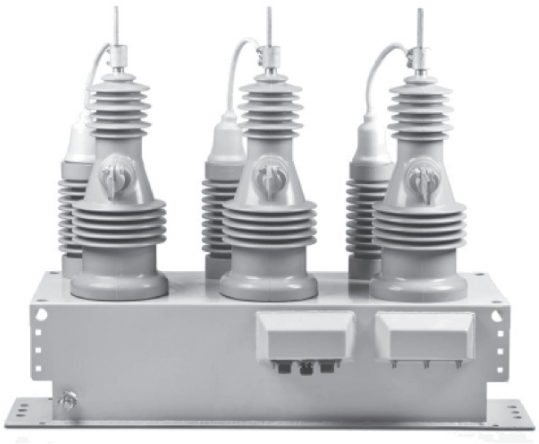
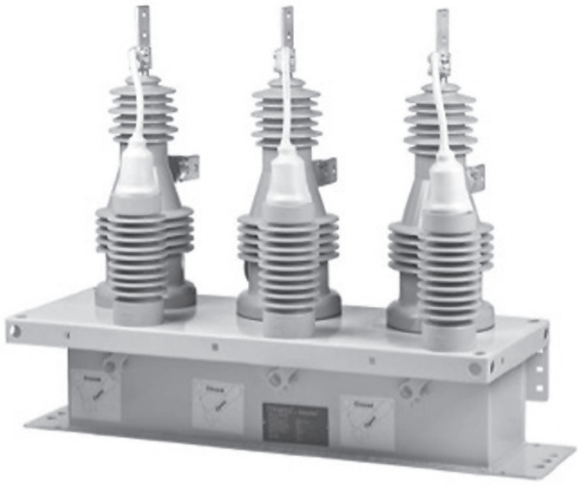
TRINETICS™

INSTALLATION INSTRUCTIONS





# SmartClose 3-phase, Synchronous Close Vacuum Capacitor Switch

The equipment covered by these installation instructions should be installed and serviced only by properly trained and qualified personnel. It is not the intent of these instructions to provide for every possible condition in connection with installation, operation or maintenance, nor to cover all details or variations in equipment options. Should problems arise which are not sufficiently covered herein or should further information be required, the matter should be directed to Hubbell Power Systems, Inc.

**SMARTCLOSE RATINGS:**

3-ph, 15kV, 110kV BIL, 200A
3-ph, 15kV, 110kV BIL, 400A
3-ph, 24kV, 125kV BIL, 200A
3-ph, 24kV, 125kV BIL, 400A

**INTRODUCTION**

SmartClose is derived from the UltraVac vacuum switch, a solid dielectric single pole device designed in conformance with ANSI Standard C37.66. Using this maintenance free technology, SmartClose is a completely integrated synchronous (or zero voltage) closing system making it compatible with nearly all existing capacitor bank control schemes. Integral to the switch are six voltage sensors and an onboard actuator to provide zero voltage closing. Each pole of the 3-phase SmartClose switch is constructed from a high performance vacuum interrupter fully encapsulated within a solid dielectric cycloaliphatic epoxy. AC power and a close signal from the capacitor bank control are the only external inputs required to provide point on wave closing in almost any capacitor switching application.

The SmartClose is available in a single body, 3-pole configuration, for use in synchronous close/zero voltage close, switched capacitor bank applications. The SmartClose synchronous closing design has been tested to reliably provide accurate closes to within 800 millionths of a second ( +17 degrees).

**INSTALLATION**

Air-break isolating switches must be installed on the supply side of vacuum switches to provide a visible disconnect. Cutouts or fused disconnects are normally used for this purpose. Maintenance work should be undertaken only after the maintenance personnel have established that the visible disconnects are open and the portion of the circuit to be worked on is grounded. Refer to local Codes & Practices for specific component requirements.

A five-pin receptacle is included for switch operation, and a six-pin receptacle is included for switch status. These receptacles can mate with five-pin and six-pin molded (or metal) connectors, respectively. The 5-pin mating cable and connector includes a six-foot 14/5 SO cable, reference Trinetics part number 33124102. The metal plug is an ITT/Cannon connector, part number CA06R18-12SF42 or equivalent, which meets the MIL-C-5015 specification. Alternate receptacle configurations are available from Trinetics. SmartClose switches may be mounted directly to a pole, structure, or cross arm. Contact Hubbell/Trinetics for more details when pole or cross arm mounting is required.

**3-PHASE SMARTCLOSE, 200A & 400A MODELS**

The three-phase, 200A & 400A SmartClose switches are provided with 2-hole NEMA tin plated bronze terminals on each bushing. Each pole operates independently; each vacuum switch can be opened or closed electrically or by manual lever. Separate opening and closing solenoids provide ideal vacuum interrupter contact motion through a rotating cam. The proprietary cam curve provides excellent weld break capability as well as improved vacuum bellows life. The mechanism utilizes sealed ball bearings to provide more than 50,000 open and 50,000 close operations. A spring latches the mechanism in either position, and also provides the toggle action. The mechanism is sealed in a corrosion resistant powder painted steel tank with zinc rich primer.

**OPERATION**

40 to 150 VAC OR VDC close or open commands should have a minimum pulse duration of 100ms. The maximum pulse duration is unlimited; inputs are opto-isolated with 50k ohm impedance. An open command takes precedence over a close command. Open and Close signals, common, neutral, and 120V for SmartClose are supplied via a 5-pin receptacle. SmartClose is designed for compatibility with legacy capacitor bank controls and systems that send a command signal when the capacitor bank should be switched. The synchronous close logic imbedded in the SmartClose mechanism tank receives the close command and implements the synchronous close. A 5-minute close inhibit timer and a loss of LV supply trip function are also imbedded and can be optionally activated prior to installation. The time to open the switch, measured from the time the signal is applied until the end of the open operation, is typically 65ms. The total time to close includes a wait time between each phase and is typically calculated as follows:

**80ms: receive external close command**
**25ms: apply command and close the first pole**
**125ms: wait before next phase command is issued**
**25ms: apply command and close the second pole**
**125ms: wait before final phase command is issued**
**25ms: apply command and close the final pole**

**405ms: Total time to close for all phases**

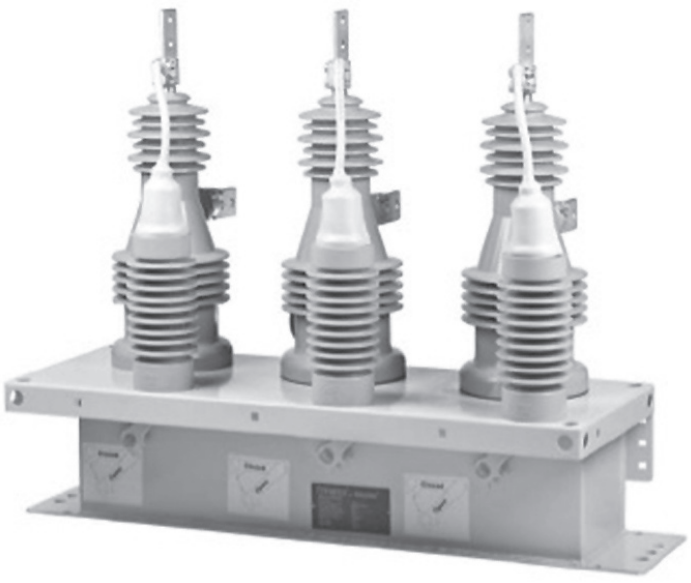
Internal micro-switches provide positive feedback when the switch mechanisms are in either the fully opened or the fully closed position. A separate 4-wire 6 pin receptacle is provided for this purpose. Pin A and Pin B terminate the series connected Form A contacts from each mechanism; all poles must be closed for continuity on Pin A and Pin B. Pin C and Pin D terminate the series connected Form B contacts from each mechanism. All poles must be open for continuity on Pin C and Pin D.

Nominal operating requirements are 120VAC, with 8A rms during close, 24A rms during open operations. Maximum acceptable supply range is 104 to 138VAC, 60Hz; 50Hz compatibility is optionally available. The LV power supply should not be rated less than 1kVA, 2% impedance. Quiescent power consumption is 5 Watts. Allow 30S for power supply at start up. A separate 2 pin receptacle for AC power direct to SmartClose is optionally available.

Minimum switch cable wire is 14AWG based on NEC Table 310.16 for 60C rating for operating current of 12-14A, or 20A with a temperature correction factor of 0.71 (14.2A).
In 3-phase ungrounded wye/delta applications, the Trinetics SmartClose has a simultaneous opening voltage rating. In non-synchronous open operations, typical operation time from the first pole to break to the third pole is 65ms.

**CONTACTS**

SmartClose has several distinct advantages: solid dielectric (no oil or gas), compact size, high reliability and vacuum interrupter technology resulting in maintenance-free operation. The design of the interrupter is conceptually simple: two separable contacts within an evacuated envelope. In practice, the design is quite complex, involving carefully selected contact materials, contact configurations and selection of envelope materials integrated with assembly, joining, and vacuum processing techniques.



**SYNCHRONOUS COMPONENTS**

SmartClose is designed considering the total site requirements for synchronous close capacitor switching. As such, several components are integrated in its design for that purpose. The standard configuration includes:

- An imbedded CPU that controls the synchronous closing function.
- Six integral voltage sensors; each pole has one internal and one tank mounted external sensor; these sensors auto detect system parameters critical to proper waveform switching.
- A constant current supply that compensates for temperature variations in key switch and drive system components.
- Fiber optic diagnostic port provide access to waveform capture files for downloading and analysis. This allows performance verification without the need for externally supplied high speed recording equipment.
- Easy receptacle interface for connection to legacy capacitor bank control systems, to eliminate the need to retrain personnel on a new cap bank controller.

**CONFIGURABLE SETPOINTS:**

Software selectable setpoints can be activated or deactived using the configuration software during installation and setup:

- A 5-minute close inhibit timer: This timer initiates after an open command and blocks all electrical close commands until the 5-minute minimum capacitor discharge time has elapsed. The default status is deactivated.
- A loss of LV supply trip: When activated, this feature detects a loss of the 120V supply (for 0.1 sec) and issues an open command to SmartClose. The supply loss is interpreted as an outage due to a protective device operation to isolate a fault. The intent is to prevent bank inrush that can occur during repetitive close operations of the protecting breaker or recloser. The default status is activated.
- Waveform automatic download: From the configuration software, the user may download waveforms to verify the accuracy of the each synchronous close operation. Using a PC, each wave form can be manually retrieved, or the waveforms can be configured for automatic retrieval after each operation. The default status is manual download.

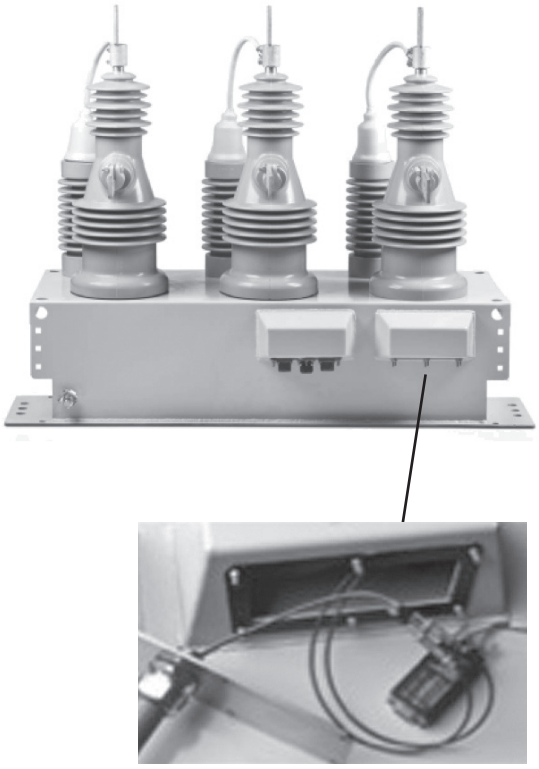
**MOUNTING POSITION OPTIONS:**

- The SmartClose is normally calibrated for zero voltage close in a vertical position.
- A horizontal mounting position can be specified during order entry.
- Proper zero voltage closing calibration at the factory requires knowledge of how the device is mounted. Mounting the device horizontally increases the speed of the closing due to less gravity acting on the mechanism, operating rod, and vacuum interrupter contacts. The high precision of this device requires this to be accounted for during calibration.

**FIBER OPTIC CONNECTIONS**

The SmartClose fiber optic interface is accessible via a separate NEMA 4 junction box. The removable 1/8" Stainless Steel gland cover plate is secured with #10-32 (6) nuts and accessed with 3/8" wrench. The user can attach flexible conduit to the cover plate with suitable hardware as deemed necessary. 2 plates are supplied to accommodate either "D" below should be 3/4" or 1" conduit.

This compartment contains the fiber optic interface for downloading the waveforms used in verifying the accuracy of the synchronous close. The interface consists of a 12" length of fiber optic cable pair, terminated with two (2) versatile, Type V, snap-on AVAGO HFBR-4501/45 simplex connectors. Also includes two (2) AVAGO HFBR-4505/4515 bulk head connectors in the junction box. A fiber optic to USB adapter is available through Trinetics. The interface software and adapter instructions are available on the Trinetics website or from your local HPS representative. Alternatively, a SEL-2800 RS-232 to fiber optics adapter can be sourced separately if or when conversion to RS-232 is appropriate.



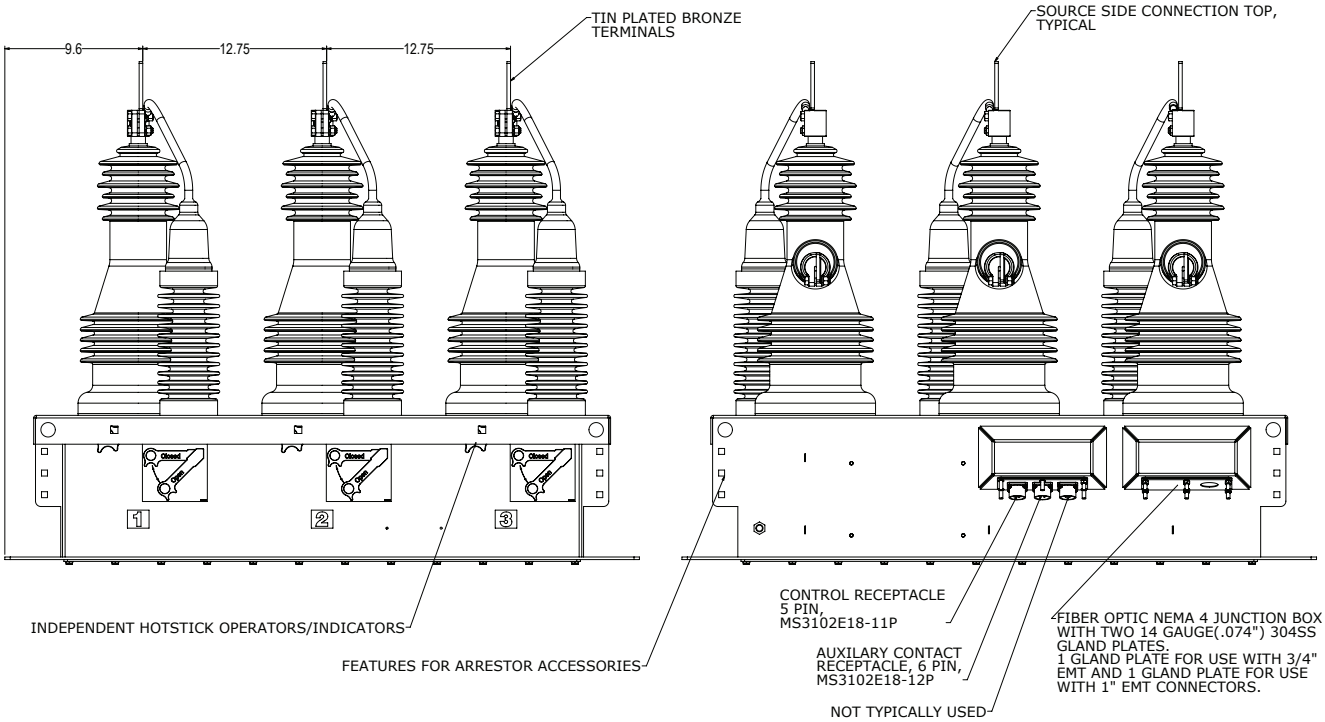
*The SmartClose fiber optic interface is accessible via a separate NEMA 4 junction box.*

**SMARTCLOSE SPECIFICATIONS**

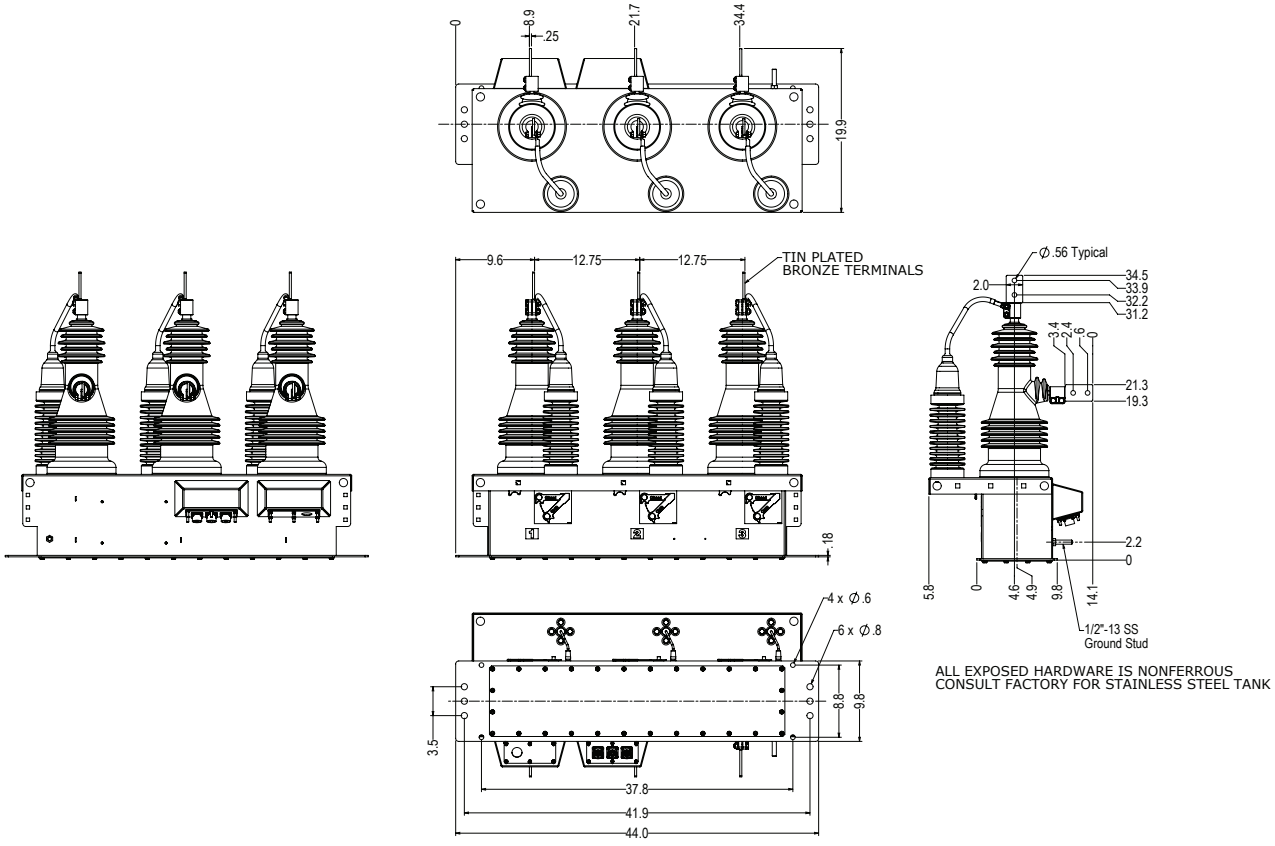
| | | |
|---|---|---|
| Rated Maximum Voltage, Phase to Phase, for Underground Banks, kV, RMS | 15.5 | 27.6 |
| Impulse Withstand Voltage, kV BIL | 110 | 125 |
| Terminal-to-Ground Creep Distance, inches (mm) | 18 (457) | 18 (457) |
| Terminal-to-Terminal Creep Distance, inches (mm) | 19 (482) | 19 (482) |
| Low Frequency Insulation Level Withstand | | |
| 1 Minute Dry, kV | 60 | 70 |
| 1 Minute Wet, kV | 50 | 60 |
| Continuous Current, Amps | 200/400 | 200/400 |
| Capacitive Switching Current, Amps | 200/400 | 200/400 |
| Fault Making Current Rating, Amps, Peak, Asymetrical | 32500 | 32500 |
| Short Time Current Rating, 1 second, Amps, RMS | 12500 | 12500 |
| High Frequency Transient Making Current, Amps, Peak, at 6kHz | 16000 | 16000 |
| Operating Voltage Range, VAC 50/60Hz, +/-15% | 120 | 120 |
| Operating Current Rating, Amps | 24 | 24 |
| Close Command Input Voltage pulse (>90mS), AC or DC | 40 to 150 | 40 to 150 |
| Open Command Input Voltage pulse (>90mS), AC or DC | 40 to 150 | 40 to 150 |
| Environmental Operating Temperature,˚C, Standard | -30 to +65 | -30 to +65 |
| Environmental Operating Temperature,˚C, Optional | -50 to +65 | -50 to +65 |
| Maintenance-Free Operations | 30000 | 30000 |
| Oil Free, Solid Dielectric | Yes | Yes |
| Restrike Performance, 0 restrikes | C2 | C2 |
| ANSI Test Standard | C37.66-2005 | C37.66-2005 |
| Weight, lbs. (kg) | 195 (88) | 195 (88) |

## OVERALL DRAWING

TRINETICS SMARTCLOSE
FACTORY CALIBRATED, AUTOMATIC ZERO VOLTAGE CLOSE CAPACITOR SWITCH

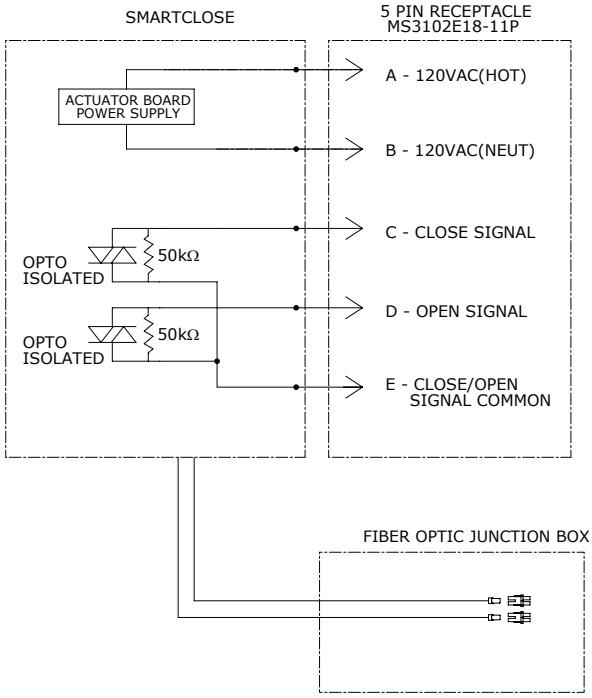



## DIMENSIONAL DRAWING




ALL EXPOSED HARDWARE IS NONFERROUS
CONSULT FACTORY FOR STAINLESS STEEL TANK

## POWER AND SIGNAL DRAWING




POWER SUPPLY

-POWER SUPPLY RATED NOT LESS THAN 1KVA, 2% IMPEDANCE.
-AC SUPPLY HOT AND NEUTRAL ARE NOT POLARITY SENSITIVE
-AC SUPPLY IS POWER SUPPLY ONLY, AND IS NOT A REFERENCE SIGNAL FOR ZERO CLOSING
-104 - 138 VAC OPERATING VOLTAGE, 60 HZ(50 HZ AVAILABLE)
-QUIESCENT POWER CONSUMPTION 5 WATTS
-30 SECONDS FOR POWER SUPPLY START UP TIME
-SEPARATE 2 PIN RECEPTACLE FOR AC INPUT AVAILABLE UPON REQUEST
-TRIP WITH LOSS OF POWER, GREATER THAN 10 CYCLES, STANDARD OPTION
-8 A RMS DURING CLOSE, 24A RMS DURING OPEN

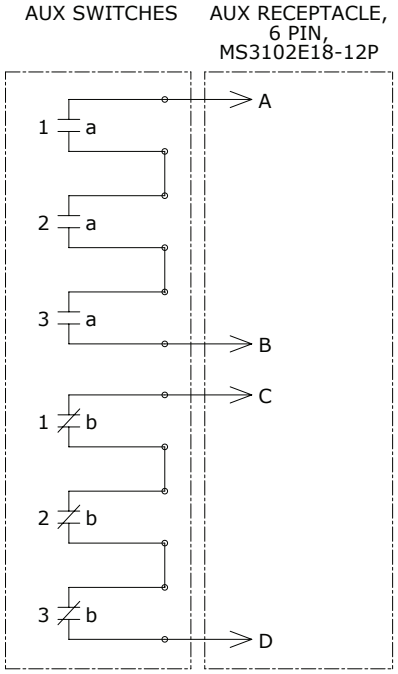
CLOSE AND OPEN SIGNALS

-40 - 150 VAC OR VDC
-MINIMUM PULSE TIME TO OPERATE, 0.1 SECONDS
-MAXIMUM PULSE TIME - UNLIMITED
-OPTO ISOLATED INPUT, 50kΩ INPUT IMPEDANCE
-AN OPEN COMMAND TAKES PRECEDENCE OVER A CLOSE COMMAND
-OPEN AND CLOSE SIGNAL COMMON CAN BE ISOLATED WITH 6 OR MORE PIN RECEPTACLE UPON REQUEST
-5 MINUTE DELAY BETWEEN OPEN AND CLOSE STANDARD

FIBER OPTIC CONNECTIONS

-CONNECTOR(2), VERSATILE, TYPE V, SNAP-ON AVAGO HFBR-4501/4511 SIMPLEX CONNECTOR
-INCLUDES(2) AVAGO BULKHEAD CONNECTORS, HFBR-4505/4515, IN THE JUNCTION BOX
-FIBER OPTIC TO USB ADAPTER AVAILABLE THROUGH TRINETICS. COMPATIBLE WITH SEL-2800 RS-232 TO FIBER-OPTIC COMMUNICATIONS.
-FIBER LONG TERM BEND RADIUS 35mm, SHORT TERM BEND RADIUS 25mm
-FIBER OPTICS IN NEMA 4 JUNCTION BOX ON SIDE OF SWITCH WITH SS GLAND PLATES(2); ACCESS WITH 3/8" WRENCH, #10-32 NUTS(6). USE WITH 3/4" OR 1" EMT CONNECTORS.

## TYPICAL AUXILIARY SWITCH RECEPTACLE WIRING




STANDARD AUX WIRING.

ALL SWITCHES MUST MAKE FOR CONTINUITY ACROSS A - B. FORM a AUX SWITCHES FOLLOW MAIN CONTACTS.

ALL SWITCHES MUST BE OPEN FOR CONTINUITY ACROSS C - D. FORM b AUX SWITCHES OPPOSITE MAIN CONTACTS.

CONTACT FACTORY FOR OTHER OPTIONS.

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