



STB Self-Checking Optical Touch Button Features

- Diverse-redundant microcontroller-based photoelectric touch buttons
- Continuous internal self-checking operation
- Ergonomically designed to eliminate hand, wrist and arm stresses associated with repeated switch operation; require no physical pressure to operate
- Immune to ambient light, EMI and RFI interference
- High excess gain cuts through heavy contamination
- Yellow field cover included
- LED power, output and fault indicators

Patent Pending

STB Series Touch Button Models

Models	Cable	Upper Housing	Supply Voltage	Output Type	DUO-TOUCH [®] SG Compatibility
STBVP6 STBVP6Q STBVP6Q5	4-wire 2 m (6.5') integral cable 4-Pin Mini-style QD 4-Pin Euro-style QD	Polysulfone	10 to 30V dc	Complementary PNP	AT-FM-10K Two-hand control module
STBVR81 STBVR81Q STBVR81Q6	5-wire 2 m (6.5') integral cable 5-Pin Mini-style QD 5-Pin Euro-style QD		20 to 30V ac/dc	Two Individual Complementary Relays (see Figure 3)	
STBVP6L STBVP6LQ STBVP6LQ5	4-wire 2 m (6.5') integral cable 4-Pin Mini-style QD 4-Pin Euro-style QD	Lexan [®]	10 to 30V dc	Complementary PNP	
STBVR81L STBVR81LQ STBVR81LQ6	5-wire 2 m (6.5') integral cable 5-Pin Mini-style QD 5-Pin Euro-style QD		20 to 30V ac/dc	Two Individual Complementary Relays (see Figure 3)	

Notes:

- 9 m (30') cables are available by adding suffix "W/30" to the model number of any cabled STB (e.g., **STBVP6 W/30**)
- QD models require an accessory QD cable. See page 10 for more information.



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, such as the Banner AT-FM-10K, in order to meet all relevant safety requirements of the appropriate standards.

STB Series Self-Checking Optical Touch Buttons



Important ... read this page before proceeding!

In the United States, **Banner's STB Series Self-Checking Optical Touch Buttons are not by themselves safety devices!** If they will be used to initiate potentially dangerous machinery, certain industrial standards and regulations must be followed. Two-hand control functions are regulated by the Occupational Safety and Health Administration (OSHA). Whether or not any particular STB Touch Button 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 button 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 Actuation Device 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 Actuation Device 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 Actuation Device must be thoroughly familiar with all appropriate OSHA regulations and ANSI standards. 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 Actuation Device are satisfied. We recommend that you carefully check 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 (1997)"
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

European Standards Applicable to Use of Two-Hand-Control Systems

EN292-1	"Safety of Machinery – Basic Concepts, General Principals for Design, Part 1: Basic Terminology, Methodology"
EN292-2	"Safety of Machinery – Basic Concepts, General Principals for Design, Part 2: Technical Principals and Specifications"
EN60204-1	"Electrical Equipment of Machines: Part 1: General Requirements" Also, request a type "C" standard for your specific machinery.
EN999	"Safety of Machinery – The Positioning of Protective Equipment"
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

STB Series Self-Checking Optical Touch Buttons

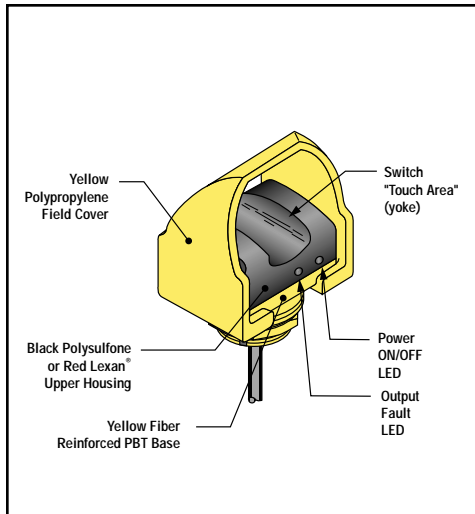


Figure 1. STB Touch Button features

STB Touch Button Description

STB Self-Checking Optical Touch Buttons are touch-activated photoelectric devices designed to replace capacitive touch switches and mechanical push buttons. Their outputs activate while a finger is in the "touch area" (yoke) of the switch, interrupting the button's infrared sensing beam.

Banner STB Series buttons are ergonomically designed to eliminate the hand, wrist, and arm stresses associated with mechanical push buttons. They require absolutely no physical pressure to operate. LED indicators light when power is on and outputs are activated.

All models are immune to EMI, RFI, and ambient light interference. STBs have either a black polysulfone or red Lexan® upper housing (depending on model) and yellow PBT base. Environmental considerations for use of the two types differ; see specifications. The 30 mm threaded base on all models provides easy mounting and easy retrofitting into existing applications.

STB Self-Checking Optical Touch Buttons are identical in fit, form and function with the proven and popular OTB Series buttons. The internal design of the new buttons, however, based on dual microcontrollers, allows the hookup to a Banner DUO-TOUCH SG Two-Hand-Control Safety Module, or other two-hand-control designed to meet Type IIIC requirements per EN 574 (requiring 1 normally open and 1 normally closed contact per input channel).

The major advantage to these second-generation touch buttons is that the microcontrollers perform a continuous self-check. The emitter is continuously pulsed, and receiver response is checked accordingly by the microcontrollers. STB Series Touch Buttons are designed to immediately detect any internal component failure, go into a lockout mode, and indicate the failure with a flashing green Fault LED.

The STB outputs, however, are not monitored by the STB circuitry, and there is no external device monitoring feedback. This output monitoring must be done with an external device, such as a Type IIIC Two-Hand-Control module.

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

Rugged yellow polypropylene (TP) field covers are supplied with all models to prevent inadvertent switch actuation due to objects (such as loose clothing or debris) which might accidentally block the sensing beam. The polypropylene material is capable of absorbing high impact (even at low temperatures) and is highly resistant to abrasion and to damage by most chemicals.



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.**

STB Series Self-Checking Optical Touch Buttons

STB Series Touch Button Installation

STB Series Self-Checking Touch Buttons were designed primarily to provide the self-checking function required in control-reliable machine cycle initiation applications. However, STBs are suitable for use anywhere mechanical push buttons or the original OTB Touch Buttons are being used today.

Both the solid-state and relay-output versions have complementary outputs and can be connected to switch power to equipment as long as the STB's switching voltage and current limits are not exceeded (see output ratings, page 8).

STBs must be connected to a type IIIC Two-Hand-Control circuit module, in most cases, when used to initiate potentially dangerous machine cycles.

Mechanical Installation

OSHA and ANSI require that the hand controls be mounted to protect them from accidental or unintentional operation. Use shields, covers, rings, collars, dividers, or similar protection to prevent accidental switch actuation and to discourage use of forearms or elbows. European standard EN 574 includes a detailed discussion of approaches to protection of hand controls.

The hand controls must be arranged to require the use of both hands for simultaneous actuation. They must be located far enough apart so that the operator cannot operate both hand controls by the use of one arm.

Figure 2 shows two methods for mounting the STB Touch Buttons. When mounted on top of the control bar, the protective field covers should be in place, as shown. For added protection, mount the STB Touch Buttons sideways under and behind a protective hood, rather than on top of the bar. This side mount prevents the operator from positioning and leaving an object in the path of the beam, intentionally bypassing the safeguard.



CAUTION ... Install Hand Controls to Prevent Accidental Actuation

Total protection for the two-hand-control system from "defeat" is not possible. However, the user is required by OSHA regulations to arrange and protect hand controls to minimize possibility of defeat or accidental actuation.



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, the STB must be interfaced with a type IIIC two-hand-control module, such as the Banner AT-FM-10K, in order to meet all relevant safety requirements of the appropriate standards.

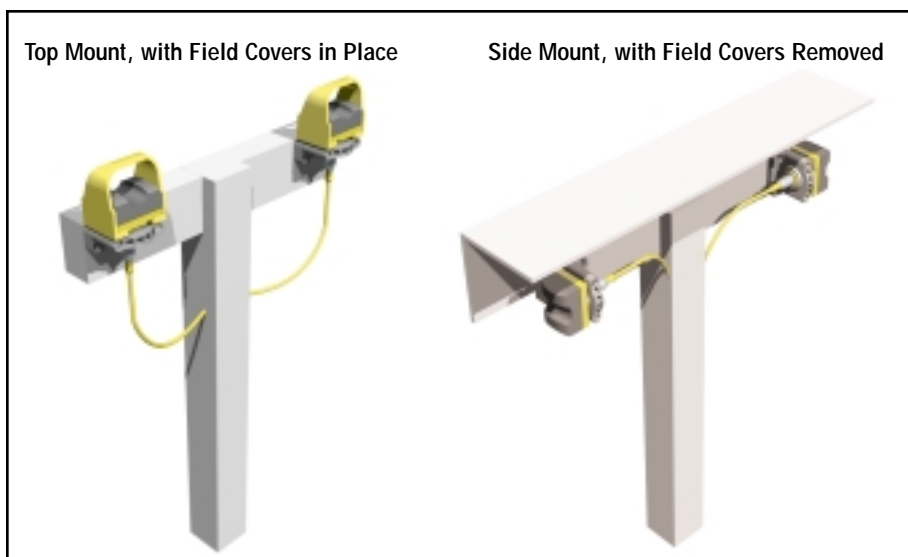


Figure 2. Install STB Buttons so that they are protected to prevent defeat or inadvertent actuation

STB Series Self-Checking Optical Touch Buttons

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 (ANSI B11.19, 4.2.4.3.2). This is the "separation distance," and may be calculated as follows [see OSHA CFR 1910.217 (c) (3) (vii) & (viii)].

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:

D_S = 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, below),

T_r = the response time of the Two-Hand-Control safety module as measured from the time either hand disengages a hand control

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, below)

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.

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 0.025 seconds for T_r and T_h :

K = 63" per second,

T_S = 0.50 seconds (measured by a stop-time measuring device)

T_r = 0.025 seconds

T_h = 0.025 seconds

$D_S = K \times (T_S + T_r + T_h)$
= 63" (0.50 + 0.025 + 0.025)
= 35"

In this example, both hand controls must be located no closer than 35" from the nearest hazard point.



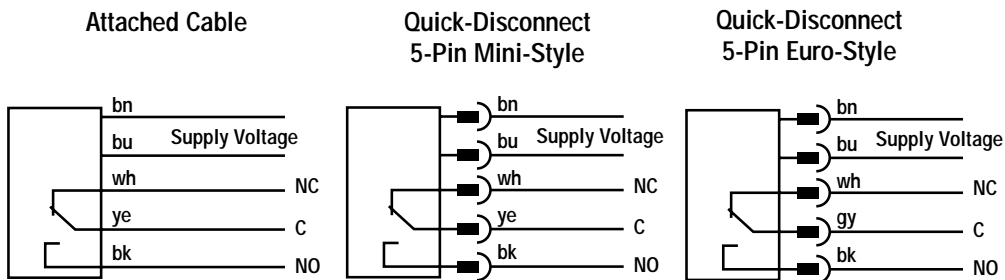
WARNING ... Location of Touch Button Controls

Hand controls must be mounted a safe distance from moving machine parts, as determined by OSHA Regulation CFR 1910.217 (c) (3) (vii) and (viii). It must not be possible for the operator or other non-qualified persons to relocate them. **Failure to establish and maintain the required safety distance could result in serious injury or death.**

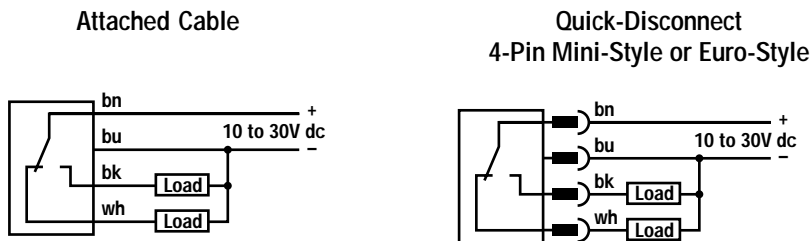
STB Series Self-Checking Optical Touch Buttons

STB Hookup Diagrams

Electromechanical Relay Output Models



Solid-State Models



WARNING ... Safety Systems Used for Two- Hand-Control

In a two-hand-control/trip system that incorporates STB Touch Buttons as the actuation devices and functions as a safeguard, the **anti-tiedown and simultaneity monitoring functions should not be performed by a non-safety-related device** (e.g., a PLC or PC). Per OSHA 29CFR1910.211(d)(62), the "safety system must...operate together as a unit, such that a single failure or single operating error will not cause injury to personnel due to point-of-operation hazards."

Refer to the appropriate standard to determine the requirements of a two-hand-control/trip system when used for safeguarding. See page 2 for a partial list of standards.

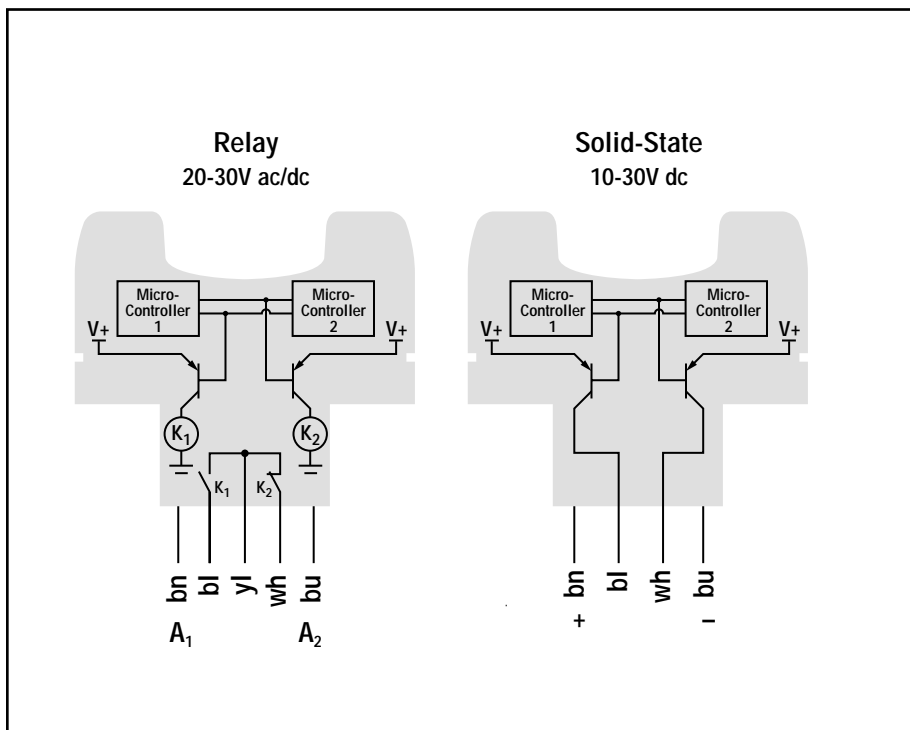


Figure 3. STB Touch Button block diagrams

STB Series Self-Checking Optical Touch Buttons

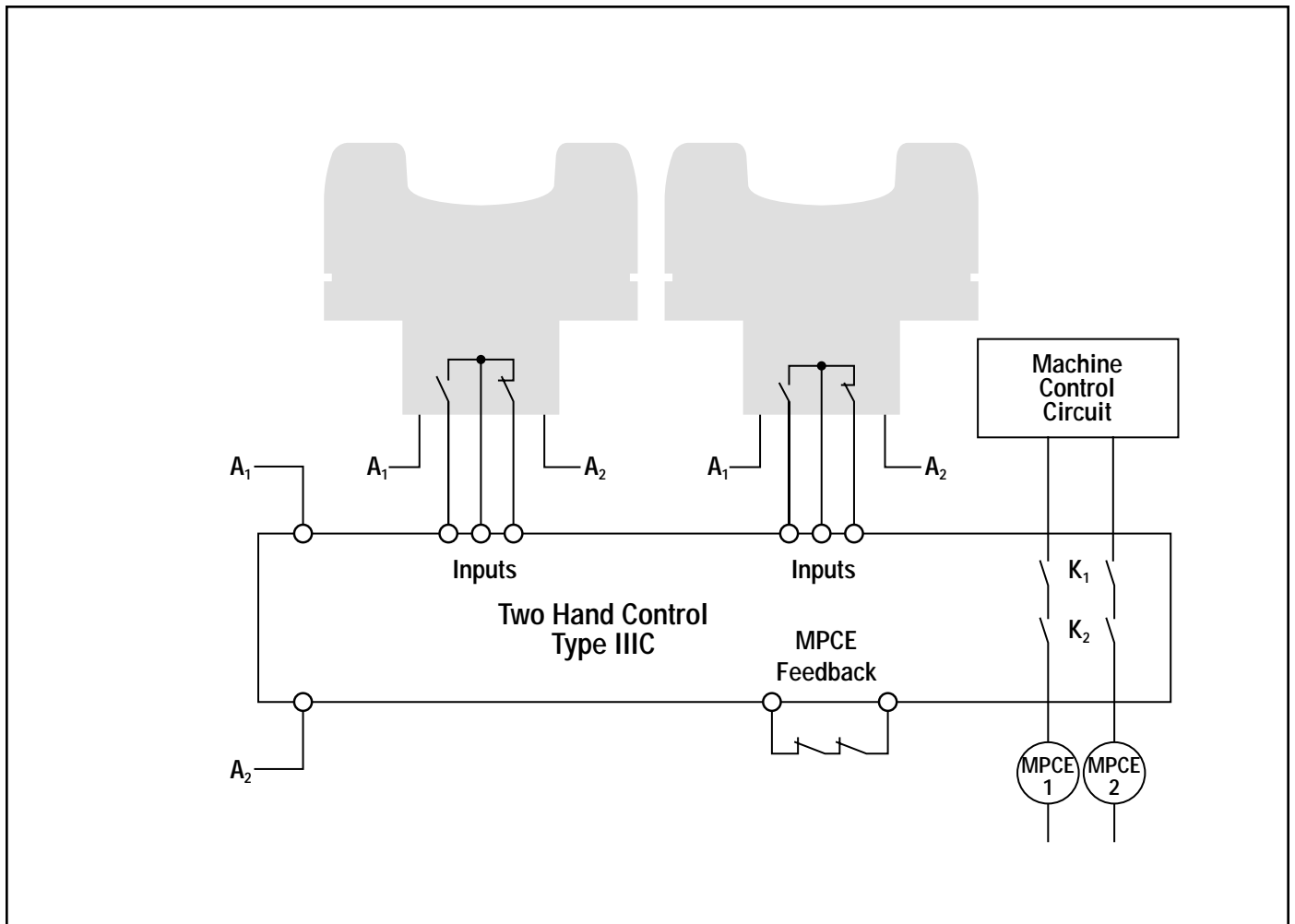


Figure 4. Generic interface of a relay-output STB Touch Button to a type IIC two-hand-control module

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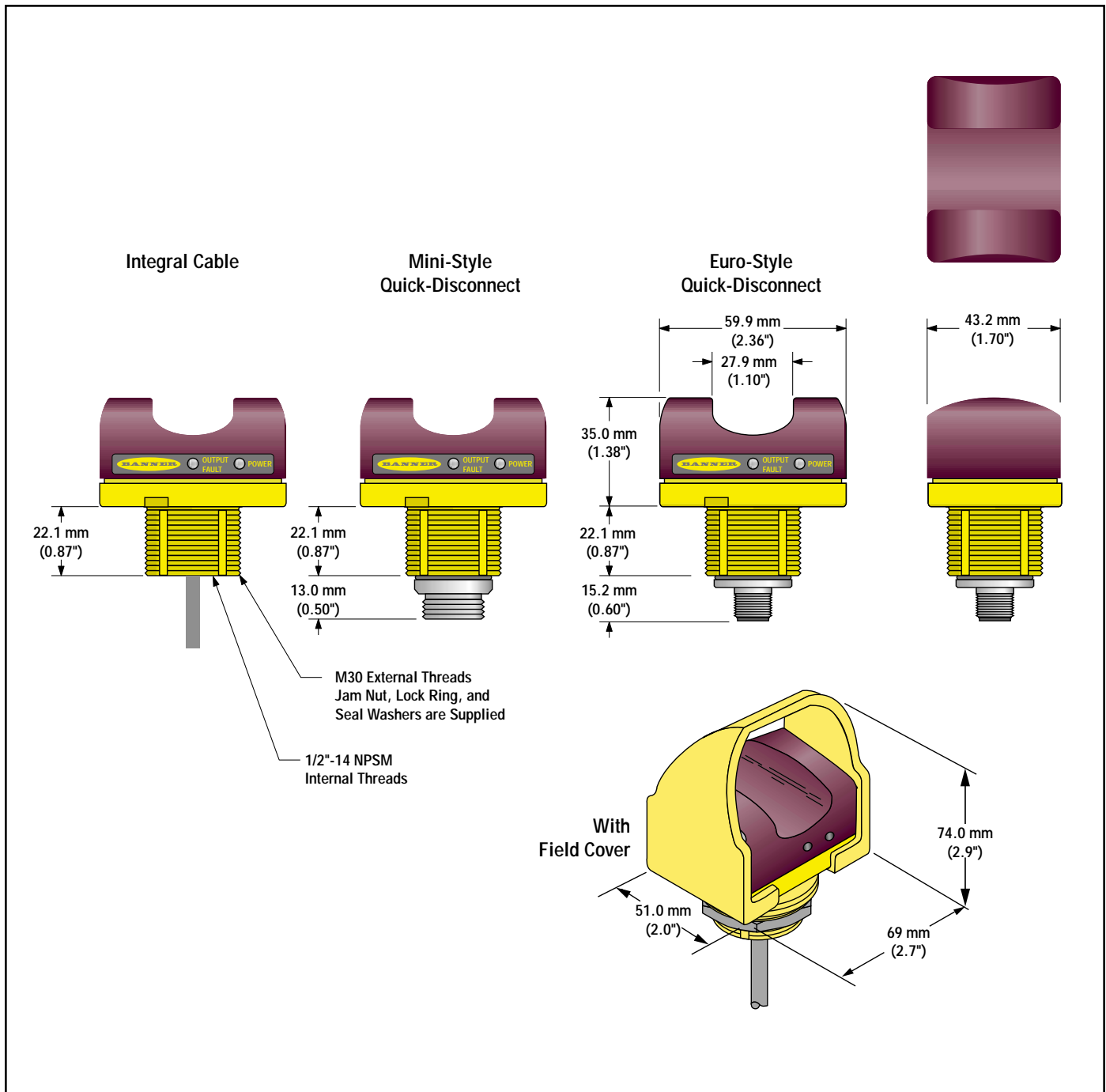


Figure 5. STB Touch Button dimensions

STB Series Self-Checking Optical Touch Buttons

STB Touch Button Specifications

Supply Voltage and Current	STBVP6 Models: 10 to 30V dc STBVR81 Models: 20 to 30V ac/dc
Supply Protection Circuitry	Protected against transient voltages and reverse polarity
Output Configuration	STBVP6 Models: Complementary PNP (sourcing) open-collector transistors STBVR81 Models: Complementary electromechanical relays
Output Rating	<p>STBVP6 Models (solid-state outputs): Maximum load: 150 mA On-state saturation voltage: ≤ 15V @ full load Off-state leakage current: < 1 μA</p> <p>STBVR81 Models (electromechanical relays): Maximum switching voltage: 150V dc/125V ac Maximum switching current: 1A Maximum resistive power: 30W dc/60VA ac Mechanical life of relays: 10⁹ cycles Electrical life of relays: 3 x 10⁶ cycles at 1 amp, 24V resistive</p>
Output Protection	All models protected against false pulse on power-up. Models with solid-state outputs have overload and short-circuit protection.
Response Time	20 milliseconds ON/OFF
Indicators	<p>2 green LED indicators: Power: ON – power applied Output/fault: ON – button is activated OFF – button is deactivated Flashing – internal fault or blocked button on power-up detected</p>
Construction	Totally encapsulated, non-metallic enclosure. Black polysulfone or red Lexan® upper housing (see Application Note below); fiber-reinforced PBT polyester base. Electronics fully epoxy-encapsulated. Supplied with polypropylene (TP) field cover.
Environmental Rating	Meets NEMA standards 1, 3, 4, 4X, 12 and 13; IEC IP66
Connections	PVC-jacketed 2 m (6.5') cables or QD fitting, depending on model. Accessory QD cables required for QD models; see Accessories, page 9. STBVP6 Models: 4-wire (4-pin Mini-style or Euro-style QD) STBVR81 Models: 5-wire (5-pin Mini-style or Euro-style QD) Integral 9 m (30') cables are also available; see model selection chart, page 1.
Ambient Light Immunity	Up to 100,000 lux
EMI/RFI Immunity	Immune to EMI and RFI noise sources, per IEC 947-5-2.
Operating Conditions	Temperature: 0° to +50°C (+32° to +122°F) Maximum relative humidity: 90% @ +50°C (non-condensing)
Application Notes	<p>Environmental considerations for models with polysulfone upper housings: The polysulfone upper housing will become brittle with prolonged exposure to outdoor sunlight. Window glass effectively filters longer wavelength ultraviolet light and provides excellent protection from sunlight. Avoid contact with strong alkalis. Clean periodically using mild soap solution and a soft cloth.</p> <p>Environmental considerations for models with Lexan® upper housings: Avoid prolonged exposure to hot water and moist high-temperature environments above 66°C (150°F). Avoid contact with aromatic hydrocarbons (such as xylene and toluene), halogenated hydrocarbons and strong alkalis. Clean periodically using mild soap solution and a soft cloth.</p>

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STB Series Self-Checking Optical Touch Buttons

Repairs

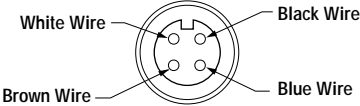
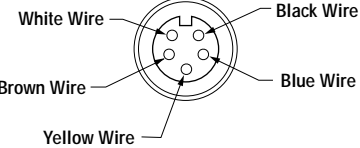
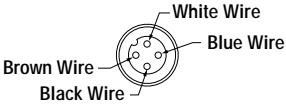
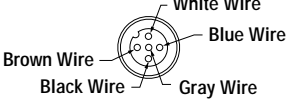
NOTE: Do not attempt any repairs to the STB Touch Buttons. They contain no field-replaceable components. Return them to the factory for warranty repair or replacement.

If it ever becomes necessary to return an STB Touch Button to the factory, please do the following:

- 1) Contact the Banner Factory Application Engineering Group at the address or at the numbers listed at the bottom of the back page. They will attempt to troubleshoot the system from your description of the problem. If they conclude that a component is defective, they will issue an RMA (Return Merchandise Authorization) number for your paperwork, and give you the proper shipping address.
- 2) Pack the components carefully. Damage which occurs in return shipping is not covered by warranty.

Accessories

STB Touch Button Quick-Disconnect (QD) Cables

Style	Model	Length	Used with:	Pin-out
4-Pin Mini Female Pin-out Straight	MBCC-406 MBCC-412 MBCC-430	2 m (6.5') 4 m (12') 9 m (30')	All STB Mini-Style QD models with solid-state outputs	
5-Pin Mini Female Pin-out Straight	MBCC-506 MBCC-512 MBCC-530	2 m (6.5') 4 m (12') 9 m (30')	All STB Mini-Style QD models with electromechanical relay outputs	
4-Pin Euro Female Pin-out Straight	MQDC-406 MQDC-415 MQDC-430	2 m (6.5') 5 m (15') 9 m (30')	All STB Euro-Style QD models with solid-state outputs	
5-Pin Euro Female Pin-out Straight	MQDC1-506 MQDC1-515 MQDC1-530	2 m (6.5') 5 m (15') 9 m (30')	All STB Euro-Style QD models with electromechanical relay outputs	

STB Series Self-Checking Optical Touch Buttons

Mounting Brackets

<p>SMB30C</p> <ul style="list-style-type: none"> • 30 mm split clamp bracket • Black reinforced thermoplastic polyester • Includes stainless steel mounting hardware 	<p>SMB30MM</p> <ul style="list-style-type: none"> • 30 mm, 12-gauge, stainless steel bracket with curved mounting slots for versatility and orientation • Clearance for M6 (1/4") hardware
<p>SMB30S</p> <ul style="list-style-type: none"> • 30 mm swivel bracket • Black reinforced thermoplastic polyester • Includes stainless steel mounting and swivel locking hardware 	<p>SMB30SC</p> <ul style="list-style-type: none"> • 30 mm swivel bracket • Black reinforced thermoplastic polyester • Includes stainless steel mounting and swivel locking hardware

STB Series Self-Checking Optical Touch Buttons



WARRANTY: Banner Engineering Corp. warrants its products to be free from defects for 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 does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.