applicable OSHA requirements depends upon factors that are beyond the control of Banner Engineering Corp. These factors include the specific ways the system is applied, installed, wired, operated, and maintained.

Banner Engineering Corp. has attempted to provide complete application, installation, operation, and maintenance instructions. In addition, we suggest that any questions regarding the use or installation of this two-hand control safety system be directed to the factory applications department at the telephone numbers or address shown on the back cover of this manual.

The user of this Two-Hand Control safety system must ensure that all machine operators, maintenance personnel, electricians, and supervisors are thoroughly familiar with and understand all instructions regarding the installation, maintenance, and use of this system, and with the machinery upon which it is installed.

The user and any personnel involved with the installation and use of this safety system must be thoroughly familiar with all applicable OSHA regulations and ANSI standards. The regulations and standards, listed below, directly address the use of two-hand control systems. Banner Engineering Corp. makes no claim regarding a specific recommendation of any organization, the accuracy or effectiveness of any information provided, or the appropriateness of the provided information for a specific application.

The user has the responsibility to ensure that all local, state, and national laws, rules, codes, and regulations relating to the use of this Two-Hand Control system are satisfied. Extreme care is urged that all legal requirements are met and that all installation and maintenance instructions contained in this manual are followed.

U. S. Standards Applicable to Use of Two-Hand Control Systems

ANSI B11	Standards for Machine Tools "Safety Requirements for the Construction, Care and Use"
Available from:	Safety Director AMT – The Association for Manufacturing Technology 7901 Westpark Drive McLean, VA 22102 Tel.: 703-893-2900 Fax: 703-893-1151
NFPA79	"Electrical Standard for Industrial Machinery"
Available from:	National Fire Protection Association 1 Batterymarch Park, P.O. Box 9101 Quincy, MA 02269-9101 Tel.: 800-344-3555
ANSI/RIA R15.06	"Safety Requirements for Industrial Robots and Robot Systems"
Available from:	Robotic Industries Association 900 Victors Way, P.O. Box 3724 Ann Arbor, MI 48106 Tel.: 734-994-6088

International (European) Standards Applicable to Use of Two-Hand Control Systems

ISO/TR12100-1 & -2 (EN292-1 & -2)	"Safety of Machinery – Basic Concepts, General Principals for Design, Part 1: Basic Terminology, Methodology" Part 2: Technical Principals and Specifications"
IEC/EN60204-1	"Electrical Equipment of Machines: Part 1: General Requirements" Also, request a type "C" standard for your specific machinery.
ISO13849-1 (EN954-1)	"Safety of Machinery – Safety Related Parts of Control Systems"
ISO13855 (EN999)	"Safety of Machinery – The Positioning of Protective Equipment"
ISO13851 (EN574)	"Safety of Machinery – Two-Hand Control Devices"
Available from:	Global Engineering Documents 15 Inverness Way East Englewood, CO 80112-5704 Tel.: 800-854-7179

Description

The DUO-TOUCH® Run Bar with STB Self-Checking Optical Touch Buttons is designed to satisfy the ergonomic principles found in ANSI B11.TR1 to reduce the hand, wrist, and arm stresses associated with mechanical push buttons. The rugged 13-ga. steel housing is designed to prevent inadvertent switch actuation due to objects (such as loose clothing or debris) which might accidentally block the sensing beam.

The STB Touch Buttons are touch-activated photoelectric devices designed to replace capacitive touch switches and mechanical push buttons. Their outputs activate when a finger is present in the yoke ("touch area") of the switch, interrupting the button's infrared sensing beam. These "buttons" require absolutely no physical pressure to operate, and are immune to EMI, RFI, and ambient light interference (see specifications on page 10).

The STB button's internal design incorporates dual microcontrollers, allowing hookup to a Banner DUO-TOUCH SG Two-Hand Control Safety Module (or other two-hand control systems designed to meet Type IIIC requirements per ISO 13851 (EN 574), and ISO 13849-1 category 4 requirements).

The microcontrollers in the STB buttons perform a continuous self-check: the emitter is continuously pulsed, and receiver response is checked accordingly by the microcontrollers. STB touch buttons are designed to immediately detect any internal component failure, go into lockout mode, and indicate the failure with a flashing red Fault LED.

STB Series Touch Button LED Indicators

Power On (green): Steady ON when power is applied

Output, Fault (green): Steady ON when button is activated
OFF when button is not activated
Flashing when a fault condition is detected

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Appropriate Applications

The DUO-TOUCH Run Bar is intended for use as the initiation device in a two-hand control system for most powered machinery, when machine cycling is controlled by an individual.

The two-hand control system makes the operator a "hostage" while the hazard is present, thus limiting or preventing exposure of that operator to the hazard (see Warning at right). The two-hand control actuators must be located in a way that hazardous motion is completed or stopped before the operator can release one or both of the buttons and reach the hazard (see Separation Distance on page 6).

Two-hand control systems must meet requirements found in several U.S. and international standards. See the machine-specific standard (e.g., "C-level" in ISO/EN standards), ANSI NFPA 79, IEC 60204-1, ANSI B11.19, and ISO 13851 (EN 574) for complete information. Some of the requirements are:

- Simultaneous use of both hands ("synchronous action"): both buttons must be actuated within 500 ms of one another, even under single-fault conditions. Whenever this time is exceeded, both actuating devices must be released. This requirement reduces the possibility of intentional defeat and unintended initiation.
- Continuous actuation of both buttons during the hazardous situation. Releasing one or both buttons must cause the ceasing of the hazardous situation, and before the machine cycle can continue, both buttons must be released.
- When used in single-cycle or single-stroke mode, the machine control must provide an anti-repeat feature so that the operator must release the two-hand control actuators after each machine cycle, before a new cycle can be initiated.
- The actuating devices must be protected from accidental or unintended operation.
- When used for safeguarding, the interfacing must be at an appropriate level of safety circuit integrity as determined by a risk assessment. In the U.S., the required level of integration is Control Reliability (see ANSI B11.19). In many situations governed by ISO/IEC and EN regulations, the required integration for Type IIIC per ISO 13851 (EN 574) is Category 4 per ISO 13849-1 (EN 954-1).

To assist in complying with the above requirements, Banner Engineering recommends interfacing the STB buttons of the run bar with a DUO-TOUCH SG Two-Hand Control Module, such as the model AT-FM-10K, AT-..M-13A, or AT-..M-11KM, or other Type IIIC-compliant two-hand control system. See Warnings on front page and at right.

WARNING . . . Point-of-Operation Guarding

When properly installed, a two-hand-control system using STB Touch Buttons as the actuating devices provides protection only for the hands of the machine operator. It may be necessary to install other guarding devices, such as safety light screens and/or hard guards, to protect personnel from hazardous machinery. **Failure to install appropriate point-of-operation guards on hazardous machinery can result in a dangerous condition which could lead to serious injury or death.**

CAUTION . . .
Hand Controls

The environment in which hand controls are installed must not adversely affect the means of actuation. **Severe contamination may cause slow response or false ON conditions of mechanical palm/push buttons or STB buttons. This may result in exposure to a hazard.**

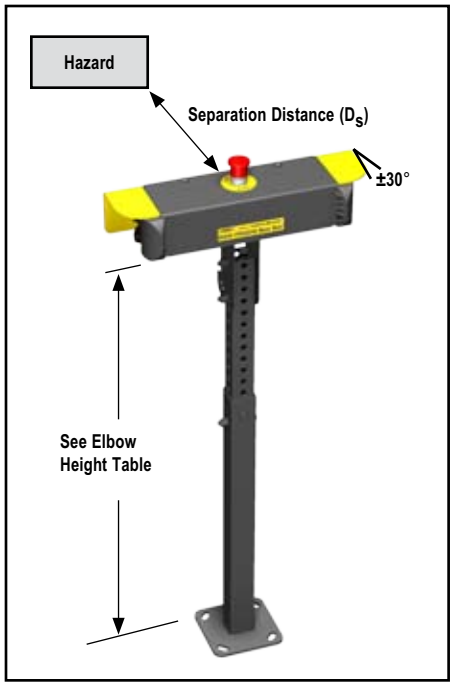

Figure 1. Run Bar location

Mechanical Installation

Mount the DUO-TOUCH Run Bar in a way that maximizes its ergonomic design and minimizes the possibility of defeat. To minimize the possibility of defeat, ISO 13851 (EN 574) recommends that the hand controls be arranged on a horizontal (or nearly horizontal) surface, 1100 mm (43.3") above the floor. The Run Bar makes this installation easy.

To maximize ergonomics, ANSI B11.TR1 recommends that for light to normal work the position should be 50 to 100 mm (2" to 4") above or below elbow height. Elbow height should be determined and adjusted for each individual operator. Anthropometric tables provide a range for guidance (see ANSI B11.TR1 Annex A):

Elbow Height (to floor, without shoes)	5%	95%
	Male/Female	Male/Female
Inches	39.2" / 36.5"	45.4" / 42.3"
Millimeters	995 / 926 mm	1153 / 1074 mm

Tilting the run bar (using the bracket's multiple-hole adjustment) can allow for varying operator heights, while maintaining a neutral wrist position. This rotation should not exceed ±30º, especially when an emergency stop button is mounted on the top of the run bar. Hand and wrist posture is considered to be neutral when the hand is neither flexed nor extended beyond about 15º of the normally relaxed position.

Per ANSI B11.TR1, the most desirable location for controls used by a standing operator is a position directly in front of the operator, and at a height between chest and waist level. Frequent reaches should nominally be made within 350 to 450 mm (14" to 18") from the center of the shoulder to the run bar. Only occasional reaches should be made within 550 to 650 mm (22" to 26"); avoid reaches farther than 650 mm (26"), see Figure 2.

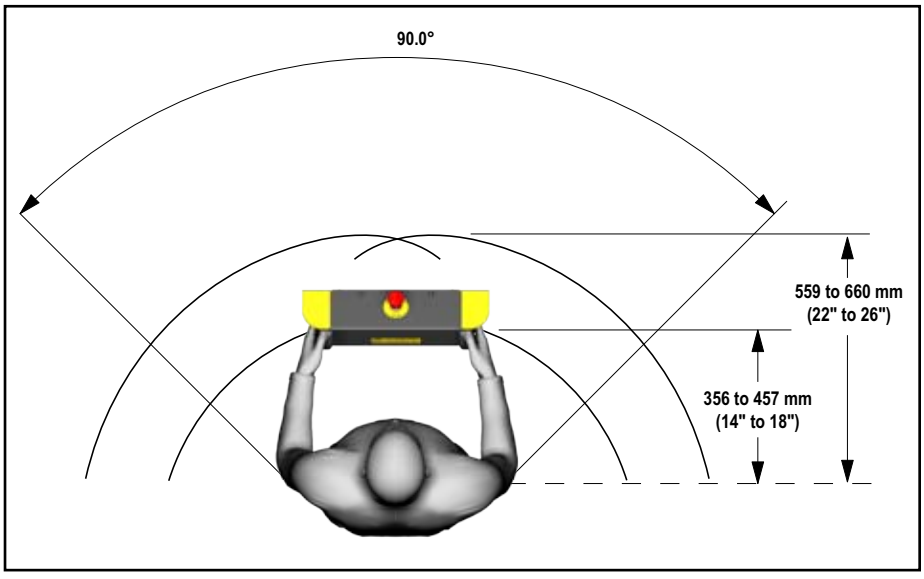

Figure 2. ANSI BII.TR1-recommended maximum-reach distances

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Example Separation Distance (D_S) Calculation

The following example illustrates the use of the formula to calculate separation distance for a part-revolution clutch machine. This example uses 0.50 seconds as a typical value for T_S and 0.02 seconds for T_h:

- K = 63" per second,
- T_S = 0.50 seconds (measured by a stop-time measuring device)
- T_r = 0.035 seconds
- T_h = 0.02 seconds
- D_S = $K \times (T_S + T_r + T_h)$
  = 63" (0.50 + 0.035 + 0.02)
  = 35"

In this example, both hand controls must be located no closer than 36" from the nearest hazard point.

WARNING . . . Location of Touch Button Controls

Hand controls must be mounted a safe distance from moving machine parts, as determined by the appropriate standard. It must not be possible for non-qualified persons to relocate them. **Failure to establish and maintain the required safety distance could result in serious injury or death.**

Separation Distance

Both hand controls must be located far enough away from the nearest hazard point that the operator cannot reach the hazard with a hand or other body part before the hazardous motion ceases. This is the "separation distance," and may be calculated as follows.

For Part-Revolution Clutch Machinery

Where the machine and its controls allow the machine to stop motion during the hazardous portion of the machine cycle, use the following formula.

$$D_S = K \times (T_S + T_r + T_h)$$

For Full-Revolution Clutch Machinery

Where the machine and its controls are designed to complete a full machine cycle, once activated, use the following formula:

$$D_S = K \times (T_m + T_r + T_h)$$

For both formulas:

- **Ds** = the separation distance in inches,
- **K** = 63" per second (the hand speed constant currently accepted by OSHA; see NOTE 1, below)
- T_S = the stop time (in seconds) of the machine, measured from the application of the "stop" signal to the final ceasing of all motion, including stop times of all relevant control elements, and measured at maximum machine velocity (see NOTE 2)
- T_r = the response time of the Safety Module as measured from the time a stop is signalled by either hand control. (Banner AT.. Series IIIc two-hand control Safety Modules approx. 0.035 seconds)
- T_h = the response time of the slowest hand control (from the time when a hand disengages that control until the switch opens; see NOTE 3)
- T_m = the maximum time (in seconds) the machine takes to cease all motion after it has been tripped. For full-revolution clutch presses with only one engaging point, T_m is equal to the time necessary for one and one-half revolutions of the crankshaft. For full-revolution clutch presses with more than one engaging point, T_m is calculated as follows:

  $T_m = (1/2 + 1/N) \times T_{cy}$

  where:

  - **N** = number of clutch engaging points per revolution
  - T_{cy} = time (in seconds) necessary to complete one revolution of the crankshaft

NOTES:

1. The OSHA-recommended hand speed constant **K** has been determined by various studies, and although these studies indicate speeds of 63"/sec to over 100"/sec, they are not conclusive determinations. The employer should consider all factors, including the physical ability of the operator, when determining the value of **K** to be used.
2. T_S is usually measured by a stop-time measuring device. If the specified machine stop time is used, add at least 20% as a safety factor to account for brake system deterioration. If the stop-time of the two redundant machine control elements is unequal, the slower of the two times must be used for calculating the separation distance.
3. T_h is usually insignificant for purely mechanical switches. However, T_h should be considered for separation distance calculation when using electronic or electromechanical (i.e. powered) hand controls. In this example, STB response time = 0.02 seconds.