
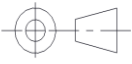


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SPECIFICATION CONTROL DOCUMENT, SERIES 200, LIGHT-EMITTING DIODE (LED) LIGHTED PUSHBUTTON SWITCHES AND INDICATORS

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1.0 SCOPE

This Specification Control Document (SCD) defines the requirements for the Series 200 pushbutton switch assemblies and companion products. Companion products are covered by their respective SCD's.

The Staco Systems Series 200 is a complete product line of high brightness light-emitting diodes (HB LED) lighted pushbutton switches and indicators.

This product line meets the general requirements of MIL-PRF-22885, and, in matrix form, MIL-S-24317.

The high-brightness LED light source is qualified for NVIS under MIL-L-85762 (when applicable), MIL-STD-3009, and MIL-PRF-22885.

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2.0 APPLICABLE DOCUMENTS

The following documents form a part of this document to the extent specified herein. Where specific paragraphs are called out, all subordinate paragraphs also apply. Where individual paragraphs are not specified, the document is applicable in its entirety.

2.1. Staco Systems Documents

Series 200 SCD	Specification Control Document, Series 200, Light-Emitting Diode (LED) Lighted Pushbutton Switches and Indicators
ICD-F2H	Interface Control Drawing, Front Mount Matrix, S200
ICD-R2H	Interface Control Drawing, Rear Mount Matrix, S200

2.2. Government Documents

Military Specifications

MIL-PRF-22885	General specification for switches and illuminated push button.
MIL-S-24317	General Specification for Switches, Multi-station, Pushbutton.
MIL-DTL-5541	Chemicals conversion coating on aluminum alloys (chemical-film).
MIL-A-8625	Anodic Coatings for Aluminum Alloys.
MIL-R-25988	Oil and Fuel Resistant for Rubber, Fluor silicone Elastomer.
MIL-G-45204	Gold Plating, Electrodeposited.
MIL-I-45208	Inspection Systems Requirements.
MIL-S-901	Requirements for Shock Tests, High Impact Shipboard Machinery, Equipment, and Systems.
MIL-L-85762	Lighting, Aircraft, Night Vision Imaging System (NVIS) Compatible.

Military Standards

MIL-STD-202	Test Method for Electronic and Electrical Component Parts.
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MIL-STD-108	Definitions of and Basic Requirements for Electric and Electronic Equipment Enclosure.
MIL-STD-454	General Requirements for Electronic Equipment.
MIL-STD-889	Dissimilar Metals.
MIL-STD-45662	Calibration System Requirements.
MIL-STD-3009	Lighting, Aircraft, Night Vision Imaging System (NVIS) Compatible.

2.3. Order of Precedence

In the event of conflict, the requirements of the following documents shall apply in the priority shown:

MIL-PRF-22885

Specification control document S200 (SCD 200).

Other referenced specifications, documents and drawings.

Nothing in this document supersedes applicable laws and regulations unless a specific exemption has been obtained.

Use of shall, should, may and will: In this SCD, "shall" is used to express a provision that is binding; "should" and "may" are used to express a non-mandatory provision; and "will" is used to express a declaration of intent.

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3.0 THE SERIES 200 PRODUCT LINE

This section provides an overview of the S200 standard product characteristics, plus features, options, configurations, and accessories.

3.1. Characteristics and Standard Features

The Series 200 Ultra-compact line of switches represents an integration of 4-pole switching capabilities, advanced LED lighting performance, and Military grade reliability in a subcompact package.

Series 200 switches are unique in that the pushbutton is an attached integral part to the switch by means of flex circuit (see [Figure 1: Pushbutton Switch – exploded view \(Splash-Proof and PC Termination Extended Version Shown\)](#)), and shall not be separated from the switch's main body. The pushbutton should only be extracted from switch's main body, when necessary, to access the mounting screws.

Other standard features of the Series 200 include:

- Shortest switch on the market
- Non-reflective surface
- Lowest operating temperature
- Uniform LED illumination
- Lightest weight: 11 grams
- Clarity of legends
- Lowest power consumption
- LED polarity insensitive
- Gold plated fine silver switch contacts for low and/or high current applications
- Electromagnetic interference (EMI) shielding for EMC requirement applications
- High brightness light-emitting diode (HB LED) light source.

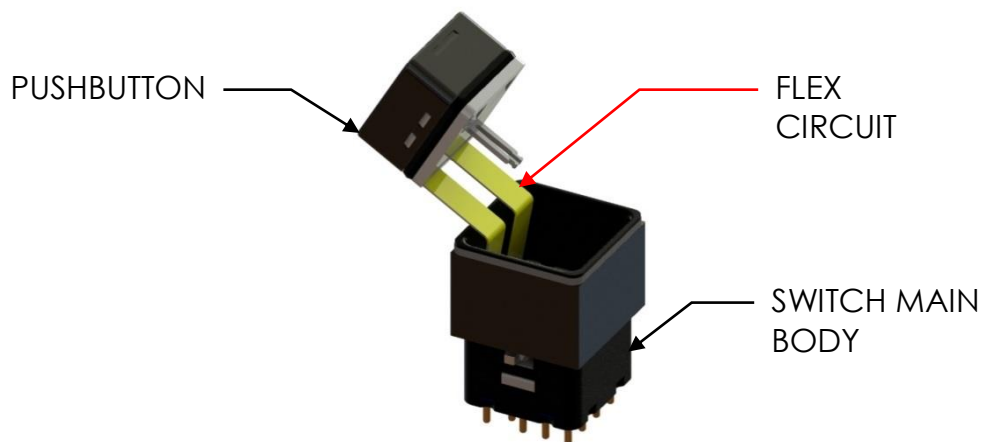


Figure 1: Pushbutton Switch – exploded view (Splash-Proof and PC Termination Extended Version Shown)

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- 3.1.1. Standard Options
 - 3.1.1.1. Mechanical.
See [Table XX: Mechanical Option.](#)
 - 3.1.1.2. Electrical.
See [Table XXI: Electrical Option.](#)
 - 3.1.1.3. Enclosure Design.
 - 3.1.1.3.1. Splash Proof:
See [Table XXII: Enclosure Design.](#)
 - 3.1.1.3.2. Watertight.
See [Table XXII: Enclosure Design.](#)
 - 3.1.1.4. Display
 - 3.1.1.4.1. Display Style.
See [Table XXIII: Display Style and Character Size Option.](#)
 - 3.1.1.4.2. Legend Style and Size
Font style – Alternate gothic number II
Font height – 0.072", 0.087", 0.100", 0.125", and 0.145". See [Table XXIII: Display Style and Character Size Option.](#)
 - 3.1.1.5. Optical
 - 3.1.1.5.1. Display Type: See Table XXIV: Display Type Option.
 - 3.1.1.5.2. Illuminated Color: See Table XXV: Illuminating Color Option.

3.2. Coded Configuration

Coded configurations defined in this section are to identify various characteristics and options which are available with standard Series 200 switches.

3.2.1. Standard Coded Configuration

The following enclosure designs defined in MIL-PRF-22885 are available in the Series 200 product line, as shown in [Table XXII: Enclosure Design.](#)

The coded part numbers for splash-proof (type I and III), watertight (type II and IV) are as follows:

2Hxxx-xxx1xxxxxxx S200 splash-proof pushbutton switch / indicator.

2Hxxx-xxx2xxxxxxx S200 watertight pushbutton switch / indicator.

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Figures 2 thru 5 depict a typical splash-proof and watertight enclosure designs, in various terminations.

Each switch or indicator assembly intended for individual mount application is provided with a set of mounting hardware, which consists of a panel spacer and two mounting sleeves. These are used in conjunction with the mounting screws and cam nuts (located on two opposite sides of switch's main body) to install the switch/indicator to the panel. Refer to [Figure 6: Splash Proof \(PCB Termination Extended Version Shown, Panel Spacers and Mounting Sleeves not shown for clarity\)](#). Bill of materials (BOM) for each configuration is shown in [Table I: Pushbutton Switch Assembly BOM](#).

Each splash-proof pushbutton switch assembly is provided with a splash-proof panel seal to meet the splash-proof requirements of MIL-PRF-22885. Refer to [Figure 2: Splash-Proof \(Solder Termination Extended Version Shown\)](#) and [Figure 4: Splash Proof \(Crimp Pin Termination Extended Version Shown\)](#).

Each watertight pushbutton switch assembly is provided with a watertight pushbutton seal assembly and panel seal, which prevents leakage of water, sand and dust. This system meets the watertight requirements of MIL-PRF-22885. Refer to [Figure 3: Watertight \(Solder Termination Version Shown\)](#) and [Figure 5: Watertight Details](#).

For extended mount applications, the panel spacer may be used. This feature is to enable the pushbutton to align with commonly used edge-lighted panels when applicable. For flushed mount application, the panel spacer can be discarded. Refer to [Figure 29: Flushed Mount – Splash-Proof, Extended Design](#), [Figure 30: Flushed Mount - Watertight Design](#), [Figure 31: Extended Mount – Splash-Proof, Extended Design](#) and [Figure 32: Extended Mount – Watertight Design](#) for flushed and extended mounts outline dimensions.

A keying feature is designed to ensure that pushbutton can only fit into the switch's main body one way. Similarly, a snap-retainer mechanism is designed into the pushbutton to ensure that it cannot become separated from the body unexpectedly due to shock, vibration, or sudden hand movement, whatever the position of the pushbutton. See [Figure 7: Locking Mechanism \(Splash-Proof Extended Version Shown\)](#) for snap-retainer mechanism.

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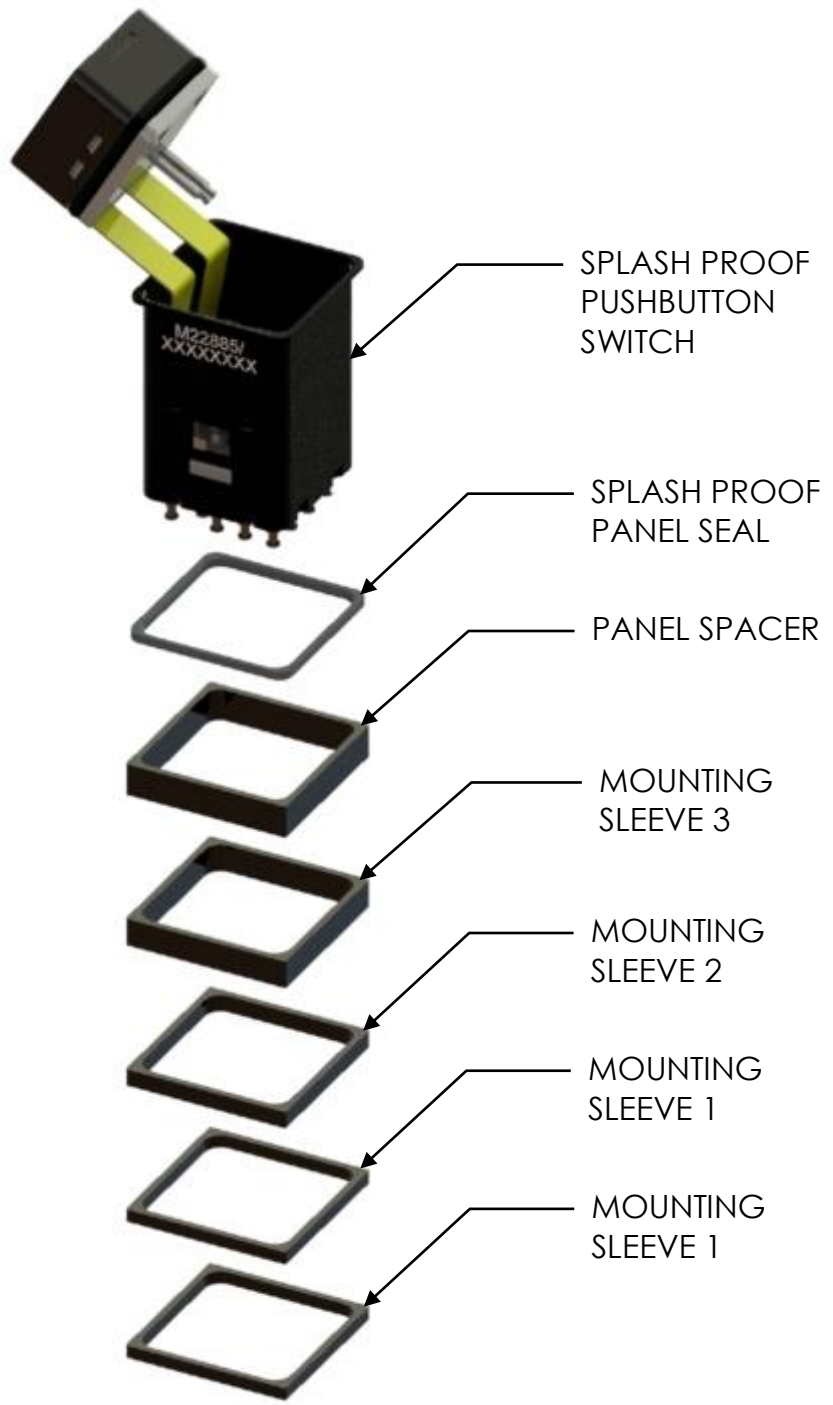


Figure 2: Splash-Proof (Solder Termination Extended Version Shown)

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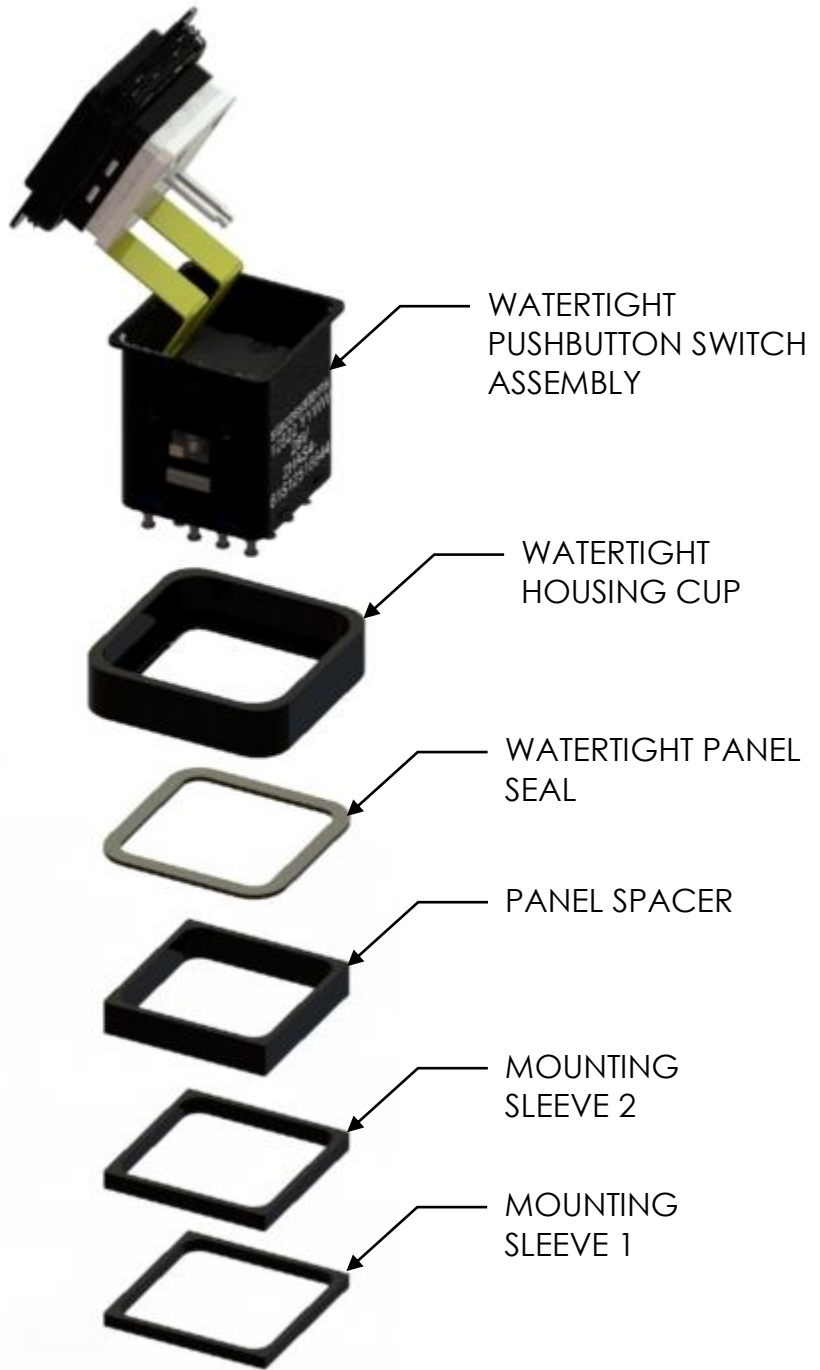


Figure 3: Watertight (Solder Termination Version Shown)

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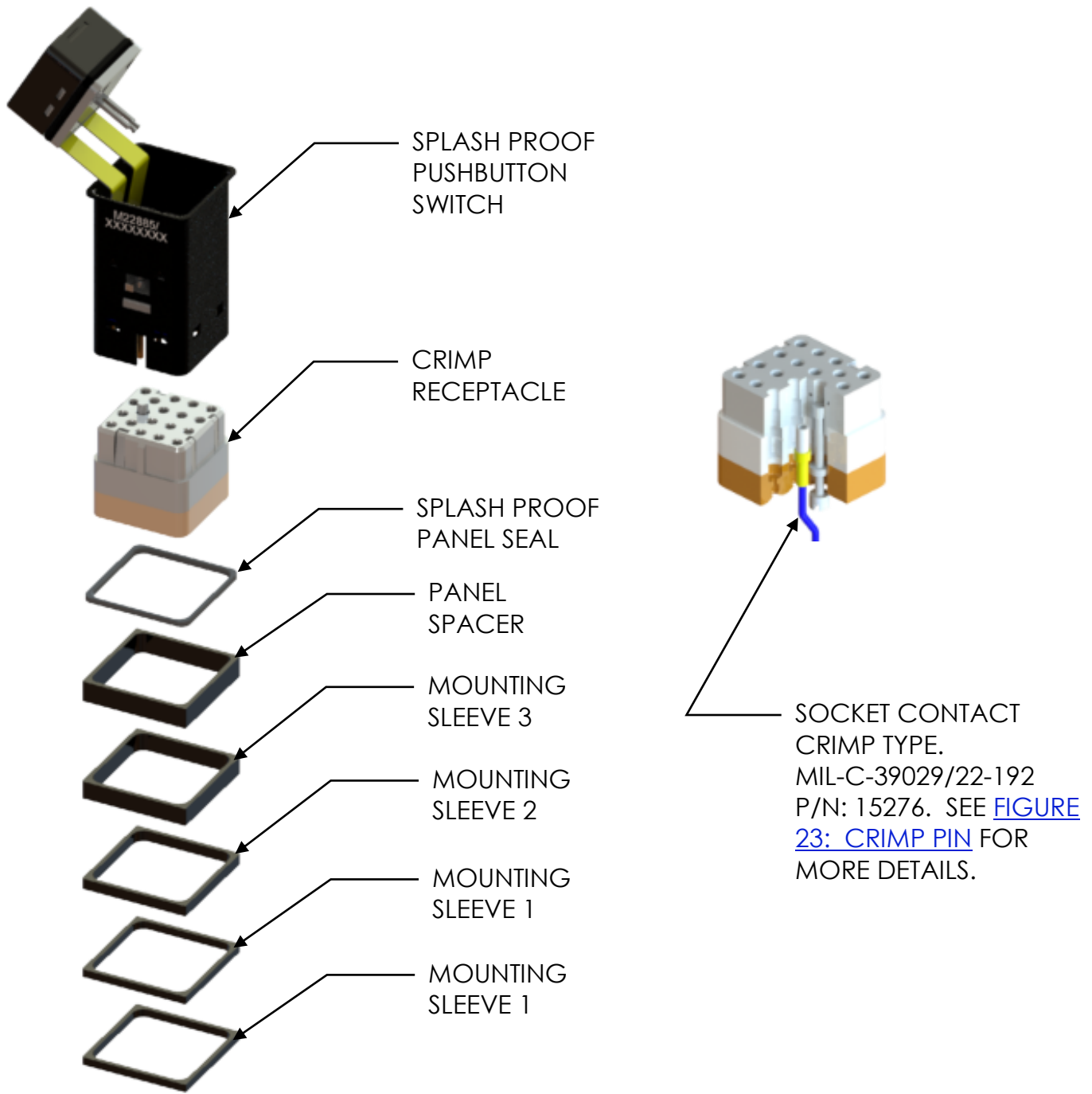


Figure 4: Splash Proof (Crimp Pin Termination Extended Version Shown)

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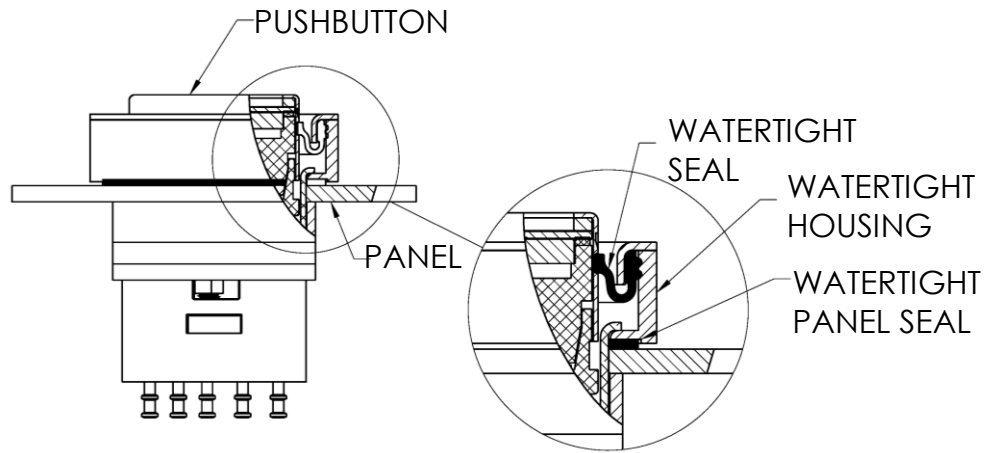


Figure 5: Watertight Details

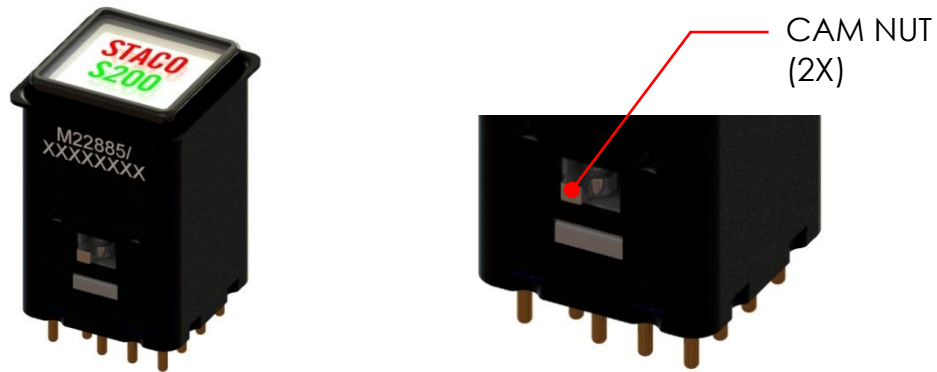


Figure 6: Splash Proof (PCB Termination Extended Version Shown, Panel Spacers and Mounting Sleeves not shown for clarity)

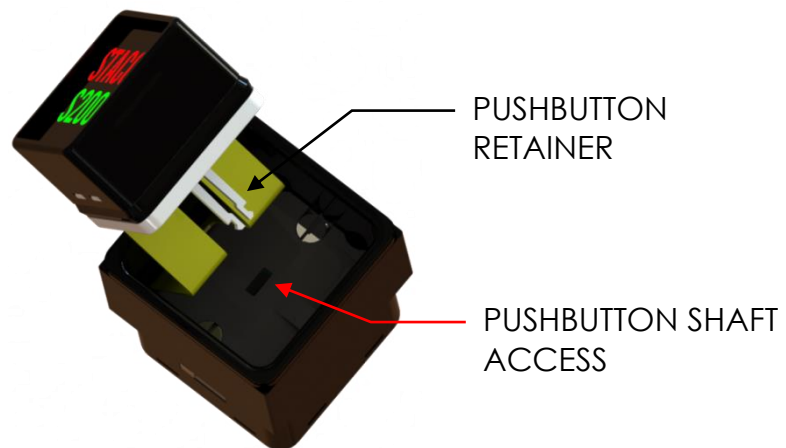


Figure 7: Locking Mechanism (Splash-Proof Extended Version Shown)

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Table I: Pushbutton Switch Assembly BOM

Part Number	Description	Splash-proof		Watertight	
		Type I	Type III	Type II	Type IV
-	Pushbutton Switch	1	1	1	1
15097	Panel Seal	1	1	-	-
15196/005	Watertight Panel Seal	-	-	1	1
-	Panel Spacer (0.150)	1	1	1	1
-	Mounting Sleeve 1 (0.060)	2	2	1	1
-	Mounting Sleeve 2 (0.080)	1	1	1	1
-	Mounting Sleeve 3 (0.130)	1	1	-	-
156106	Receptacle Assembly	-	1	-	1
		QTY	QTY	QTY	QTY

3.2.2. Customized Configurations

Customized configurations are unique in which they conform to a specific customer-defined configuration and/or have unique requirements for performance, marking, or both.

Customized configurations shall be designed and manufactured to meet the general requirements of MIL-PRF-22885 whenever possible. However, specific customer-invoked design requirements may compromise certain performance characteristics and thus prevent total compliance with the details of the mentioned specification.

23XXX-TAB numbers shall be used when define non-standard pushbutton switch assembly. Such as:

- a. Customized artworks; and/or
- b. Customized form, fit, and / or function; and/or
- c. Customized marking; and/or
- d. When the customers/sales require that a non-coded part number to be used

The XXXX in this model number is a 4-digit, sequentially assigned number. All of these numbers are tabulated and have a three-digit or, under special circumstances, a 3-digit sequential TAB number (Typical example would be 230123-123).

3.3. Matrix Frame Assembly

The pushbutton switch assemblies are available in matrix frames. The matrix frames are available in the following configurations:

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ICD F2H – Front dress bezel matrix in solder, PCB, and crimp pin terminations.

ICD R2H – Rear mount flange matrix in solder, PCB, and crimp pin terminations.

Details of matrix frames and specifications are found in Interface Control Drawings ICD-F2H and ICD-R2H.

Matrix assemblies are designed, tested and qualified in accordance to the requirements of MIL-S-24317

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4.0 General Specifications

This section provides an overview of the S200 outline dimensions plus mechanical, electrical, display, and optical specifications.

4.1. Outline Dimension

Outline dimensions of splash-proof and watertight switches in various configurations are shown in [Table II: Outline Dimensions](#):

Table II: Outline Dimensions

Seal Description/Option	Enclosure Type	View	Figure
Splash-Proof	I	Front	Figure 8
Splash-Proof	I	Top	Figure 9, Figure 9A*
Splash-Proof	I	Side	Figure 10, Figure 10A*
Splash-Proof	III	Front	Figure 11,
Splash-Proof	III	Top	Figure 12, Figure 12A*
Splash-Proof	III	Side	Figure 13, Figure 13A*
Watertight	II	Front	Figure 14
Watertight	II	Top	Figure 15
Watertight	II	Side	Figure 16
Watertight	IV	Front	Figure 17
Watertight	IV	Top	Figure 18
Watertight	IV	Side	Figure 19

*Extended housing, lens retainer and lens jacket for improved lighting.

[Figure 20: Solder Termination](#), [Figure 21: PC Termination](#) and [Figure 23: Crimp Pin](#) for termination details. Mounting hardware location and dimension are shown in and [Figure 24A: Hardware \(Splash-Proof and Watertight, Extended\)](#).

4.1.1. Pushbutton Switch and Mounting Hardware

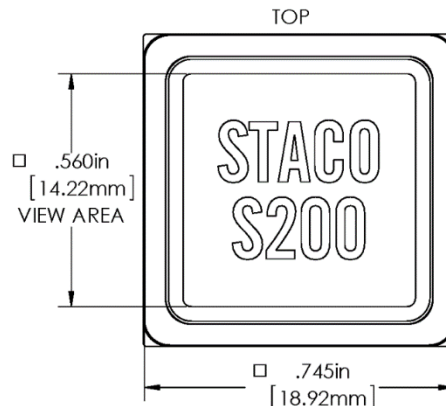


Figure 8

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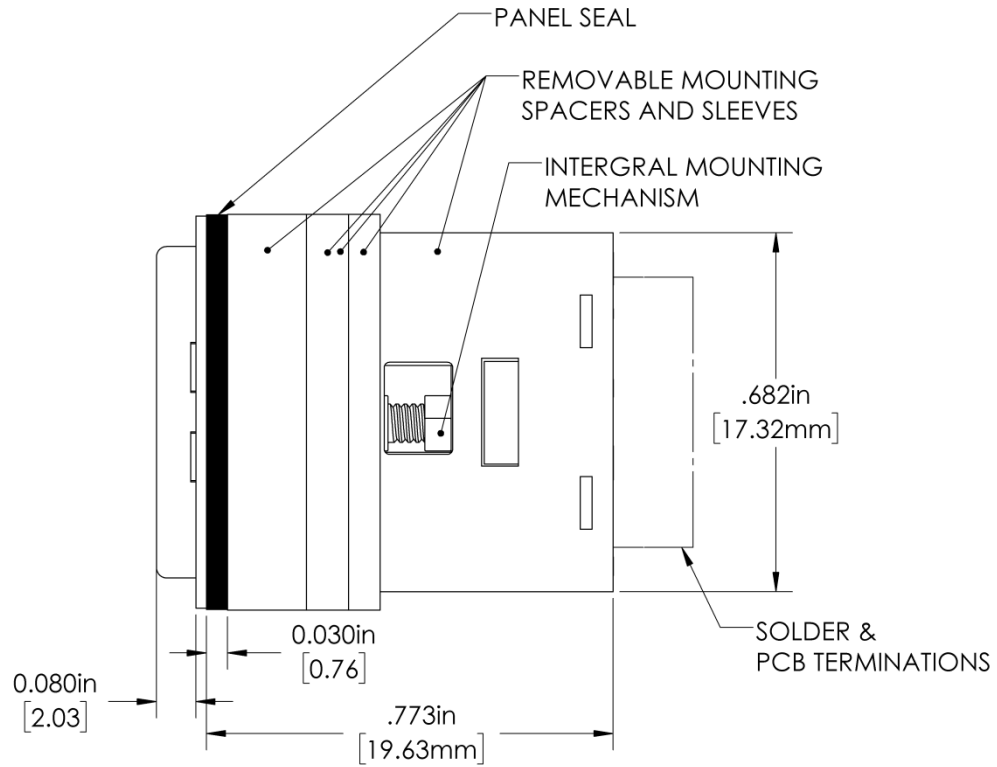


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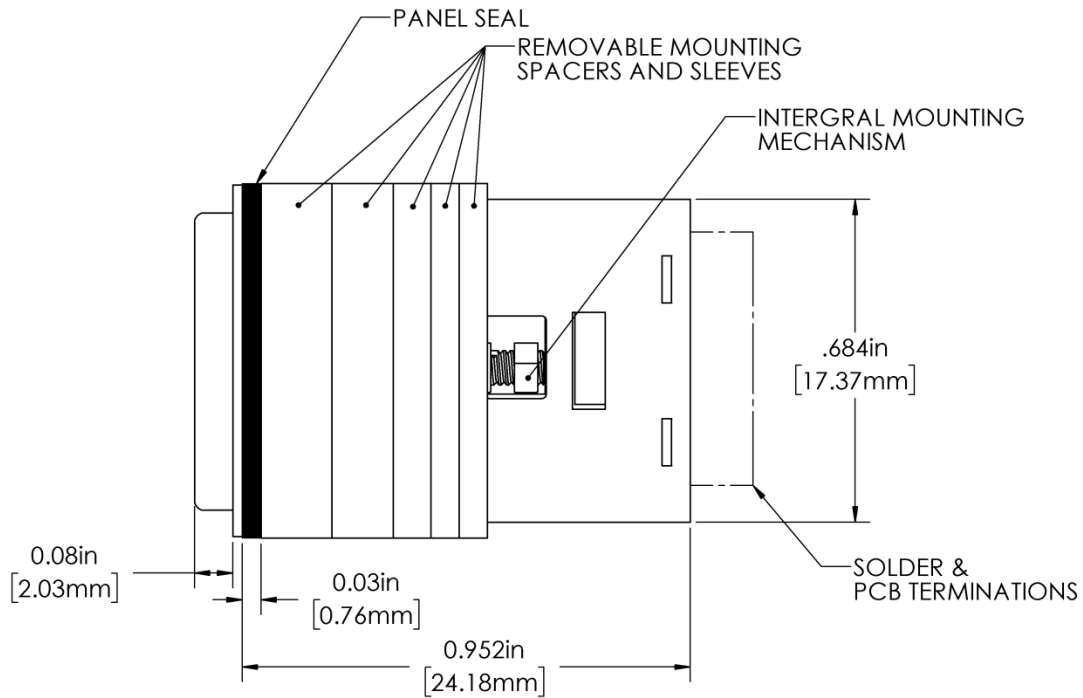


Figure 9A

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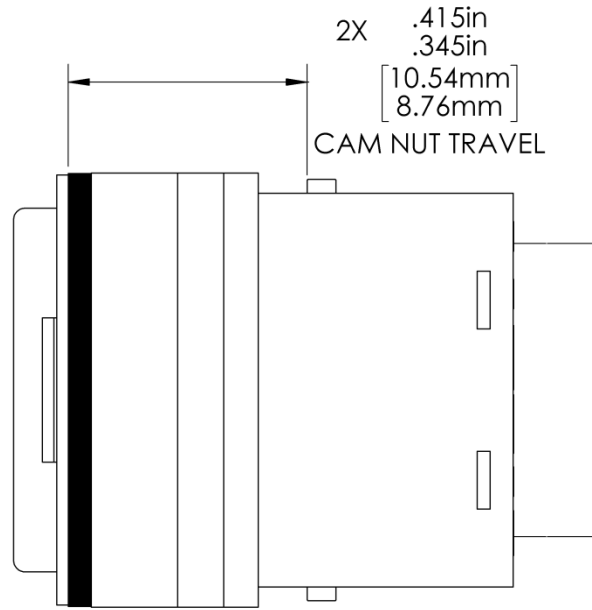


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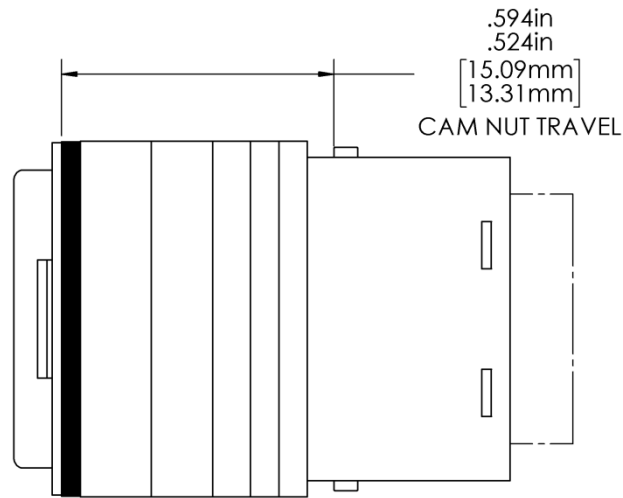


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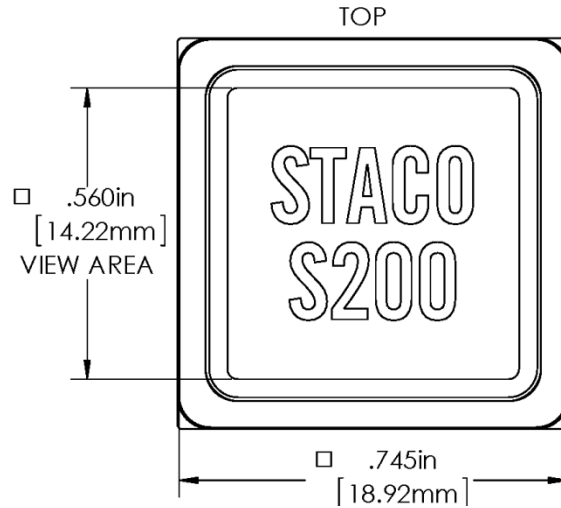


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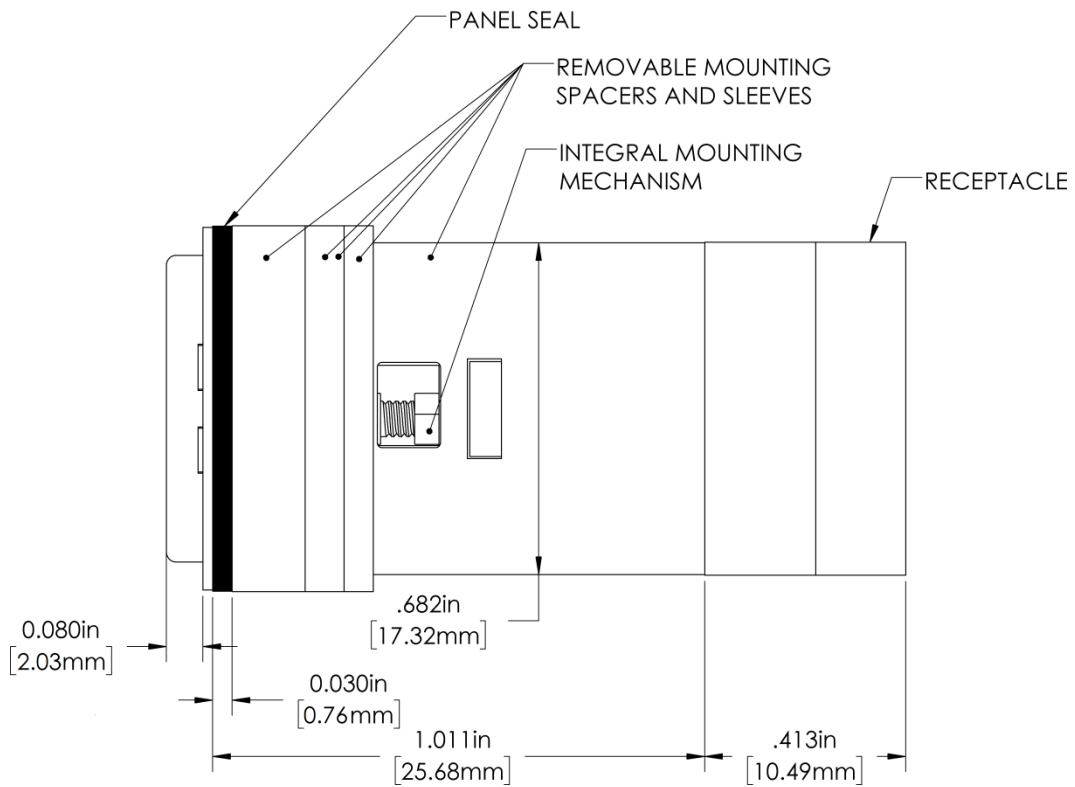


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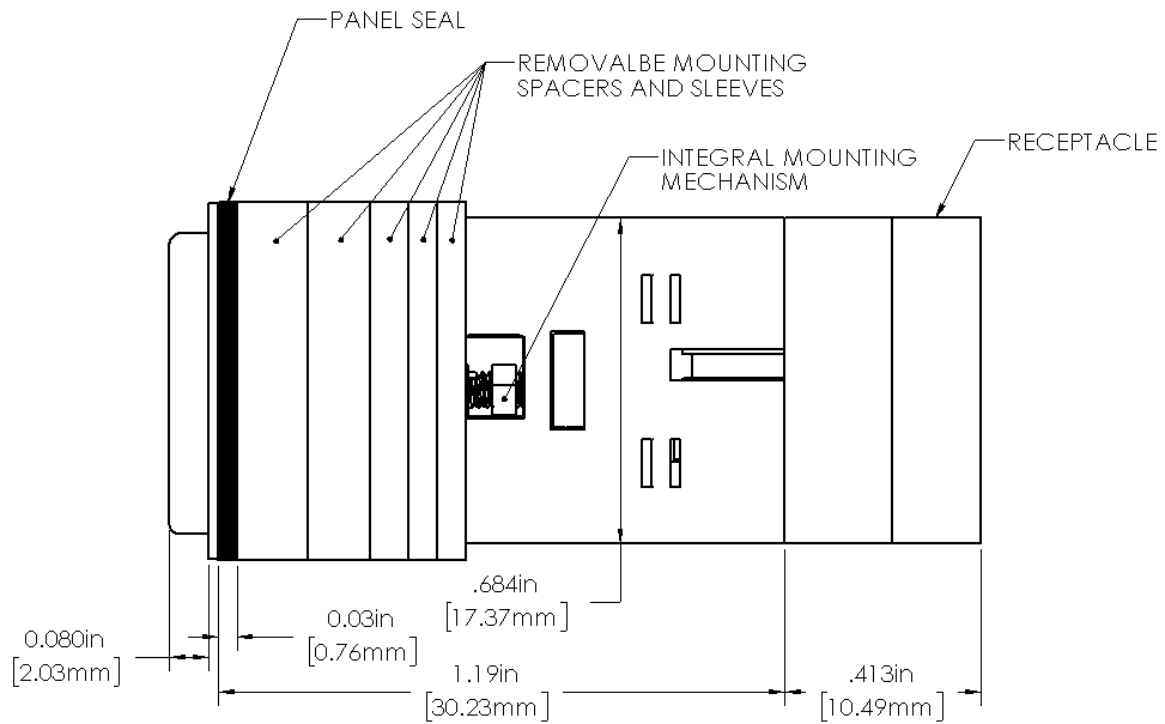


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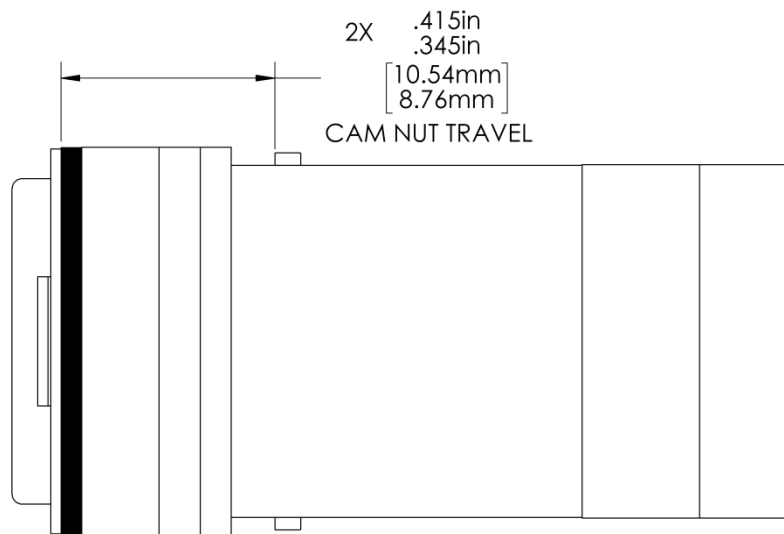


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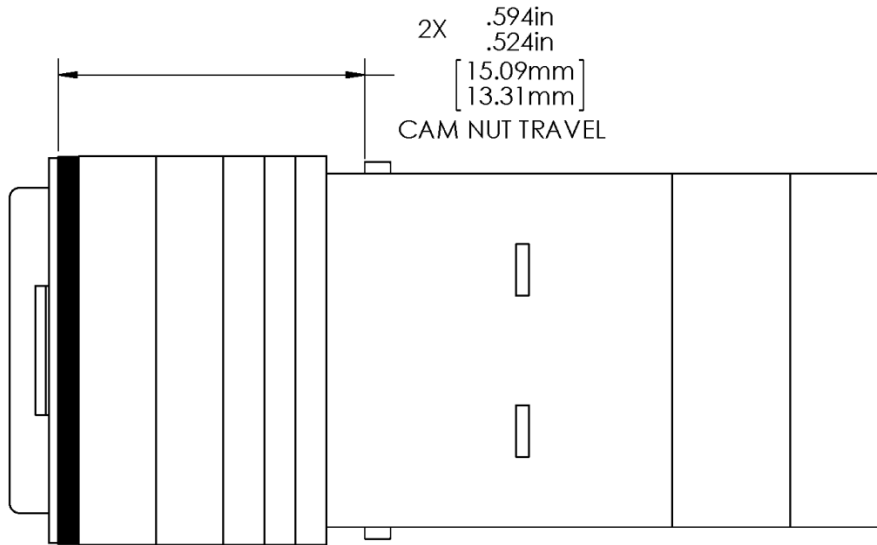


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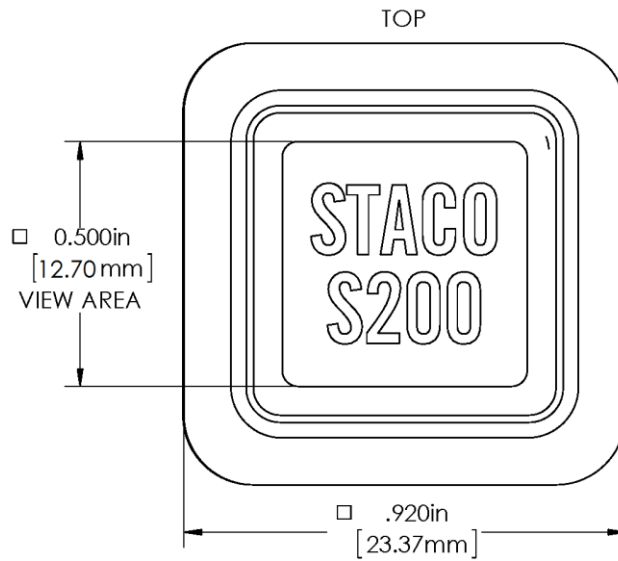


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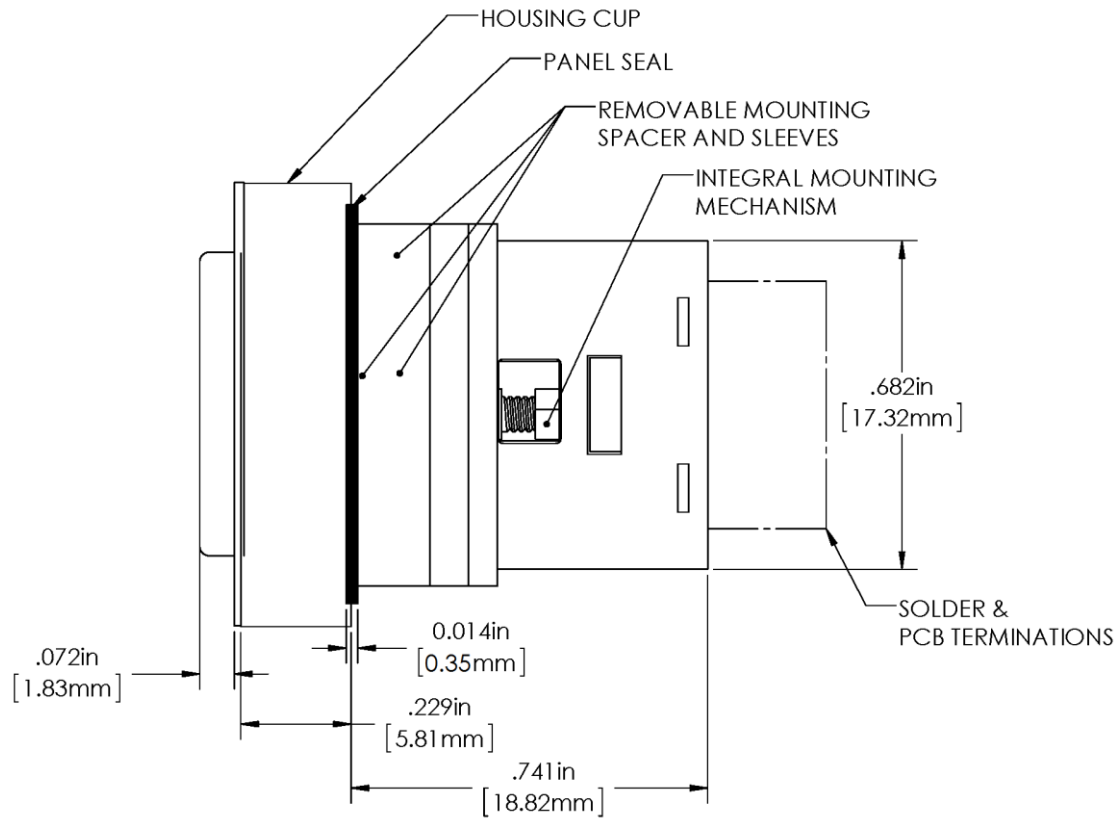


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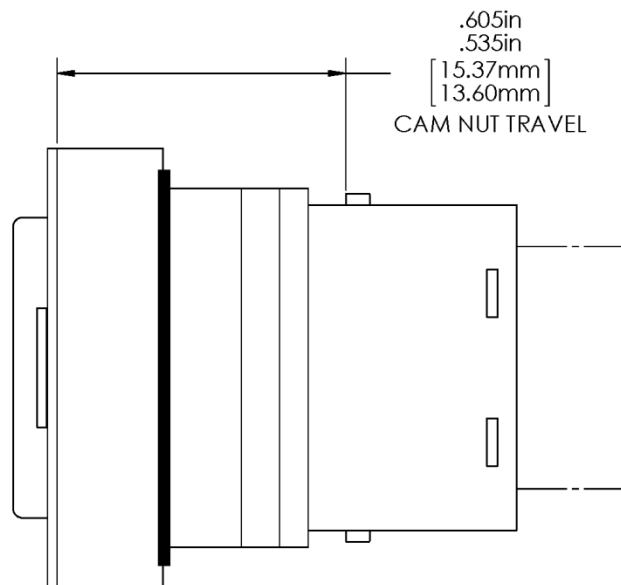


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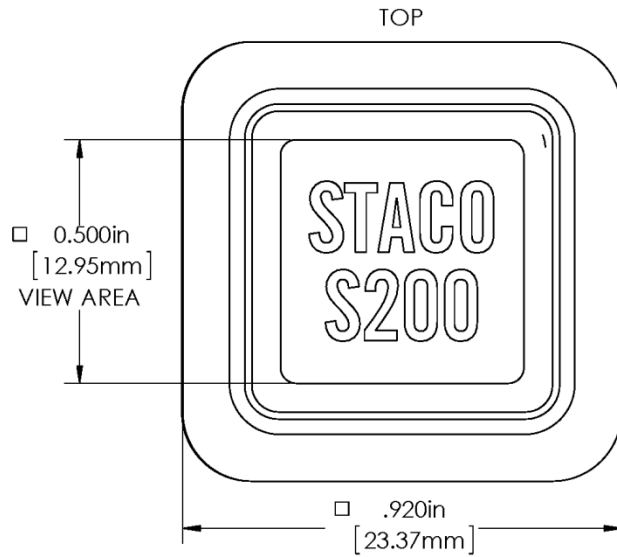


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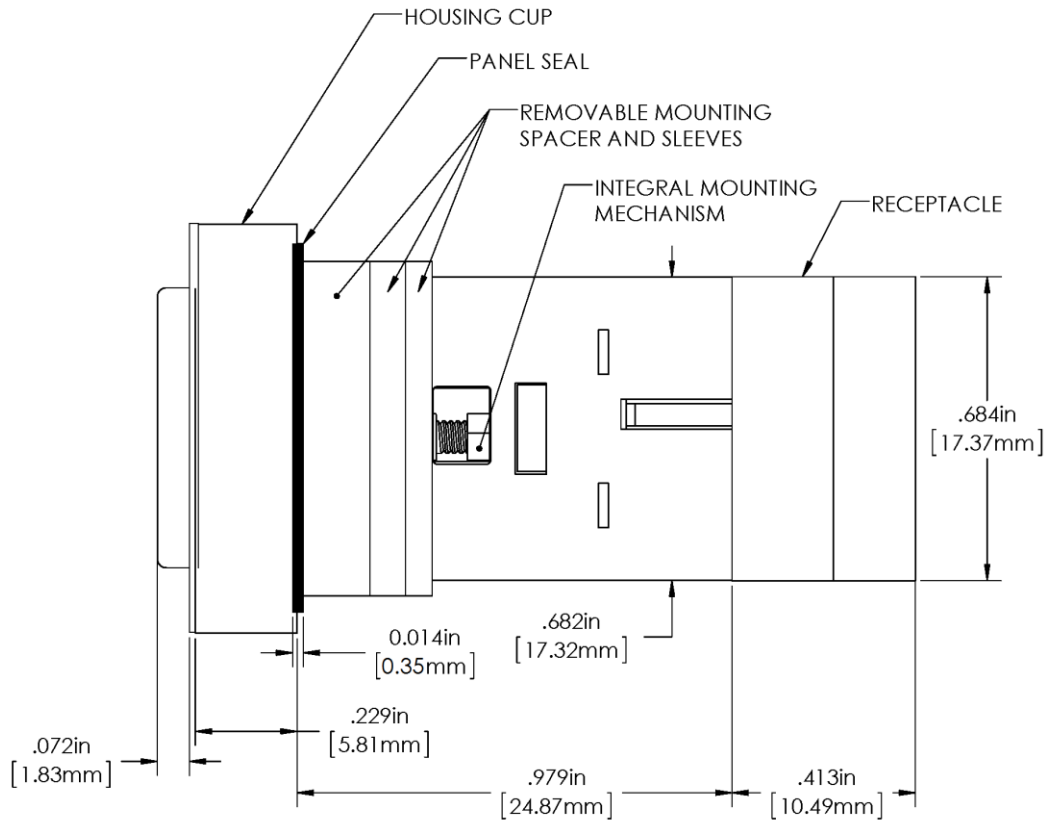


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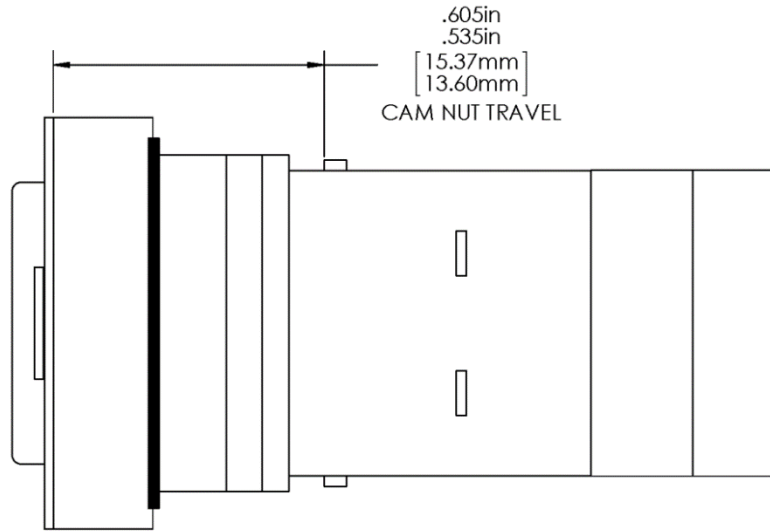


Figure 19

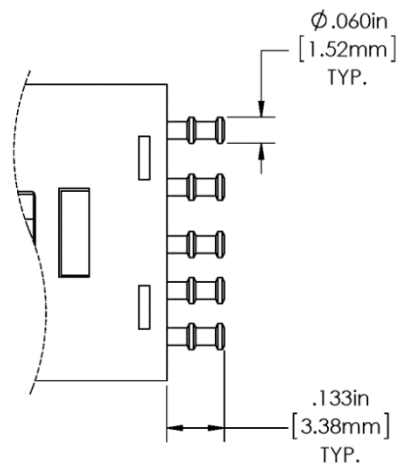


Figure 20: Solder Termination

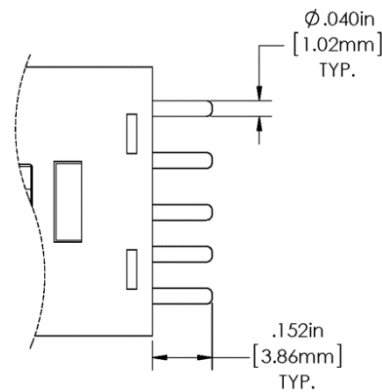


Figure 21: PC Termination

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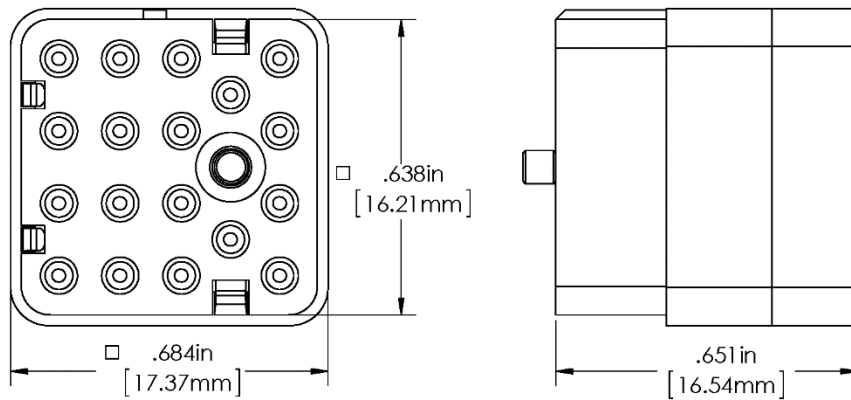
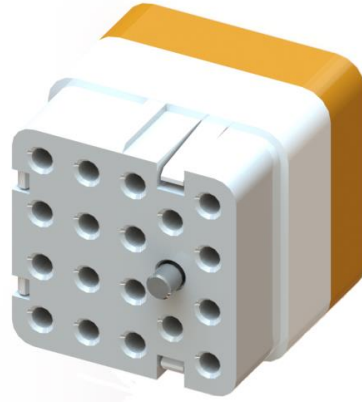


Figure 22: Crimp Termination

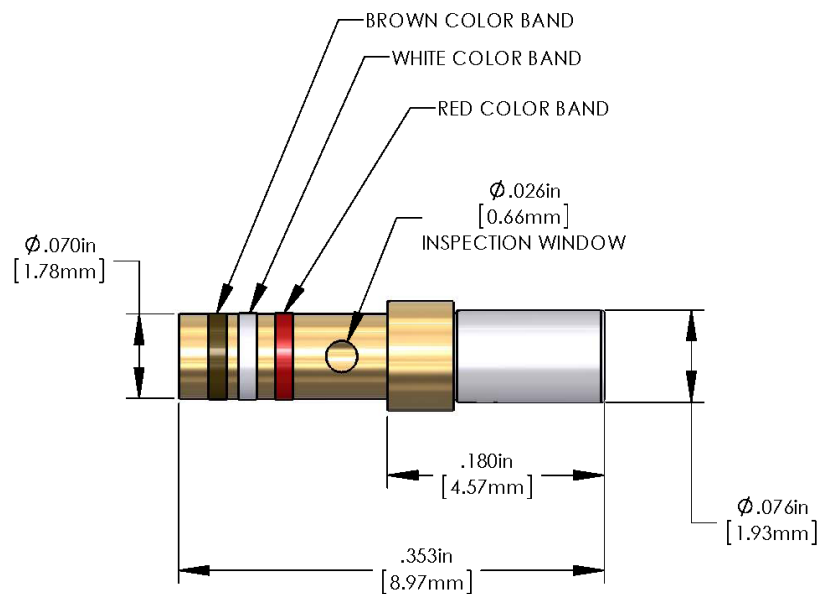


Figure 23: Crimp Pin (MIL-C-39029/22-192, Staco Systems P/N: 15276)

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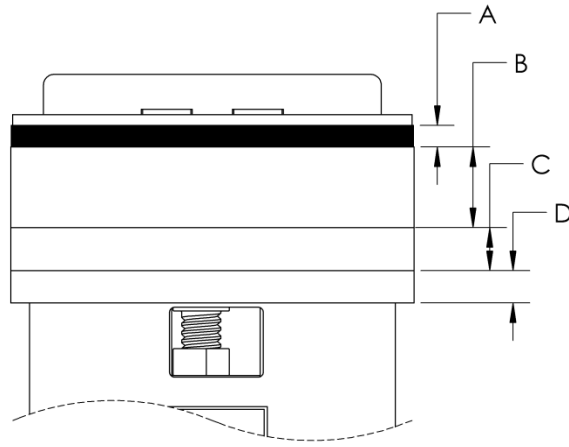


Figure 24: Hardware (Splash-Proof)

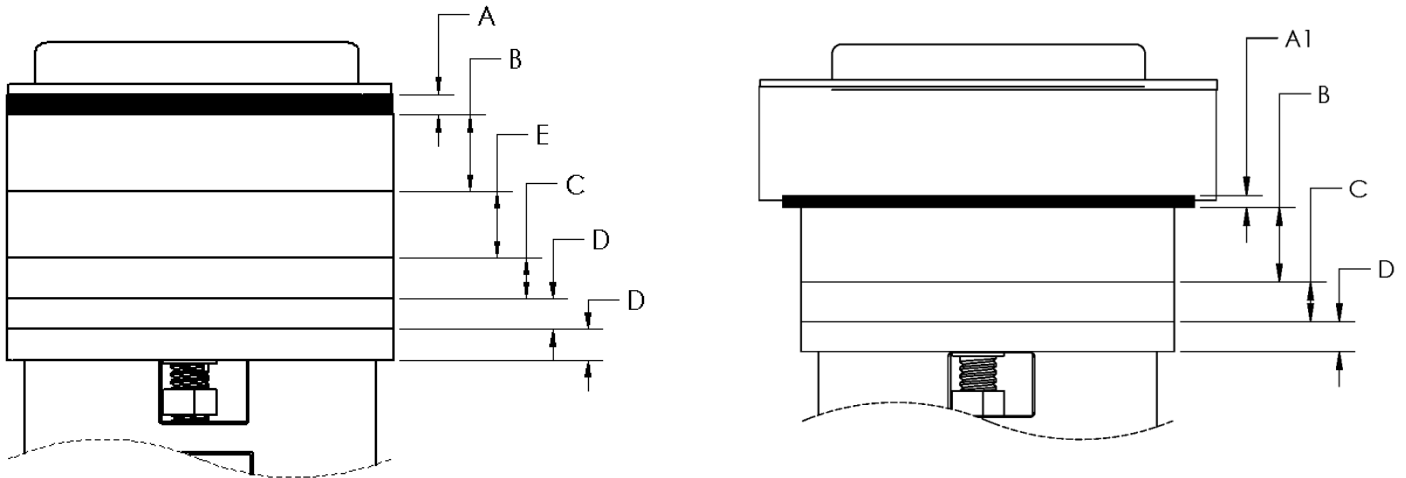


Figure 24A: Hardware (Splash-Proof and Watertight, Extended)

Table III: Mounting Hardware Dimension

Symbol	Description	Dimension
A	Splash-Proof Panel Seal*	0.030" [1.02 mm]
A1	Watertight Panel Seal**	0.014" [0.35 mm]
B	Panel Spacer	0.150" [3.81 mm]
C	Mounting Sleeve 1	0.080" [2.03 mm]
D	Mounting Sleeve 2	0.060" [1.52 mm]
E	Mounting Sleeve 3	0.130" [3.03 mm]

* Free height or uncompressed, splash-proof panel seal = 0.04" [1.016mm]

** Free height or uncompressed, watertight panel seal = 0.024" [0.609mm]

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4.1.2. Mounting Panel

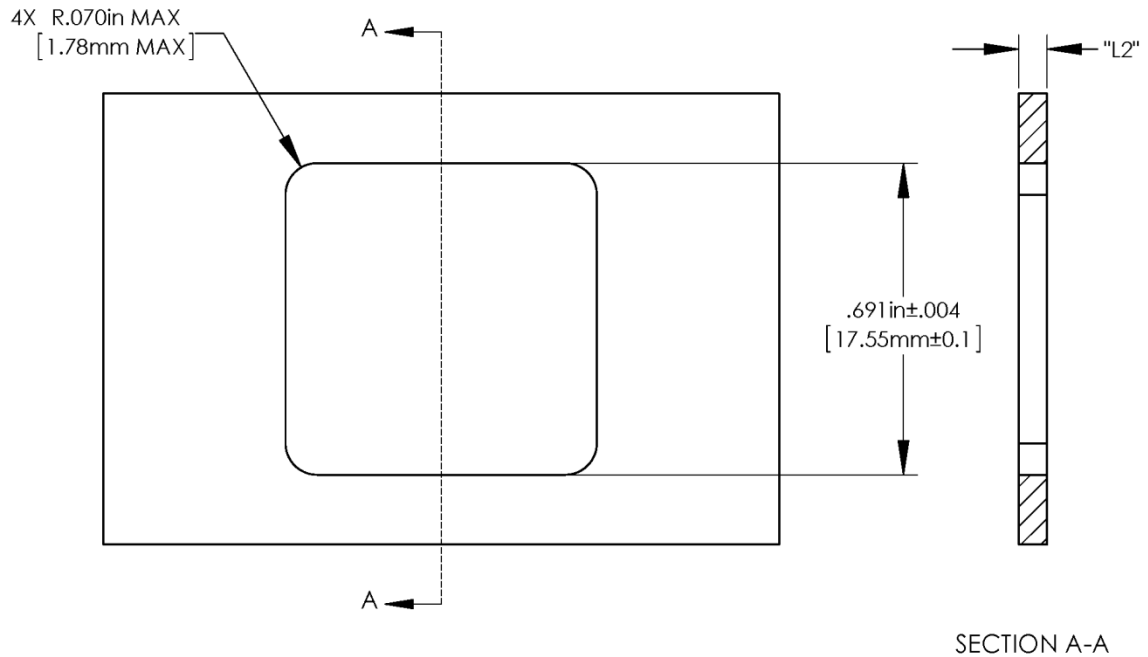


Figure 25: Panel Cutout and Thickness

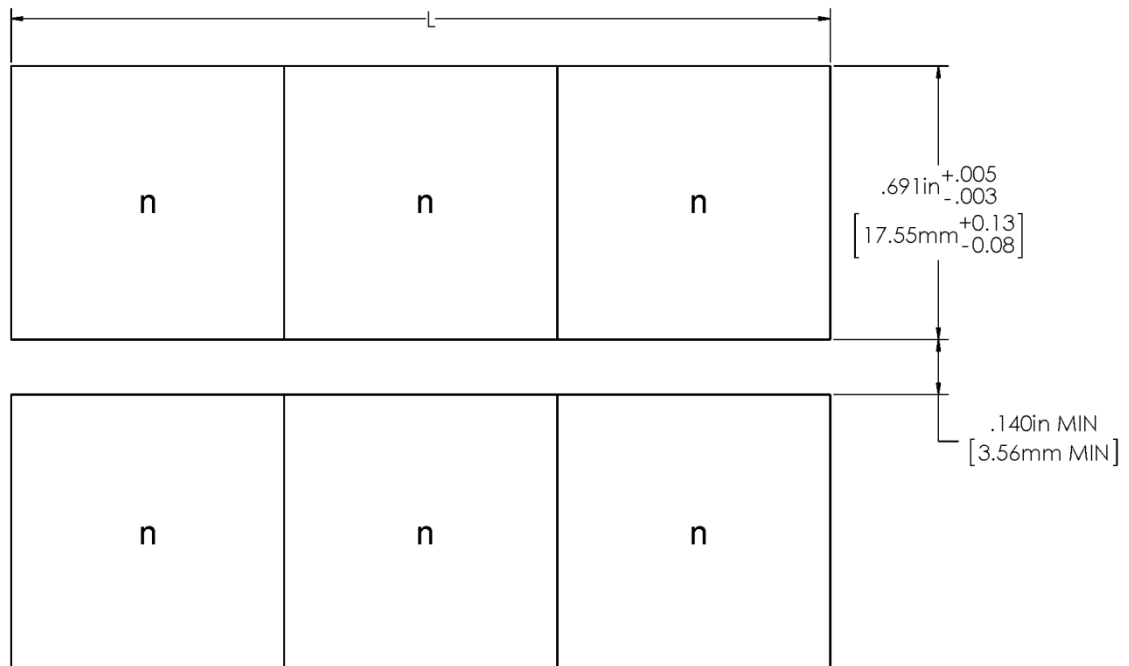


Figure 26: Slot Mount for Type I & III

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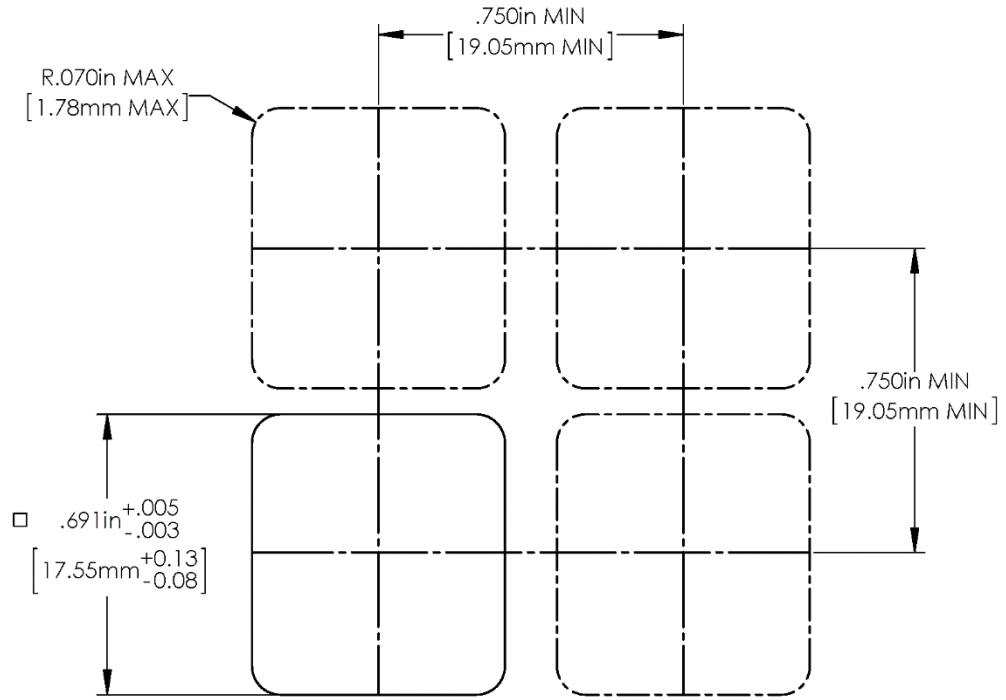


Figure 27: Matrix Mount for Type I & III

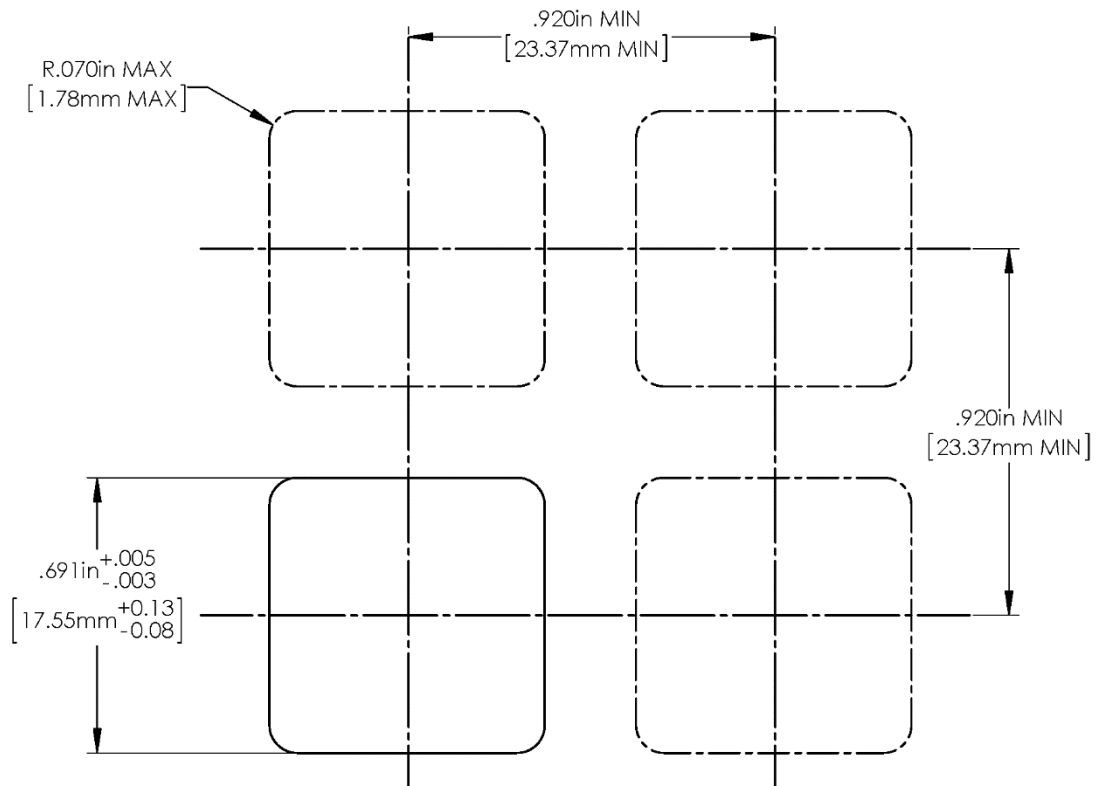


Figure 28: Matrix Mount for Type II & IV

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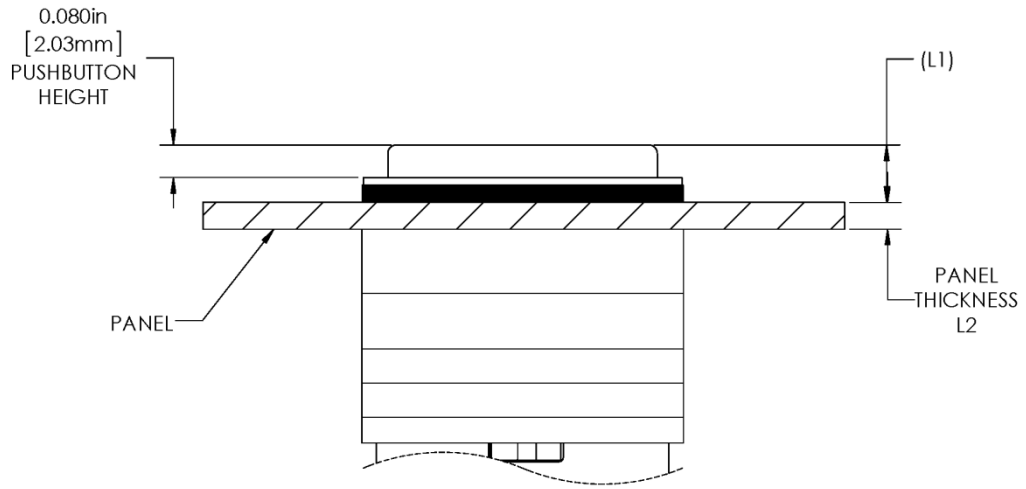


Figure 29: Flushed Mount – Splash-Proof, Extended Design Shown

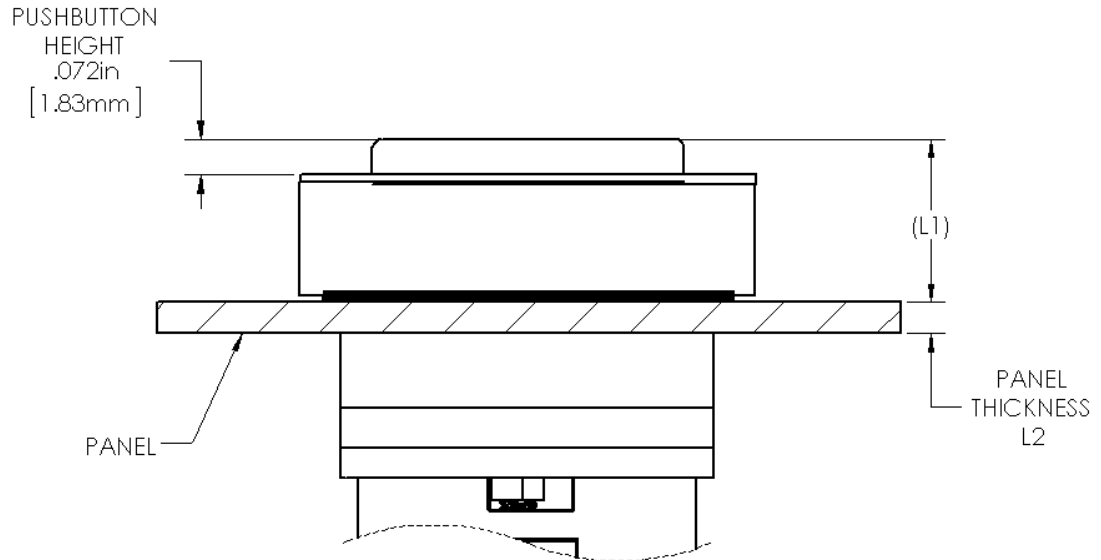


Figure 30: Flushed Mount - Watertight Design

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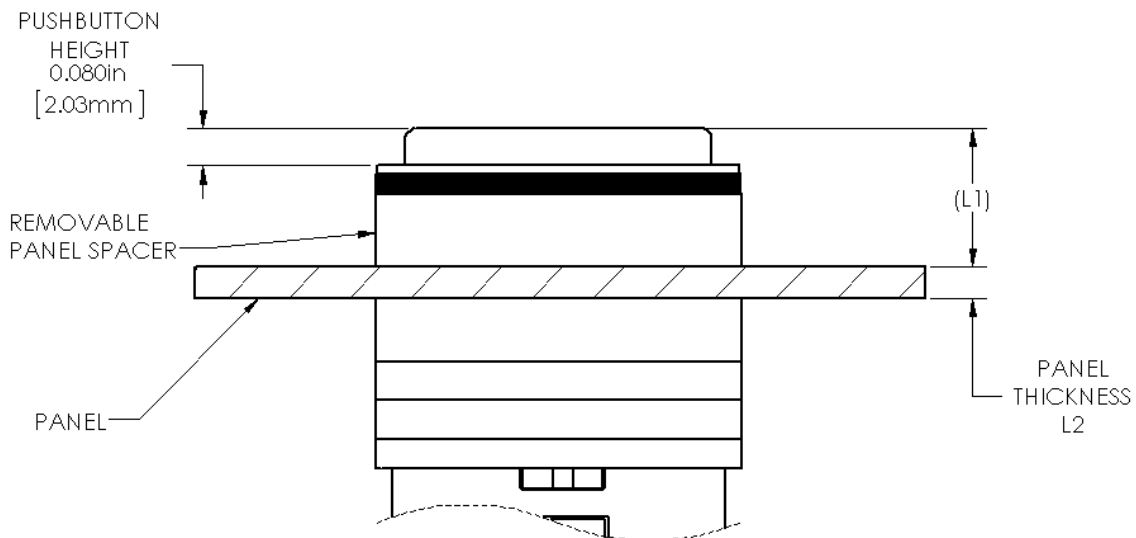


Figure 31: Extended Mount – Splash-Proof, Extended Design Shown

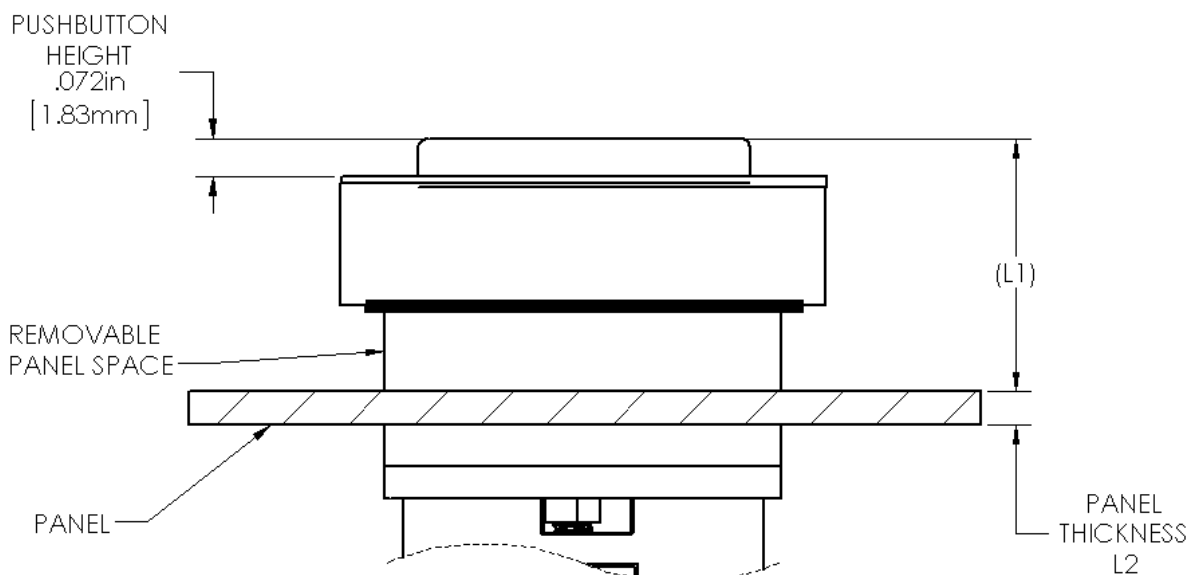


Figure 32: Extended Mount – Watertight Design

Table IV: Mounting panel thickness maximum

Description	Flushed Mount		Extended Mount	
	Splash-Proof	Watertight	Splash-Proof	Watertight
Cap protrusion (L1)	(0.130")	(0.336")	(0.280")	(0.486")
Panel thickness Max. L2	0.330"	0.320"	0.180"	0.170"

*See [Figure 27: Matrix Mount for Type I & III](#) and [Figure 28: Matrix Mount for Type II & IV](#) for flushed and extended mounts details.

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4.2. Mechanical Specifications

This section provides an overview of the S200 mechanical characteristics, features, operation, and specifications.

4.2.1. Mechanical Endurance

The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885.

Switches are tested to MIL-PRF-22885 life cycle requirement as follows:

1,000,000 cycles: 5,000 cycles of operation at -55°C, 10,000 cycles of operation at +85 °C, and 985,000 cycles at room temperature.

4.2.2. Operating Characteristics

Below are switch actions available for S200 product line. The pushbutton switches are tested in accordance with the requirements of MIL-PRF-22885 ([Table V: Action Characteristic](#)).

Table V: Action Characteristic

MIL-PRF- 22885 Symbol	Action
A	Momentary
B	Alternate
H	Indicator

Indicator - Functions as lighted display only. No switch contacts required.

Momentary - Switches on applying pressure to the pushbutton. The switch contacts return to their normally closed position when the pushbutton is released.

Alternate - Switches on applying pressure to the pushbutton. Switch contacts remain in latch down position when released, and return to their normally closed position when the pushbutton is pressed again.

Below are actuation force, pushbutton travel and alternate action displacement as shown in [Table VI: Actuation Force and Pushbutton Travel](#) and [Figure 33: Alternate Action Displacement for Splash-Proof Pushbutton Switches](#).

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Table VI: Actuation Force and Pushbutton Travel

Actuation force	2 to 5 pounds (9 to 22.2N)	Pushbutton travel and alternate action displacement is shown in Figure 33: Alternate Action Displacement for Splash-Proof Pushbutton Switches.
Pushbutton Travel	0.060-0.075 inches	
Alternate displacement	0.040 inch (latched)	

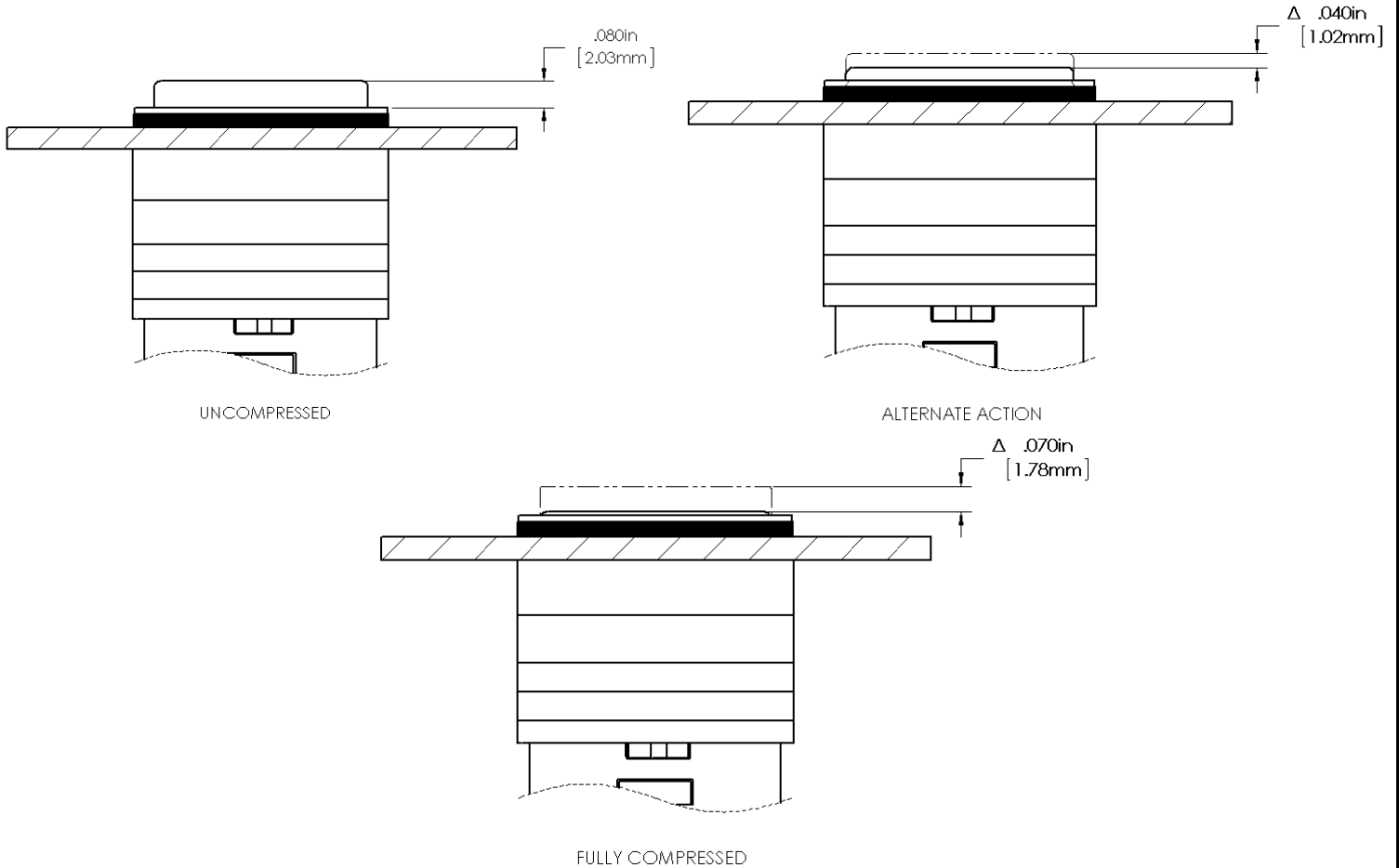


Figure 33: Alternate Action Displacement for Splash-Proof Pushbutton Switches, Extended Version Shown

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4.2.3. Termination

Solder Terminals. Solder termination shall be tin plated. Switch is tested in accordance to the requirements of MIL-PRF-22885, Para. 4.7.2, MIL-STD-202, Method 208. Terminal strength tests are conducted as prescribed by MIL-STD-211, test condition A. Refer to [Figure 20: Solder Termination](#) for details and outline dimensions.

PC Termination. PC termination shall be gold plated to facilitate hand, wave, or reflow soldering methods. Terminal strength is 3 pounds perpendicular to the long axis and 5 pounds parallel to the long axis. Refer to [Figure 21: PC Termination](#) for outline dimensions.

Crimp Pin Terminals. Crimp pin terminals are gold plated per MIL-G-45204. Crimp on wire terminations per MIL-C-39029/22-192 in conjunction with receptacle shall withstand a pull force of 5 pounds along the axis of the terminals.

Color band identification and reference dimensions of the Socket Contact used in crimp pin applications are shown in [Figure 23: Crimp Pin](#). Socket is to be used with #22-24 wire size. #20 wire shall be used in 5-10 Amp applications. Socket contact is shown for reference only and to be ordered separately. Refer to [Figure 22: Crimp Termination](#) for receptacle outline dimensions.

4.2.4. Pushbutton Switch Weight

The typical weight of the switch or indicator, including mounting hardware and the pushbutton, are given in [Table VII: Pushbutton Switch Weight](#).

Table VII: Pushbutton Switch Weight

Description	Termination	Ounces (max.)	Grams (max.)
Splash-Proof Switch Assembly 4PDT	Solder / PC	0.39	11
	Crimp Pin	0.60	17
Splash-Proof Indicator Assembly	Solder / PC	0.39	11
	Crimp Pin	0.60	17
Watertight Switch Assembly 4PDT	Solder / PC	0.53	15
	Crimp Pin	0.74	21
Watertight Indicator Assembly	Solder / PC	0.53	15
	Crimp Pin	0.74	21
Mounting Hardware	Panel Seal, Panel	0.07	2

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4.2.5. Mounting Provision

The location of the mounting screws within the switch body is shown in [Figure 34: Mounting Screw Location \(Splash-Proof, Extended Version Shown\)](#). Refer to Technical Bulletin 215 and 216 for pushbutton extraction and installation procedure for splash-proof and watertight designs, respectively.

The recommended panel cutout for individual and matrix mounting are shown in [Figure 25: Panel Cutout and Thickness](#), [Figure 26: Slot Mount for Type I & III](#), [Figure 27: Matrix Mount for Type I & III](#) and [Figure 28: Matrix Mount for Type II & IV](#). The maximum recommended panel thicknesses accommodated by each configuration is shown in [Table IV: Mounting panel thickness maximum](#).

For applications where horizontal or vertical slot mounting of two or more individual mount switch/indicator is required, the following formula provides cut-out dimensions for the slot mounting (see [Figure 26: Slot Mount for Type I & III](#)). L (inches) = $0.752'' \times (n-1) + 0.690''$.

Where:

L = length of horizontal or vertical mounting slot.

N = number of units in a row or column.

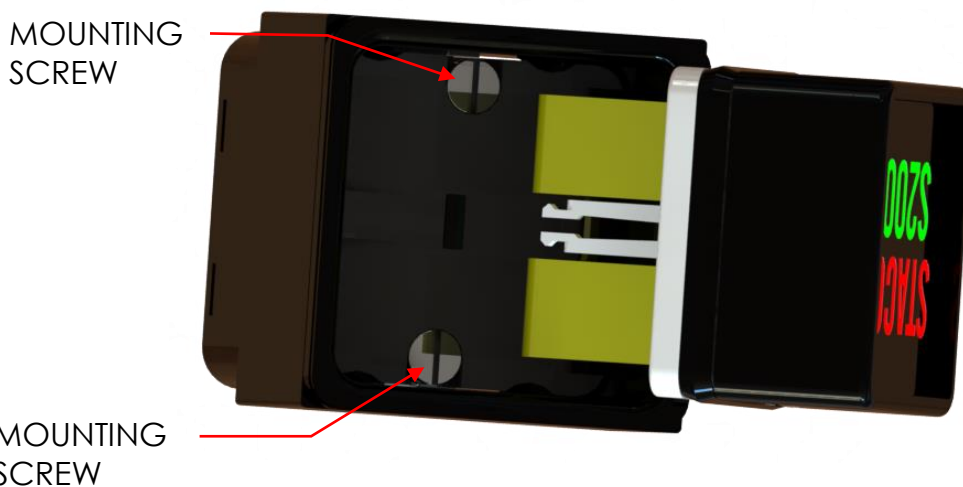


Figure 34: Mounting Screw Location (Splash-Proof, Extended Version Shown)

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4.3. Electrical Specifications

4.3.1. Schematics

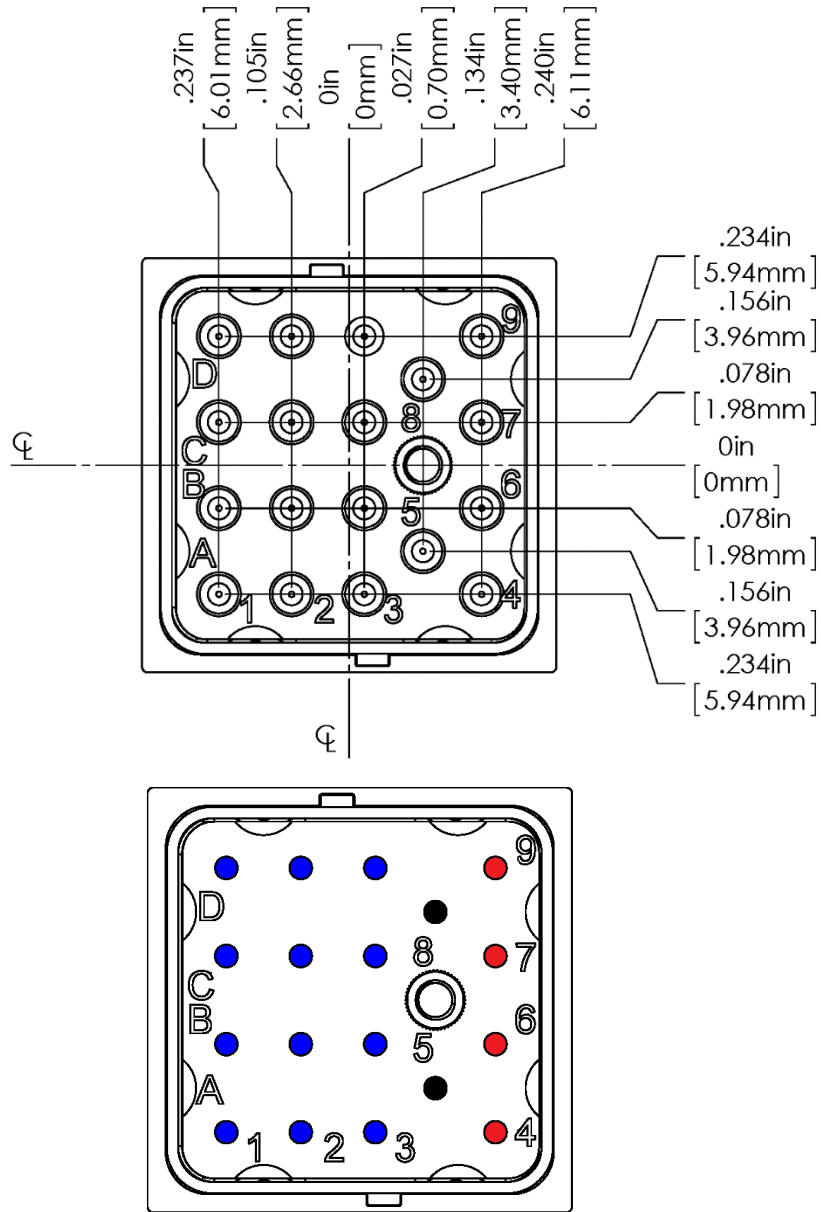


Figure 35: Switch Terminal Identification

Notes:

1. Rows A, B, C, D and columns 1, 2, and 3, identify switch contact terminations.
2. Pins 4, 6, 7, and 9, identify backlight circuit terminations.
3. Pins 5 and 8 identify ground terminations.

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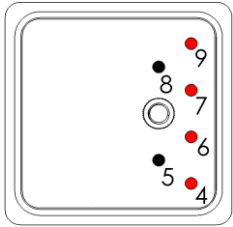
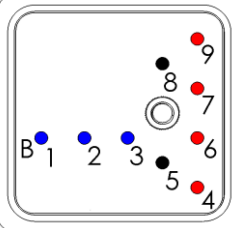
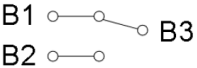
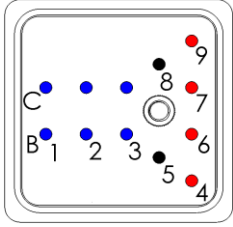
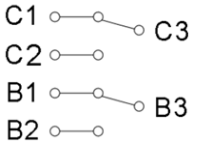
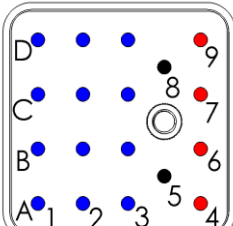
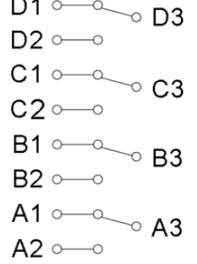
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Table VIII: Switch and Termination Diagram

Indicator		None	None
Single pole double throw			<p>B1 and B3 (NC) B2 and B3 (NO)</p>
Two pole double throw			<p>C1 and C3 (NC) C2 and C3 (NO) B1 and B3 (NC) B2 and B3 (NO)</p>
4-pole double throw			<p>D1 and D3 (NC) D2 and D3 (NO) C1 and C3 (NC) C2 and C3 (NO) B1 and B3 (NC) B2 and B3 (NO) A1 and A3 (NC) A2 and A3 (NO)</p>

Note: Shown in normally closed positions.

Refer to [Figure 35: Switch Terminal Identification](#) for terminal designations. Shown in normally closed positions

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4.3.2. Common and Bussing Circuitry

The following schematics are 5 VDC standard common, 28 VDC standard common and bussing circuitry diagrams.

For single common applications, it is recommended to the end user that both common terminations (pins 8 and 5) be used as the common return circuit for redundancy.

A typical pushbutton switch could require up to six wires to illuminate all four quadrants of the display. To reduce the number of wire input, a selection of common and bussing option is available as shown in [Table IX: Common Circuit Diagrams](#) and [Table X: Bussing Circuit Diagram](#).

Table IX: Common Circuit Diagrams

5 VDC Common Circuit Diagram - View from rear of switch		
Single Common	Horizontal Split Common	Vertical Split Common
28 VDC Common Circuit Diagram - View from rear of switch		
Single Common	Horizontal Split Common	Vertical Split Common

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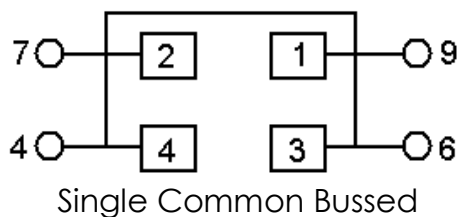
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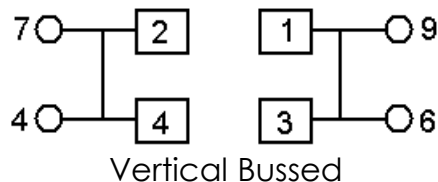
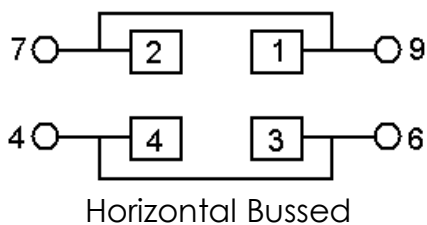
Table X: Bussing Circuit Diagram

Bussing Circuit Diagram – View from rear of switch

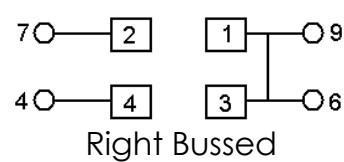
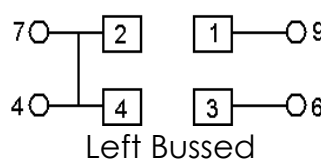
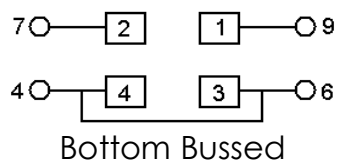
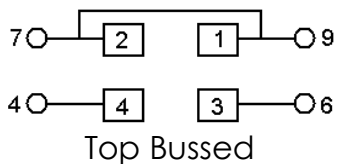
1-input / Full Screen Display



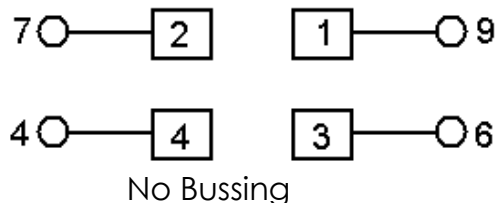
2-inputs / 2-way split display



3-inputs / 3-way split display



4-inputs / 4-way split display



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4.3.3. Operating Voltage

The Series 200 pushbutton switches offer two input voltages, 5 VDC and 28 VDC. For 5 VDC applications, the LEDs are connected in parallel and use 24 mA per quadrant when illuminated. For 28 VDC applications, the LEDs are connected in series and use 12 mA per quadrant when illuminated. There shall be two HB LEDs per quadrant. Refer to [Table XI: Electrical Characteristics](#) for power consumption, faceplate temperature and electrical load range.

Table XI: Electrical Characteristics

Lamp Circuit Power Consumption	VDC	Watt
	28	1.4
	5	0.5
Lens face temperature: 10° C max. above		

High-brightness Lighted-Emitted Diodes.

The Series 200 switch HB LED utilizes a bridge rectifier in each of its four lighting circuits to provide polarity insensitivity. This enables application in current sinking or current sourcing circuits.

4.3.4. Switch Contact Rating

The switch contacts shall be made and break the currents as listed in [Table XII: Contact Rating](#).

Table XII: Contact Rating

		Sea Level	50,000 feet
28 VDC	Resistive	10.0 Amperes	5.0 Amperes
	Inductive	5.0 Amperes	2.5 Amperes
115 VAC, 60Hz	Resistive	7.0 Amperes	
	Inductive	3.5 Amperes	
LOW LEVEL	Resistive	10 micro-amperes	
	Inductive		

Note: S200 contacts are designed for universal applications, 10 µA to 10A. However, contacts subjected to a high current (>100 mA) lose their low current capability (<100 mA).

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4.3.5. Dimming Control Circuit

Dimming the luminance to the desired level is accomplished by varying the applied voltage. The Series 200 switch has both linear and non-linear dimming circuits with built-in voltage control. 5 VDC switches are available with linear dimming circuits only. 28 VDC switches are available in either linear or non-linear dimming circuits. The output normalized luminance vs. input voltage of each voltage dimming circuit is shown in Figure 36, 37 and 38.

For 5 VDC linear dimming, visible luminance starts at about 3.6 VDC where LED current is approximately 0.0005 A and continues to 5 VDC where current reaches 0.025 A. See [Figure 36: Typical 5 VDC Linear Dimming](#).

For 28 VDC linear dimming, visible luminance starts at about 6 VDC where LED current is approximately 0.0002 A and continues to 28 VDC where current reaches 0.0125 A. See [Figure 37: Typical 28 VDC Linear Dimming](#).

For 28 VDC non-linear dimming, visible luminance starts at about 7 VDC where LED current is approximately 0.0001 A and continues to 28 VDC where current reaches 0.0125 A. See [Figure 38: Typical 28 VDC Non-Linear Dimming](#).

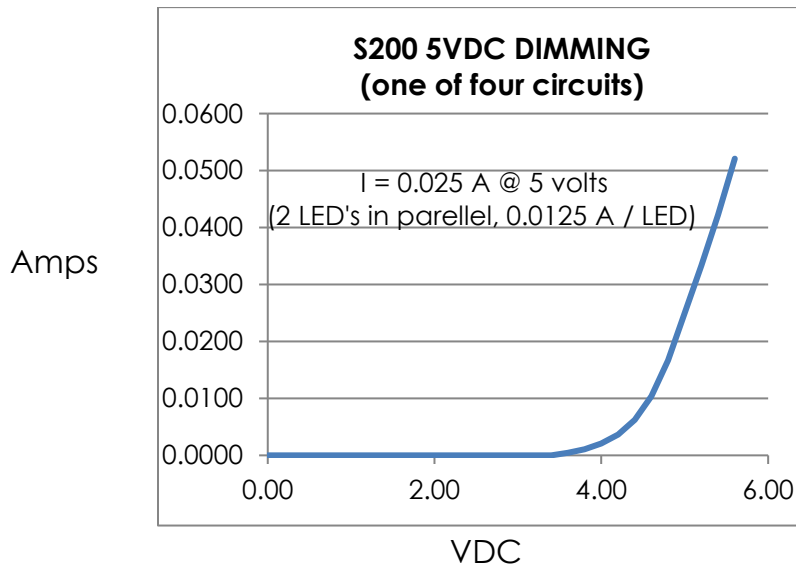


Figure 36: Typical 5 VDC Linear Dimming

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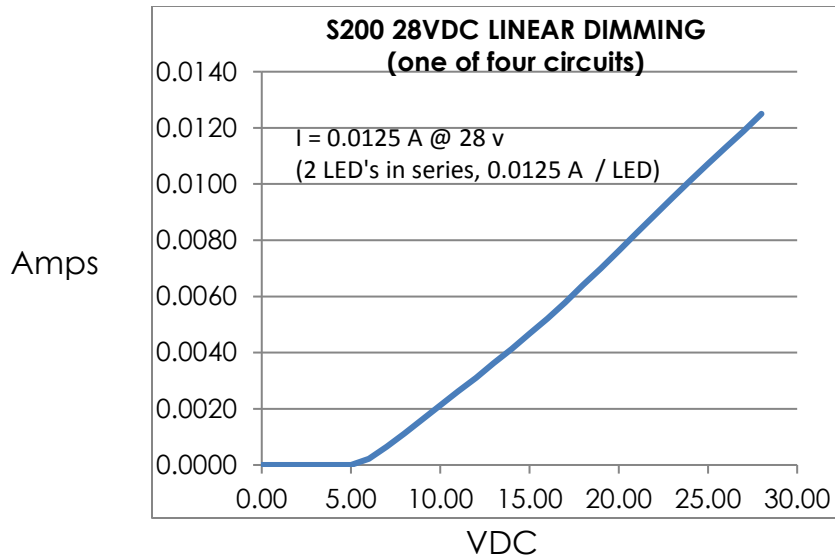


Figure 37: Typical 28 VDC Linear Dimming

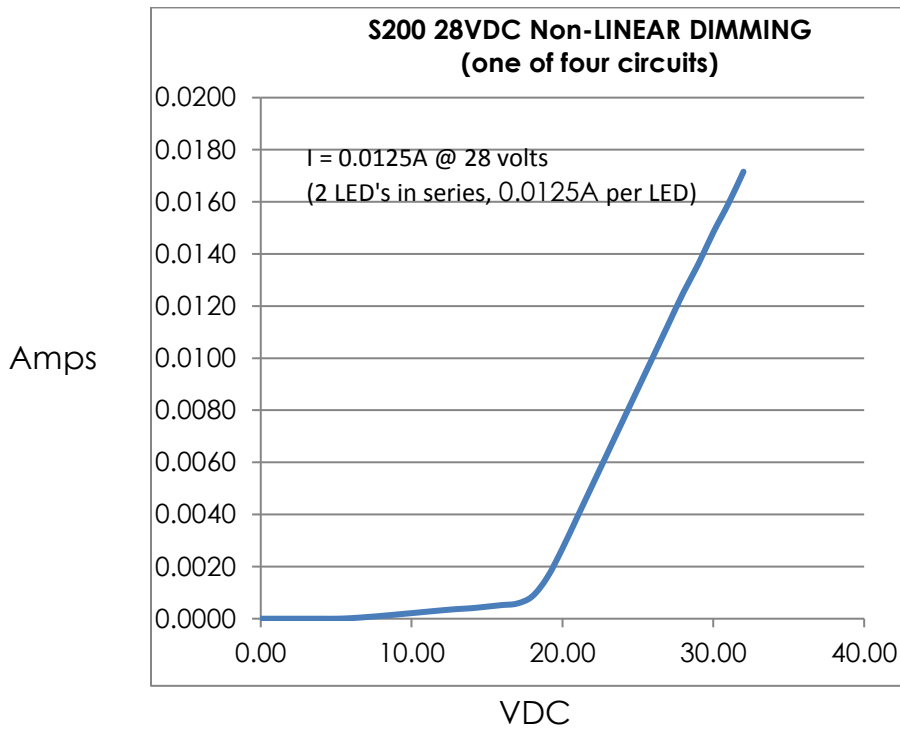


Figure 38: Typical 28 VDC Non-Linear Dimming

Following is an example of how non-linear dimming voltage control luminance is calculated.

Example:

Using the luminance data of NVIS yellow from [Table XVI: NVIS Illuminated Color](#).

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Minimum average luminance = 250 fL.
 250 fL x 1.5 (high) = 375 fL.
 250 fL x .75 (low) = 188 fL.

4.3.6. Other Electrical Specifications

Contact Resistance: The switches are tested in accordance to the requirements of MIL-PRF-22885 and MIL-STD-202, Method 307.

Low Level Circuit: The switches are tested in accordance to the requirements of MIL-PRF-22885, and MIL-STD-202, Method 311.

Electrical Endurance: The switches are tested in accordance to the requirements of MIL-PRF-22885, at the electrical ratings specified in [Table XII: Contact Rating](#).

Overload Cycling: The switches are tested in accordance to the requirements of MIL-PRF-22885.

Contact Bounce: The switches are tested in accordance to the requirements of MIL-PRF-22885. Simultaneity is under 2 milliseconds.

Dielectric Strength: Tests are performed at both sea level and at a reduced barometric pressure simulating 70,000 feet altitude.

Dielectric Withstanding Voltage at Atmospheric Pressure: The switches are tested in accordance to the requirements of MIL-PRF-22885, Para. 4.7.19.1, MIL-STD-202, Method 301.

Dielectric Withstanding Voltage at Reduced Pressure: The switches are tested in accordance to the requirements of MIL-PRF-22885, Para. 4.7.19.2, MIL-STD-202, Method 105C, Cond. C.

Insulation resistance: The switches are tested in accordance to the requirements of MIL-PRF-22885, MIL-STD-202, Method 302, Cond. B.

Short Circuit: The switches are tested in accordance to the requirements of MIL-PRF-22885, Method I, for 2 cycles.

4.4. Display Specifications

4.4.1. Field of View

The pushbutton switch displays are tested in accordance to the requirements of MIL-PRF-22885.

Legend area and viewing dimensions are shown in [Figure 39: Legend Area](#) and [Table XIII: Viewing Area](#).

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Figure 39: Legend Area

Table XIII: Viewing Area

Viewing area	Splash-Proof dimensions - Inch [mm]	Watertight dimensions - Inch [mm]
Full screen	0.56" x 0.56" [14.22 mm x 14.22 mm]	0.50" x 0.50" [12.7 mm x 12.7 mm]
Half screen – horizontal	0.56" x 0.28" [14.22 mm x 7.11 mm]	0.50" x 0.25" [12.7 mm x 6.35 mm]
Half screen – vertical	0.28" x 0.56" [7.11 mm x 14.22 mm]	0.25" x 0.50" [6.35 mm x 12.7 mm]
Quarter screen	0.28" x 0.28" [7.11 mm x 7.11 mm]	0.25" x 0.25" [6.35 mm x 6.35 mm]

4.4.2. Legends

Standard Font Style & Size.

The standard font style is 'alternate gothic number 2' (AG2), available in capital letters and numeric, plus all the character and symbols which are available as shown in [Figure 40: Standard Font Size and Style](#).

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ABCDEFGHIJKLMNOPQRSTUVWXYZ
**0123456789!@#\$%^&*()'.,\"+/
 ;;<=>?_`~≠#©¡“»-±¹²³
 ¼½¾ÀÁÂÃÄÅÈÉÊËÌÍÎÏÑÒÓÔÕÖÜÝ**

Figure 40: Standard Font Size and Style

Note: Lower case characters not available as standard option in this font.

Unless otherwise specified, all symbols will be proportional to the size of the AG2 font.

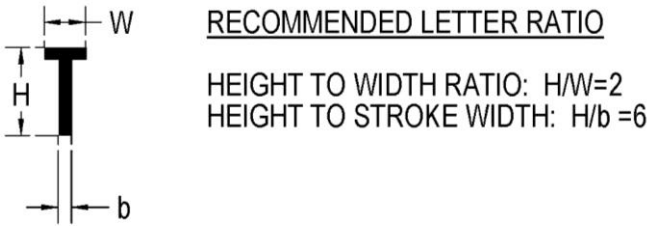


Figure 41: Character Height

The character height, as defined in [Figure 41: Character Height](#) above, shall be the distance (in decimal inches) from the top to the bottom of a capital letter (no descender) in the standard font, AG2. The standard character heights are as follow: 0.072", 0.087", 0.100", 0.125", and 0.145".

The approximate number of AG2 characters of a given size which will fit into a display area is given in [Table XXIII: Display Style and Character Size Option](#). Since AG2 characters are proportionally spaced (i.e., a character "M" or "W" is about three times as wide as the character "I") the actual number of characters will depend on the specific characters used. If the specific characters used in a given area exceed the space available, but by no more than 10%, the characters shall be condensed by 10%, using the same height but less width, in order to accommodate the legend as requested by the customer.

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Optional Font Style and Size, Non-Roman Alphabets and Symbols. By special order, other font styles and sizes may be ordered in their normal, condensed, bold, or expanded variations. These typefaces are available in either or both upper and lower cases. Depending on the character width of the chosen fonts, the number of characters per line may be different than of AG2.

Non-Roman Alphabets – Graphic representative is required from customers for non-roman alphabets such as Hebrew, Russian, Japanese, Korean, Chinese, Arabic, Sanskrit, etc.

Standard and Complex Shapes – It is recommended that the customers to provide graphic representative or drawings for standard and complex shapes such squares, rectangles, circles, icons, or graphic symbols.

4.5. Optical Performance

The pushbuttons illuminated color is tested in accordance to the requirements of MIL-PRF-22885.

4.5.1. Luminance Performance

The pushbutton luminance is tested in accordance to the requirements of MIL-PRF-22885, for Non-NVIS colors and NVIS colors.

See [Table XIV: LED Luminance Performance](#) for the minimum average luminance.

Table XIV: LED Luminance Performance

22885 Symbol	Minimum Luminance (foot-lamberts)					
	C	B	H	N	W	S
S200 Code	1	2	3	4	5	6
Red	100	100	150	2.0	125	200
Green	100	100	150	2.5	100	250
Aviation Yellow	250	250	300	3.0	250	450
Lunar White	150	150	200	3.0	150	450
Blue	100	100	100	2.0	100	200
Aviation Green	100	100	100	2.0	100	250
White	150	150	175	2.5	150	450

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Table XV: Standard Color Limits

Standard Color limits													
Red		Green		Aviation Yellow		Lunar White		Blue		Aviation Green		White	
x	y	x	y	x	y	x	y	x	y	x	y	x	y
0.695	0.285	0.3	0.56	0.545	0.425	0.4	0.375	0.25	0.33	0.14	0.47	0.48	0.395
0.705	SL 1/	0.3	SL 1/	0.56	SL 1/	0.4	0.42	0.25	0.42	0.29	0.47	0.48	0.435
0.65	0.33	0.375	0.56	0.59	0.382	0.48	0.375	0.33	0.33	0.03	SL 1/	0.54	0.431
0.66	SL 1/	0.375	SL 1/	0.604	SL 1/	0.48	0.42	0.33	0.42	0.185	SL 1/	0.54	0.391

1/ The term "SL" indicates where intersections occur with the spectrum locus on the CIE1931 chromaticity diagram ([Figure 43: CIE 1931 Chromaticity Diagram](#)).

@ 14 Vdc non-linear dimming the luminance approximately 21 foot-lambert, @ 28 Vdc non-linear dimming the luminance approximately 505 foot-lambert ([Figure 42: Typical Luminance vs Voltage \(Non-Linear Dimming\)](#)).

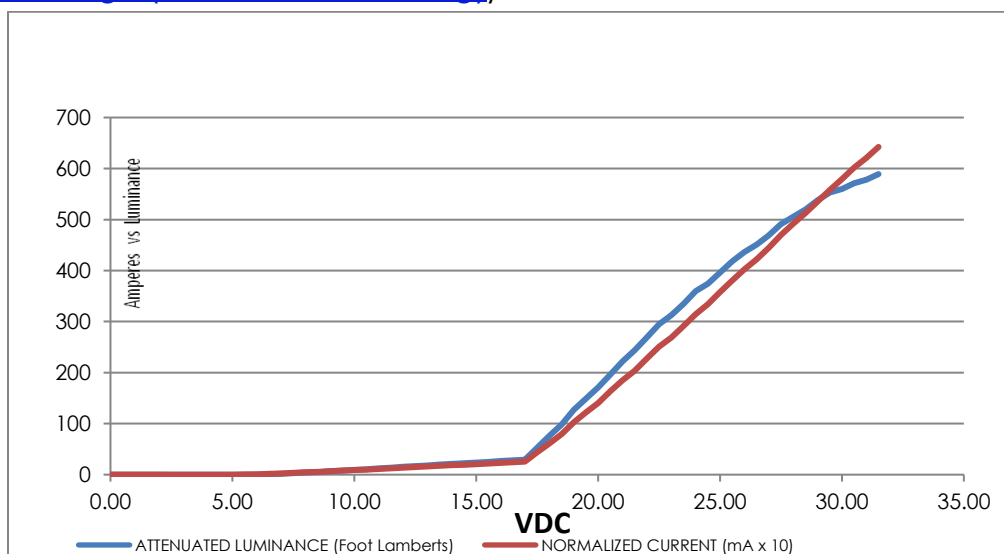


Figure 42: Typical Luminance vs Voltage (Non-Linear Dimming)

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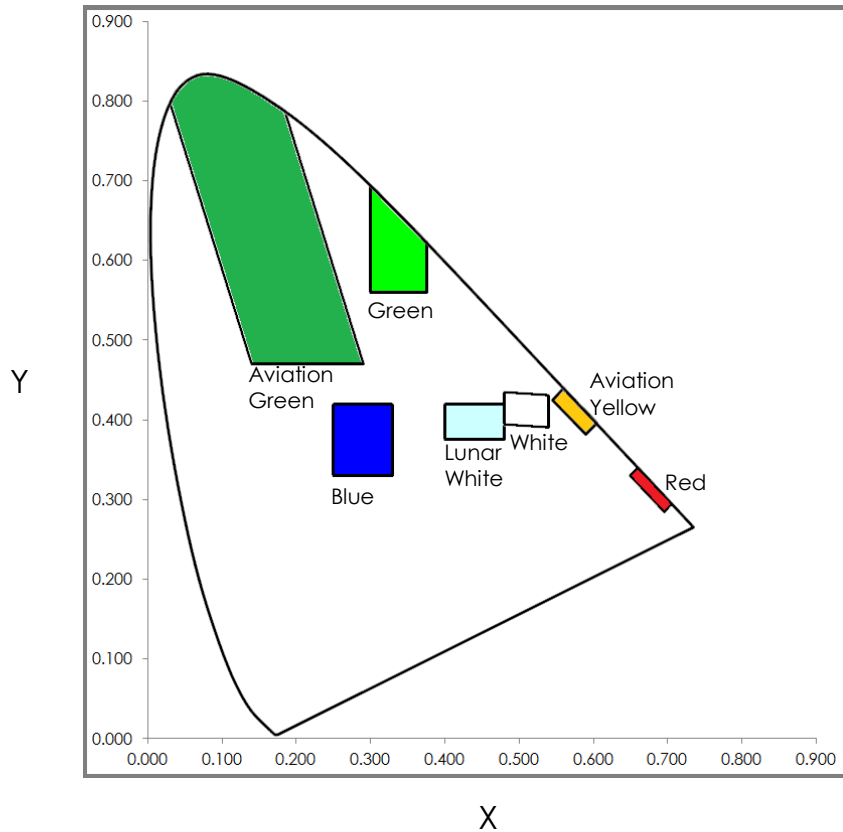
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The colors are expressed as "x" and "y" coordinates on the standard 1931 CIE chromaticity diagram. Illuminated colors, measured as specified herein, shall be within the limits bounded by the coordinates listed for each color. Refer to [Figure 43: CIE 1931 Chromaticity Diagram](#) and [Table XV: Standard Color Limits](#).

Figure 43: CIE 1931 Chromaticity Diagram

4.5.2. NVIS Compatibility

NVIS compatibility is tested in accordance to the requirements of MIL-PRF-22885, MIL-STD-3009, and MIL-L-85762 (when applicable). Available NVIS colors are white, blue, red, green A, green B, yellow A and yellow B.

In general, NVIS Green A and Green B are used for illuminated controls, caution and advisory signals. NVIS Yellow is used for master caution and warning signals. NVIS Red is only applicable to Class B systems and is used as a warning signal. NVIS blue and white are used for advisory and identification.

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NVIS GREEN B

$u' = 0.131$

$v' = 0.623$

$r = 0.057$

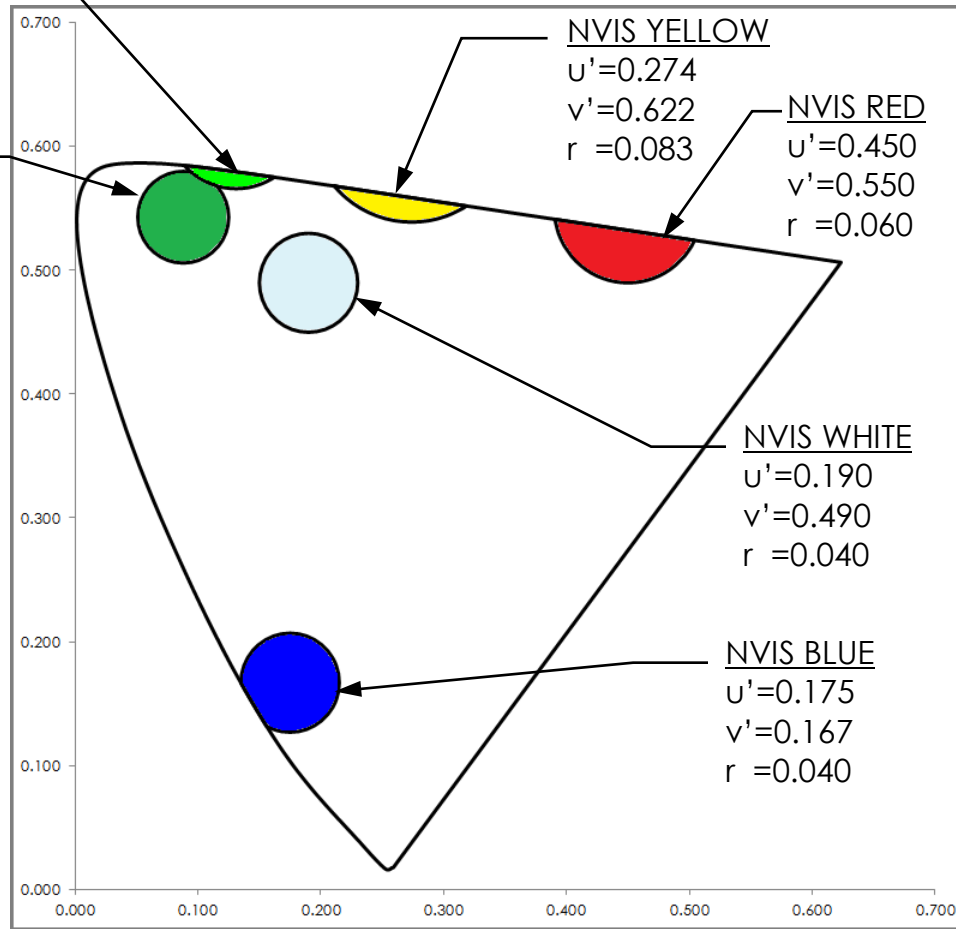
NVIS GREEN A

$u' = 0.088$

$v' = 0.543$

$r = 0.037$

v'



u'

The colors are expressed as u' and v' coordinates on the U.C.S. 1976 chromaticity diagram. See [Figure 44: U.C.S. 1976 Chromaticity Diagram](#) and [Table XVI: NVIS Illuminated Color](#).

Figure 44: U.C.S. 1976 Chromaticity Diagram

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Table XVI: NVIS Illuminated Color

NVIS Illuminated color									
Color	Minimum Luminance Estimate (fL)	Chromaticity Coordinates			Contrast - 0°/45° Degrees		Radiance		
		u'	v'	r	"ON"	"OFF"	Nra	Nrb	Scaled Luminance (fL)
Green A	150	0.088	0.543	0.037	0.60	0.10	1.7 E-10	1.7 E-10	0.10
Green B	150	0.131	0.623	0.057	0.60	0.10	1.7 E-10	1.7 E-10	0.10
Yellow A	150	0.274	0.622	0.083	0.60	0.10	1.7 E-10	-	0.10
Yellow B	150	0.274	0.622	0.083	0.60	0.10	-	1.5 E-7	15.0
Red	80	0.450	0.550	0.060	0.30	0.10	-	1.4 E-7	15.0
White	80	0.190	0.490	0.040	0.30	0.10	-	2.2 E-10	0.10
Blue	.50	0.175	0.167	0.040	N/A	0.10	-	1.00 E-08	0.50

Where: u' and v' = 1976 UCS chromaticity coordinates of the center point of the color area.

r = radius of the allowable circular area for the color. All values are per MIL-STD-3009 and MIL-L-85762 (when applicable).

Night Vision Imaging System Classes - Two NVIS classes have been defined, based on the cut-off frequency of the filters used in the goggles. Class A NVIS uses the 625 nanometer (nm) minus blue objective lens filter while Class B uses the 665 nm filter. The lower cut-off of the Class A filters allows for maximum near-IR response to tree bark, grass and other green vegetation, a general requirement for helicopter applications operating below tree-top level. The Class B filter, with the higher cut-off, allows the goggles to be used in conjunction with orange and red warning indicators in the cockpit, and is intended for aircraft which are operating above tree level.

NVIS Radiance - The NVIS radiance (NR) is measured for Class A (NRA) for compatibility with 625 nm applications, and for Class B (NRB) for 665 nm systems. Both are the result of spectral radiance measurements, in 5 nm increments, from 450 to 930 nm. The readings are automatically scaled by the spectroradiometer system to a selected brightness level given in foot-lamberts.

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NVIS spectral radiance measurements for the Series 200 shall be made on a calibrated spectroradiometer. The luminance setting for these measurement shall be 15 ± 0.5 fL (or full rated drive condition, whichever is less) as determined either by photometer or spectroradiometer measurement. The NVIS radiance value shall then be scaled from the NR value at the measured luminance to the NR at the specified luminance level. [Table XVII: Radiance Requirements](#) has the summary of the NVIS radiance specification for configurations which are applicable to the Series 200 Product Line.

Table XVII: Radiance Requirements

Radiance Requirements								
NVIS color	TYPE I SYSTEM				TYPE II SYSTEM			
	Class A		Class B		Class A		Class B	
	Min NRa	Max NRa	Min NRb	Max NRb	Min NRa	Max NRa	Min NRb	Max NRb
Blue	N/A	1.2 E-08	N/A	1.1 E-08	N/A	1.2 E-08	N/A	1.1 E-08
Red	5.0 E-08	1.5 E-07	4.7 E-08	1.4 E-07	N/A	1.5 E-07	N/A	1.4 E-07
Green B	N/A	1.7 E-10	N/A	1.7 E-10	N/A	1.7 E-10	N/A	1.7 E-10
Yellow	5.0 E-08	1.5 E-07	4.7 E-08	1.4 E-07	N/A	1.5 E-07	N/A	1.4 E-07
White	N/A	1.7 E-10	N/A	1.7 E-10	N/A	1.7 E-10	N/A	1.7 E-10
Green A	N/A	1.7 E-10	N/A	1.7 E-10	N/A	1.7 E-10	N/A	1.7 E-10

4.5.3. Sunlight Readability

The Sunlight Readability is tested in accordance to the requirements of MIL-PRF-22885. The contrast ratio of each lighted legend character to the background exceeded the 0.6 minimum requirements, and for unlighted legend character to the background, the average contrast ration is ≤ 0.1 , see [Table XXIII: Display Style and Character Size Option](#).

Sunlight readable displays in the Series 200 Product Line provide a black, non-reflective, dead-front appearance when not lighted and brightly lighted legend characters, in the specified colors, when the displays are energized. This display (type 6) protects the crew station viewer from false indications in direct sunlight at high altitude. The design overcomes two problems associated with high-intensity light directed at the instrument panel. First, when lighted, it enables the viewer to read the legend despite the intense brightness of direct sunlight at 70,000 feet altitude. Secondly, the design prevents this high intensity light from causing the legends to falsely appear to be lighted when they are actually unlighted. The measure of its effectiveness is by means of calculating two sets of contrast

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ratios based on laboratory measurements conducted under very specific conditions.

Contrast Ratio

As specified in MIL-PRF-22885, the contrast ratios CL and CUL, calculate for each character is as follows:

The lighted contrast (ON/BACKGROUND) is defined by $CL = (B2 - B1)/B1$.

The unlighted contrast (OFF/BACKGROUND) is defined by $CUL = (B3 - B1)/B1$.

B1 = Average background luminance

B2 = Average character luminance, legend lighted

B3 = Average character luminance, legend unlighted

SLR performance of sealed switches - SLR performance shall not be degraded for standard Splash-proof or Watertight seals. SLR requirements do not apply to Solvent Resistant or Hazardous Environment Seals.

Table XVIII: Type 6 Contrast

Type 6 Contrast		
Color	Average Legend On Contrast MIN	Average Legend Off Contrast MAX
Red	0.6	0.1
Green	0.6	0.1
Aviation Yellow	0.6	0.1
Aviation Green	0.6	0.1
Blue	0.6	0.1
Lunar White	0.6	0.1
White	0.6	0.1

4.6. Environmental Specifications

Temperature Characteristics

The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885.

Table XIX: Operating Temperature Range

Condition	Temperature
Operating with lamps un-energized	-65 °C to +85 °C
Operating with lamps energized	-55 °C to +71 °C
Storage Temperature	-55 °C to +85 °C
Storage Temperature Max 24 hrs.	-65 °C to +95 °C

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Touch Temperature: When switches are tested as specified below, the maximum difference between the stabilized lens face temperature and the ambient temperature shall not exceed +10 °C.

Test method: The test method shall be in accordance with EIA448.2 using the recommended panel cutout. The test shall be performed with each of the standard LED voltages at full rated current and at 100 percent duty cycle.

Salt Spray: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885 and MIL-STD-202, Method 101E, Cond. A.

Thermal Shock: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885 and, MIL-STD-202, Method 107G, Test Condition A.

Vibration: The pushbutton switches are tested in accordance to the requirements of MIL-STD-202, and MIL-PRF-22885 vibration grade 3.

Acceleration: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885.

Shock: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, and MIL-STD-202, Method 213B.

Watertight and splash-proof switches: high impact shock in accordance with MIL-S-901, grade A, Class II (for deck-mounted equipment) when attached to the anvil plate of the shock machine by means of standard mounting with simulated console, which provides resilient mounting typical on in-service use within “deck mounted” electronic cabinets or panels. These units are not recommended for direct “hull mounted” applications.

High Impact Shock: The pushbutton switch shall meet the requirements of MIL-S-901, Grade A, Class II.

Moisture Resistance: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, and MIL-STD-202, Method 106G.

Splash Proof Seal: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, and MIL-STD-108 paragraph 4.9.

Splash-Proof Seal: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, and MIL-STD-108 paragraph 4.9.

Watertight Seal: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, and MIL-STD-108 paragraph 4.13.

Solvent Resistance Seal: The pushbutton switches are tested in accordance to the requirements of MIL-STD-810, method 504, procedure II.

Explosion: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, and MIL-STD-202, Method 109G.

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Sand & Dust: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, and MIL-STD-202, Method 110, Cond. B.

EMI/RFI Shielding: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885.

4.7. Material Requirements

Materials and processes specified herein. Detailed part drawings, bills of material, bills of operation, process specifications and other manufacturing documentation are subordinate to this specification. In case of conflict, this document shall prevail. When a definite material is not specified herein, material or process shall be used which will enable the switches to meet the performance requirements of this specification.

All components contained in S200 product lines are considered *REACH* and *RoHS* compliant.

Dissimilar Metals – The pushbutton switches are manufactured in accordance to the requirements of MIL-PRF-22885. Refer to Staco Systems Engineering Design Standard on Dissimilar Metals and MIL-STD-889 for guidance.

Corrosion Resistance – All metal components, including current carrying components, shall be of corrosion-resistant material, or shall be suitably protected to resist corrosion.

Flame Retardant – Insulation materials used in the pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, Para. 3.5.2, which meet flammability requirements of 94V-0 in accordance with UL 94.

Front Panel Exposure – Parts designed to be exposed at the front of the panel after assembly shall have a black lusterless finish. These include pushbutton housings, panel spacers, pushbutton guards, and other associated mounting hardware designed to be exposed at the front of the panel after assembly.

Finish – Black anodize over aluminum alloy per MIL-A-8625, Type II, Class 2. Chemical film finishes per MIL-DTL-5541, Type II, Class 3.

Terminal Plating – Gold plating per MIL-G-45204. PC terminals are plated to facilitate hand, wave or flow soldering methods. Crimp pin terminals per MIL-G-45204.

Silicon Rubber – Silicone rubber per ZZ-R-765.

Fungus – The pushbutton switches are tested in accordance to the requirements of MIL-STD-454, Requirement 4.

Fluor Silicone – Fluor Silicone Rubber and Elastomer, Oil and Fuel Resistant per MIL-R-25988.

Tin Plated Finish – Lead content is 3% minimum.

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4.8. Other Requirements

4.8.1. Marking

Permanency and legibility of markings shall conform to requirements of MIL-STD-202, Method 215 for resistance to solvents.

4.8.1.1. For non MIL SPEC parts, the following shall be provided as a baseline and as shown in [Figure 45: Non-MIL Spec Marking \(4 pole & PC Extended Version Shown\)](#), [Figure 46: Non-MIL Spec Marking \(4 pole & PC Extended Version Shown\)](#), and [Figure 47: Non-MIL spec marking \(4 pole & PC Extended Version shown\)](#).

- a.
- b. Cage code (12522)
- c. Date code (YYWW; year year week week).
- d. Applicable voltage.
- e. Assembly part number (or customer PN).
- f. Switch schematic.

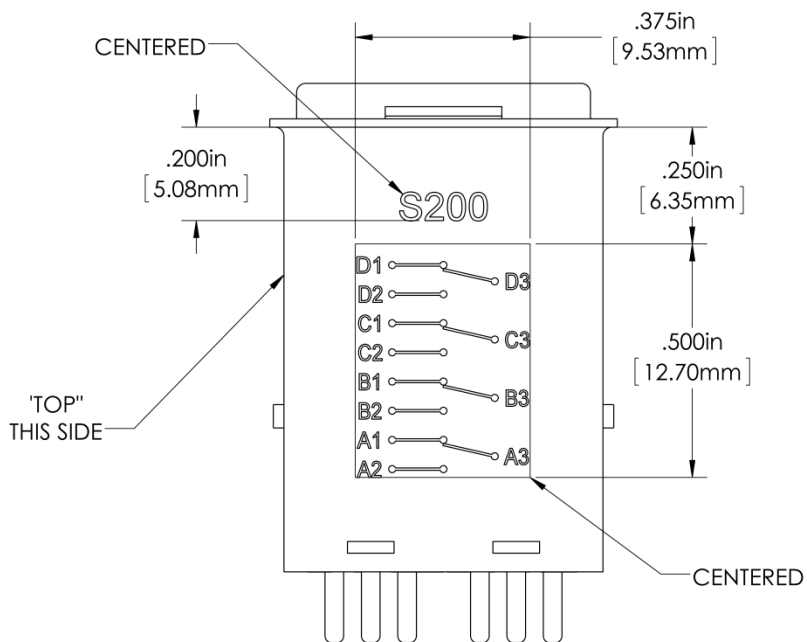


Figure 45: Non-MIL Spec Marking (4 pole & PC Extended Version Shown)

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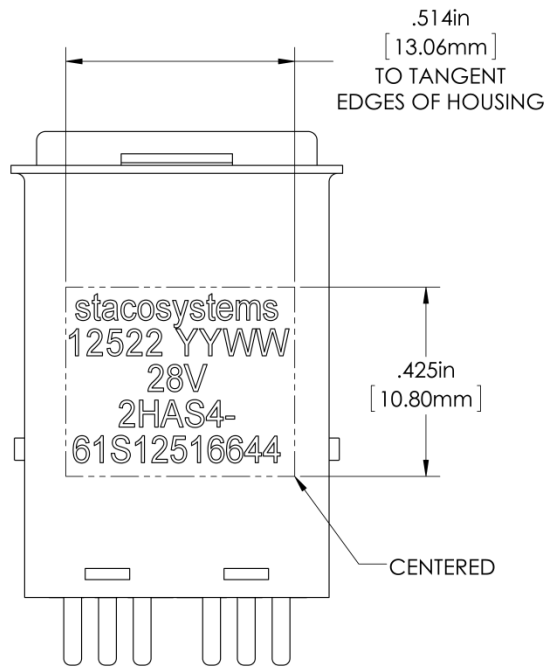


Figure 46: Non-MIL Spec Marking (4 pole & PC Extended Version Shown)

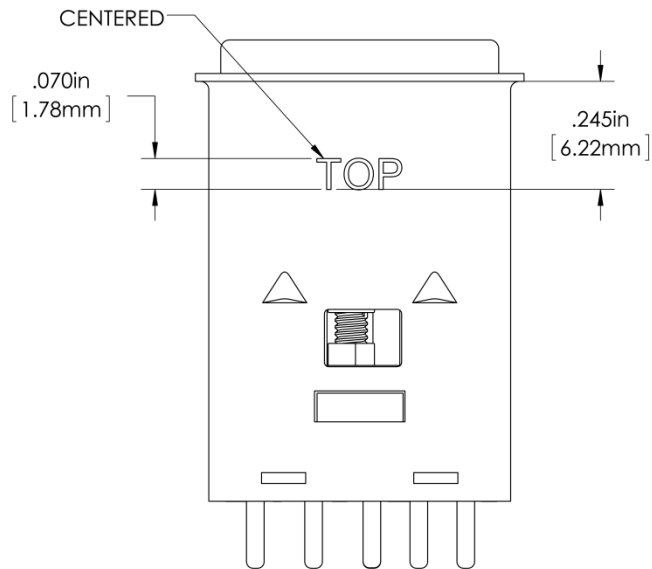


Figure 47: Non-MIL spec marking (4 pole & PC Extended Version shown)

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4.8.1.2. For MIL SPEC parts, the following shall be provided as a baseline and as shown in [Figure 48: MIL Spec Marking \(4 pole & PC Extended Version Shown\)](#).

- a.
- b. Cage code (12522)
- c. Date code (YYWW; year year week week).
- d. Applicable voltage.
- e. Assembly part number (or customer PN).
- f. Switch schematic.
- g. MIL spec part number.

Note: Part shall be marked same as Figures 45-47 with the following addition.

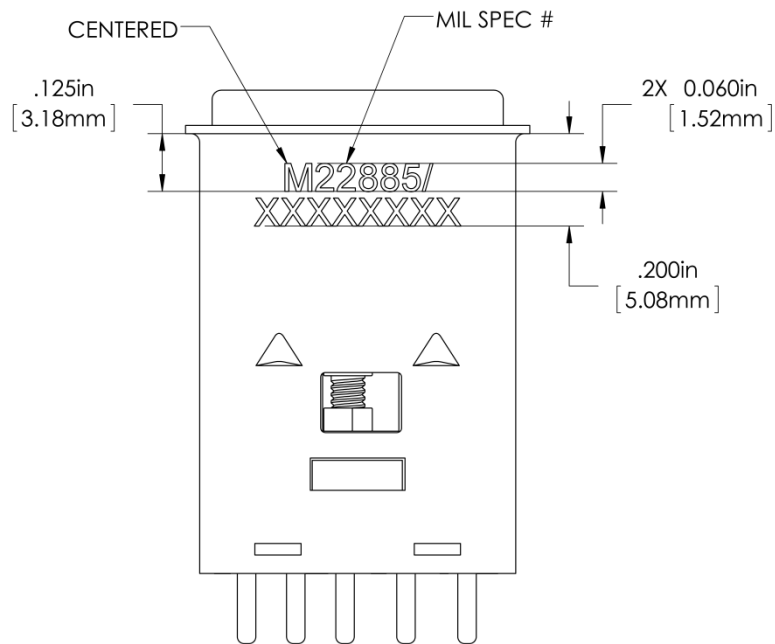


Figure 48: MIL Spec Marking (4 pole & PC Extended Version Shown)

4.8.1.3. For custom part number markings, notes a thru f apply as a minimum unless otherwise specified. See [Figure 49: Non-MIL Spec Marking \(4 pole & PC Extended Version Shown\)](#).

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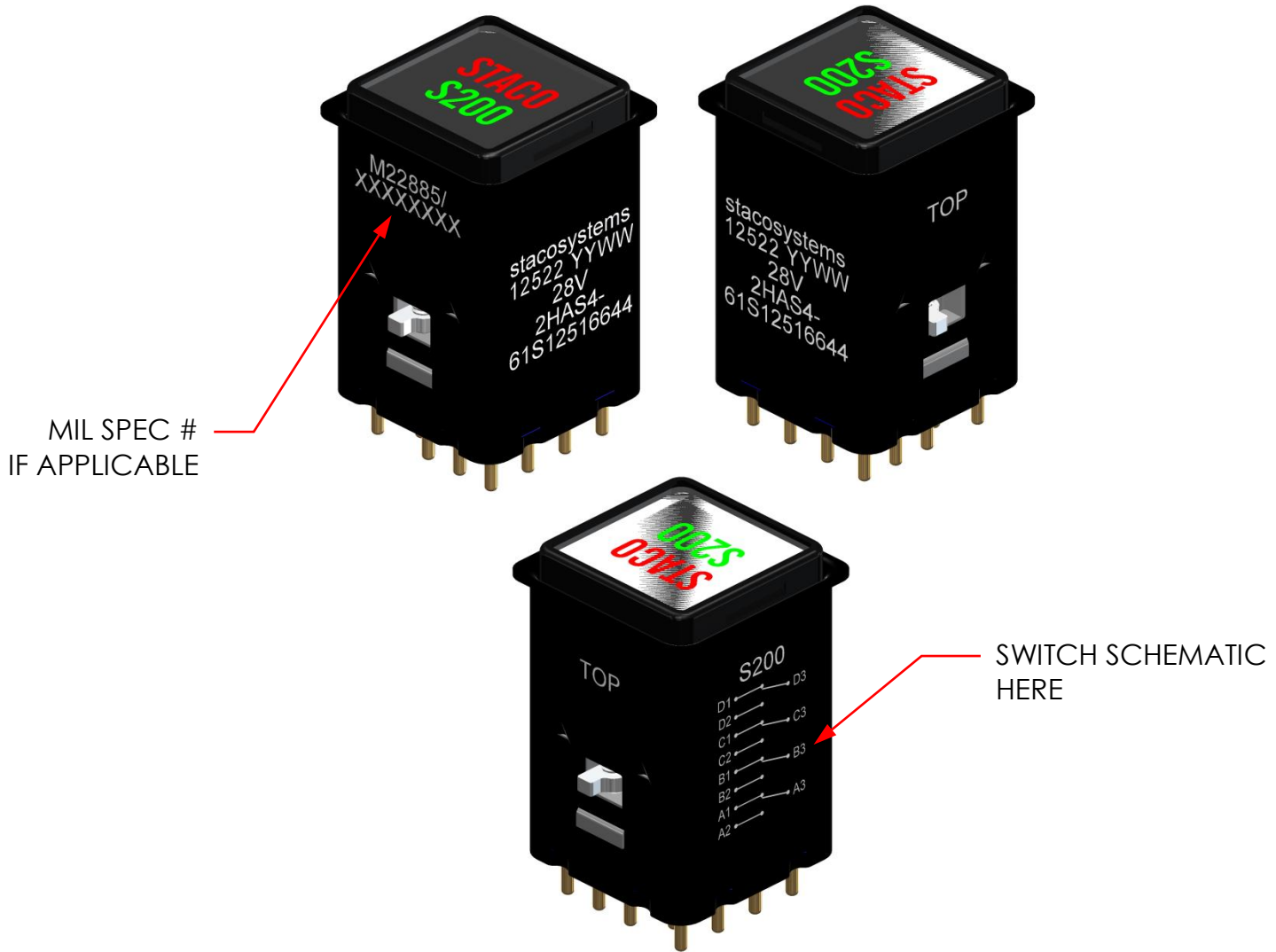


Figure 49: Non-MIL Spec Marking (4 pole & PC Extended Version Shown)

4.8.2. User Instructions and Quality

Each package containing switches or indicators shall contain a copy of 'Pushbutton extraction and installation instruction' Technical Bulletins 215 and 216.

4.8.2.1. Workmanship

Products shall be manufactured in such a manner as to be uniform in quality and free from cracked or displaced parts, sharp edges, burrs, and other defects which would be detrimental to their serviceability or performance.

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4.8.2.2. Quality

Material and products shall be controlled and inspected per the requirements of MIL-I-45208. The maintenance of the calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662. Inspection of product for delivery shall consist of Group A inspections per MIL-PRF-22885 and the applicable slash sheet.

4.8.2.3. Changes in Specifications

Specifications defined herein are accurate at the time of release and publication of this revision of this document. Staco Systems reserves the right to make changes without prior notice.

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5.0 Ordering Information

This section contains the information necessary to order the standard Series 200 pushbutton switch configurations and its features described in this specification.

PART NUMBER MODEL

The Part Number Model (PNM) shall be constructed as illustrated in [Figure 50: Part Number Model](#). See, [Table XXI: Electrical Option](#), [Table XXII: Enclosure Design](#), [Table XXIII: Display Style and Character Size Option](#), option, [Table XXIV: Display Type Option](#) and [Table XXV: Illuminating Color Option](#).

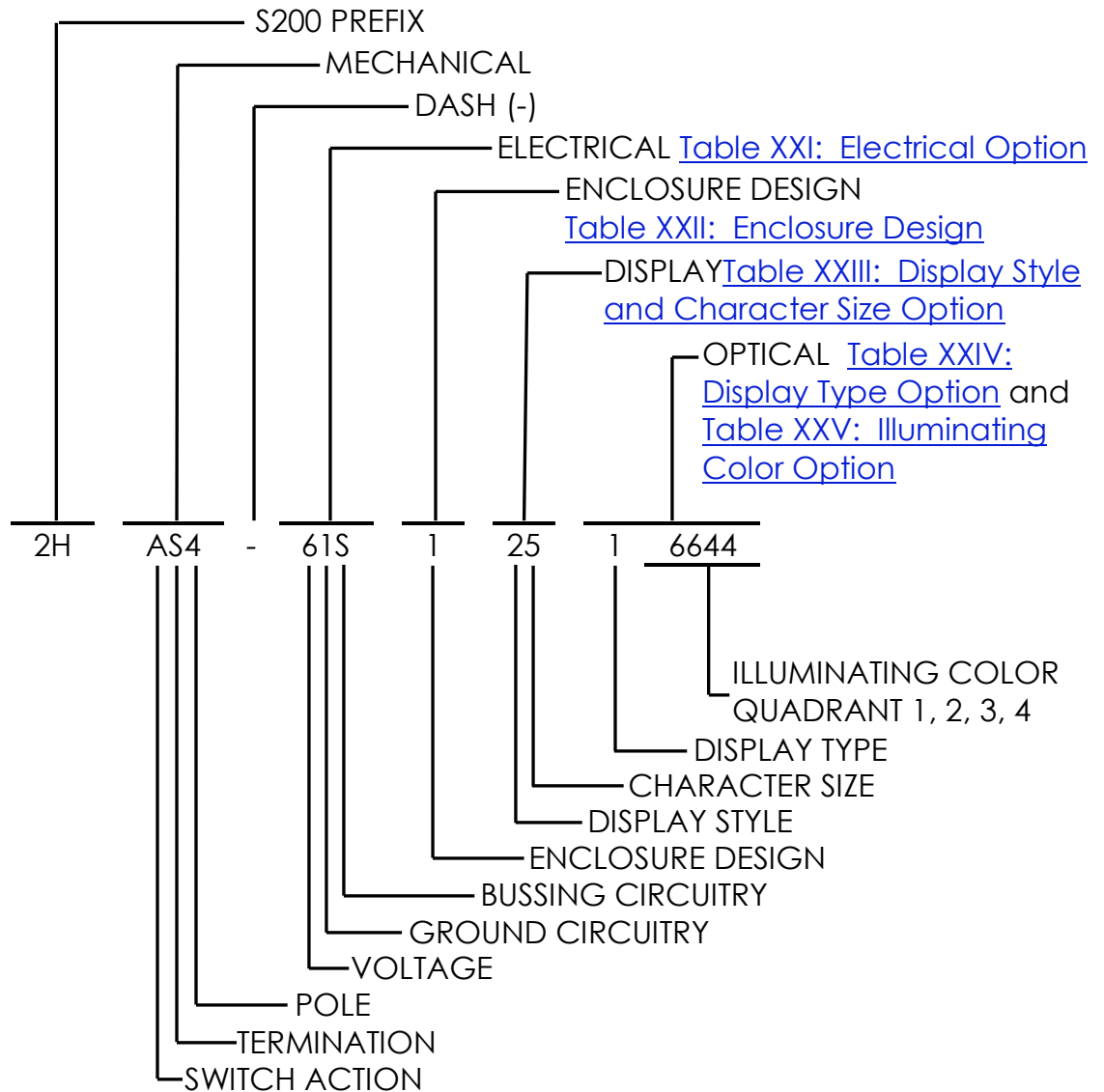


Figure 50: Part Number Model

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Table XX: Mechanical Option

Mechanical Option					
PNM Code	Action	PNM Code	Termination	PNM Code	Pole
N	No Action	S	Solder	0	Indicator
M	Momentary	P	PC	1	1-pole double throw
A	Alternate	C	Crimp pin	2	2-pole double throw
				4	4-pole double throw

Table XXI: Electrical Option

Electrical Option					
PNM Code	Voltage	PNM Code	Ground	PNM Code	Bussing Circuitry
5	5 VDC Linear Dimming	1	Common Lamp ground	S	Single Common
6	28 VDC Linear Dimming	2	Split Lamp ground	H	Horizontal
7	28 VDC Non-Linear Dimming			V	Vertical
				T	Top
				B	Bottom
				L	Left
				R	Right
				N	No Bussing

Table XXII: Enclosure Design

Enclosure Design			
PNM Code	MIL-PRF-22885	Seal Description/Option	Enclosure Type
1*	2	Drip-Proof <u>1/</u>	I (solder/PCB terminations) and III (Crimp pin termination)
	4	Splash-Proof <u>1/</u>	
2	3	Watertight <u>1/</u>	II (solder/PCB terminations) and IV (Crimp pin termination)
3		Solvent Resistant <u>2/</u>	
4	2	Drip-Proof <u>1/</u>	I (solder/PCB terminations) and III (Crimp pin termination) with extended housings, lens retainer, and lens jacket for improved lighting.
	4	Splash-Proof <u>1/</u>	

1/ In accordance to MIL-STD-108.

2/ In accordance to MIL-STD-810, method 504, procedure II.

***Not Available for New Design.**

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Table XXIII: Display Style and Character Size Option

PNM CODE	CHARACTER SIZE IN INCHES (REF)	DISPLAY AREA NO.	LEGEND AREA NO.				DISPLAY STYLE DESCRIPTION
			(H) HORIZ. LINES PER AREA				
			(C) CHARACTERS PER LINE 1/				
			1 HxC	2 HxC	3 HxC	4 HxC	
10	NONE		NONE	NONE	NONE	NONE	FULL SCREEN DISPLAY
11	0.072		5x11	x	x	x	
12	0.087		4x9	x	x	x	
13	0.100		4x8	x	x	x	
14	0.125		3x7	x	x	x	
15	0.145		2x5	x	x	x	
20	NONE		NONE	NONE	NONE	NONE	2-WAY HORIZONTAL SPLIT SCREEN DISPLAY
21	0.072		2x11	2x11	x	x	
22	0.087		2x9	2x9	x	x	
23	0.100		1x8	1x8	x	x	
24	0.125		1x7	1x7	x	x	
25	0.145		1x6	1x6	x	x	
30	NONE		NONE	NONE	NONE	NONE	2-WAY VERTICAL SPLIT SCREEN DISPLAY
31	0.072		5x5	5x5	x	x	
32	0.087		4x4	4x4	x	x	
33	0.100		4x3	4x3	x	x	
34	0.125		3x3	3x3	x	x	
35	0.145		2x2	2x2	x	x	
40	NONE		NONE	NONE	NONE	NONE	3-WAY SPLIT SCREEN DISPLAY HORIZONTAL TOP HALF
41	0.072		2x11	2x5	2x5	x	
42	0.087		2x9	2x4	2x4	x	
43	0.100		1x8	1x4	1x4	x	
44	0.125		1x7	1x2	1x2	x	
45	0.145		1x6	1x2	1x2	x	
50	NONE		NONE	NONE	NONE	NONE	3-WAY SPLIT SCREEN DISPLAY HORIZONTAL BOTTOM HALF
51	0.072		2x5	2x5	2x11	x	
52	0.087		2x4	2x4	2x9	x	
53	0.100		1x4	1x4	1x8	x	
54	0.125		1x2	1x2	1x7	x	
55	0.145		1x2	1x2	1x6	x	
60	NONE		NONE	NONE	NONE	NONE	3-WAY SPLIT SCREEN DISPLAY VERTICAL LEFT HALF
61	0.072		2x5	5x5	2x5	x	
62	0.087		2x4	4x4	2x4	x	
63	0.100		1x4	4x3	1x4	x	
64	0.125		1x2	3x3	1x2	x	
65	0.145		1x2	2x2	1x2	x	
70	NONE		NONE	NONE	NONE	NONE	3-WAY SPLIT SCREEN DISPLAY VERTICAL RIGHT HALF
71	0.072		2x5	2x5	2x11	x	
72	0.087		2x4	2x4	2x9	x	
73	0.100		1x4	1x4	1x8	x	
74	0.125		1x2	1x2	1x7	x	
75	0.145		1x2	1x2	1x6	x	
80	NONE		NONE	NONE	NONE	NONE	4-WAY SPLIT SCREEN DISPLAY
81	0.072		2x5	2x5	2x5	2x5	
82	0.087		2x4	2x4	2x4	2x4	
83	0.100		1x4	1x4	1x4	1x4	
84	0.125		1x2	1x2	1x2	1x2	
85	0.145		1x2	1x2	1x2	1x2	

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Table XXIV: Display Type Option

Display type option				
PNM Code	MIL-PRF-22885	Description	Non-Illuminated	Illuminated
1	C	Visible opaque black legends on translucent color background. When illuminated, the background appears in color while the legends remain opaque black.		
2	B	Obscure legends on opaque black background. When illuminated, the background appears in color while the legends remain opaque black.		
3	H	Obscure legends on opaque black background. When illuminated, the legends appear in color while the background remains opaque black.		
4	N	Visible trans-reflective white legends on an opaque black background. When illuminated, the legends appear in color while the background remains opaque black.		
5	W	Visible opaque black legends on trans-reflective white background. When illuminated, the background appears in color while the legends remain opaque black.		
6	S	Obscure legends on opaque black background. When illuminated, the legends are sunlight readable while the background remains opaque black.		
7	S	Obscure legends on opaque black background. When illuminated, the legends are NVIS compatible while the background remains opaque black.		

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Display Type Option				
PNM Code	MIL-PRF-22885	Description	Non-Illuminated	Illuminated
A*	-	Visible opaque white legends on an opaque black background. When illuminated, the background appears in color while the legends remain opaque white.		
E*	-	Visible trans-reflective white legends on an opaque black background. When illuminated, the legends appear in color while the background remains opaque black		
F*	-	Obscure legends on translucent white background. When illuminated, the background appears in color with white opaque white legends.		
G*	-	Visible opaque white legends on translucent color background. When illuminated, the background appears in color while legends remain opaque white.		

* Available as non-standard catalogue display type

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Table XXV: Illuminating Color Option

Illuminating Color Option		
PNM code	Non NVIS Illuminated Color	NVIS Illuminated Color
0	White	Blue
1	Red	Red
2	Green	Green B
3	Aviation yellow	Yellow B
4	Lunar white	White
5	Not available	Yellow A
6	Blue	Green A
7	Aviation green	

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6.0 Accessories

Accessories which apply to pushbutton switch assembly products are identified by 15XXX-TAB numbers. Following is the list of all standard accessory products and their part numbers.

6.1. Guards: See [Table XXVI: Switch Guards](#).

Table XXVI: Switch Guards

Switch Guard (enclosure types II,V)			
Transparent Guard		Metal Guard	
Cover color	Part number	Color	Part number
Clear	15089	Black anodize finish	15600-001
Red	15089-1	Red finish	15600-002
Clear with red border	15089-2	Figure 52: Metal Switch Guard	
Figure 51: Transparent Switch Guard			

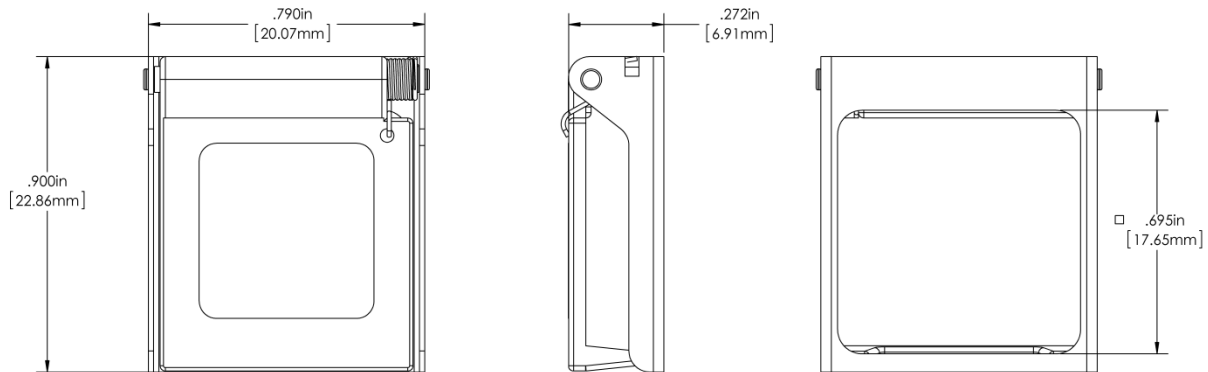


Figure 51: Transparent Switch Guard

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15600-001 (black)



15600-002 (red)

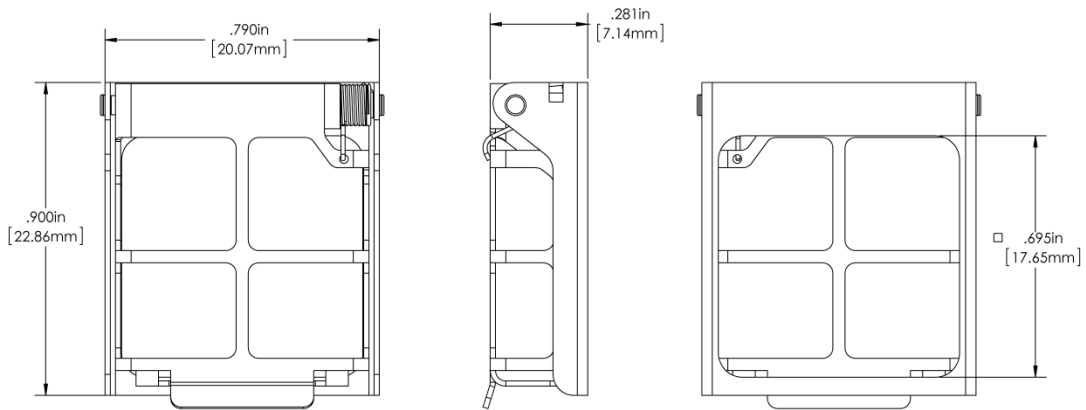


Figure 52: Metal Switch Guard

6.2. Tools

6.2.1. Pushbutton Extraction Tool (15193)

It facilitates the removal of display pushbuttons. See [Figure 53: Pushbutton Extraction Tool](#).



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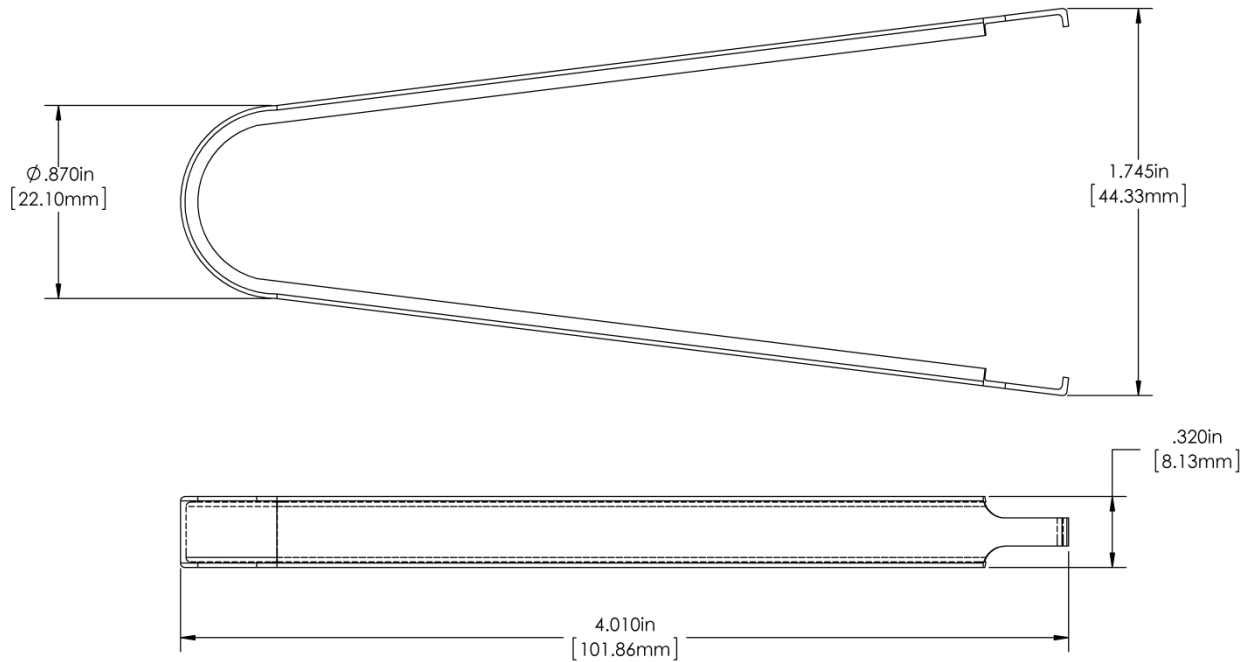
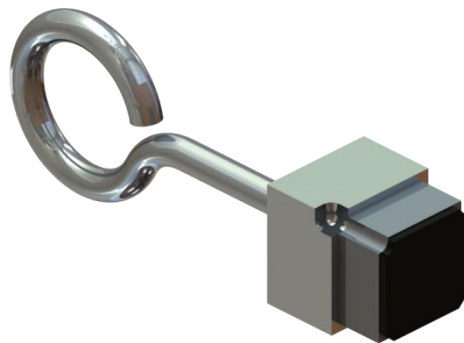


Figure 53: Pushbutton Extraction Tool

6.2.2. Matrix Switch Extraction Tool (15056)

It facilitates and eases the removal of switch/indicator assemblies from matrix housing. After removing the pushbutton and loosening the two locking cams, the tool is inserted in the front of the assembly and its rubber block expanded by tightening the looped handle ([Figure 54: Matrix Switch Extraction Tool](#)).



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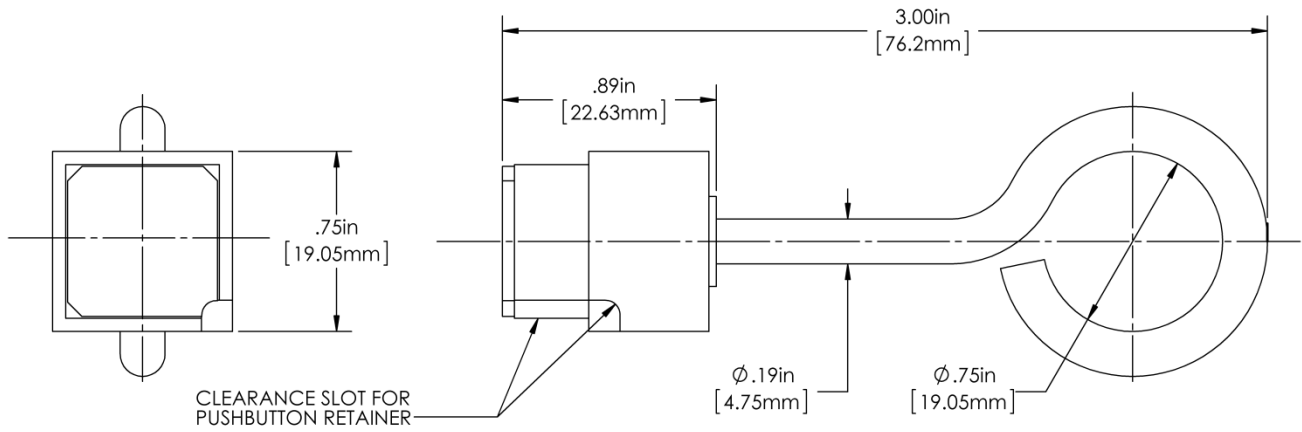


Figure 54: Matrix Switch Extraction Tool

6.2.3. Crimp Pin Tools and Positioners (15278 and 15279)

Part Number 15278 (Crimping Tool) and 15279 (Positioner) are to be used with MIL-C-39029/22-192 socket contact wire termination crimp pins, see [Figure 55: Crimp Tool and Positioner](#). The following [Table XXVII: Crimp Pin and Positioner P/N's](#) shows Staco Systems part number and the corresponding military standard part number.

Table XXVII: Crimp Pin and Positioner P/N's

Part Number	Standard Military Part Number
15278	M22520/7-01
15279	M22520/7-12

Crimping Tool and Turret are used for attaching socket contact crimp to #20-24 wires for all crimp pins switches / indicators.

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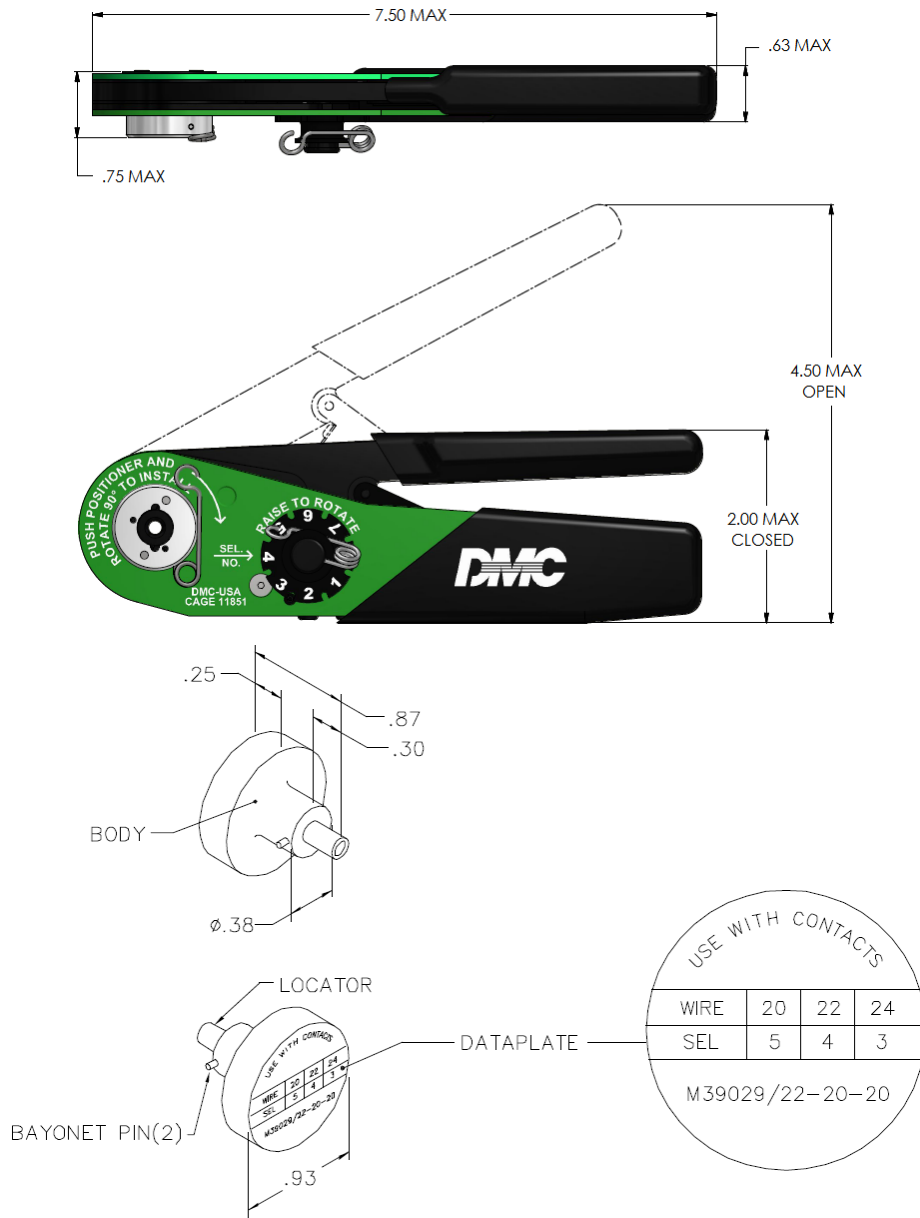


Figure 55: Crimp Tool and Positioner

6.2.4. Wire Connector Insertion and Removal Tool (15190)

Standard M81969/16-01 Insertion and Removal Tool used for inserting or removing of wire connectors with crimp pins receptacle, MIL-C-39029/22-192 pins. See [Figure 56: Wire Connector Insertion and Removal Tool](#).

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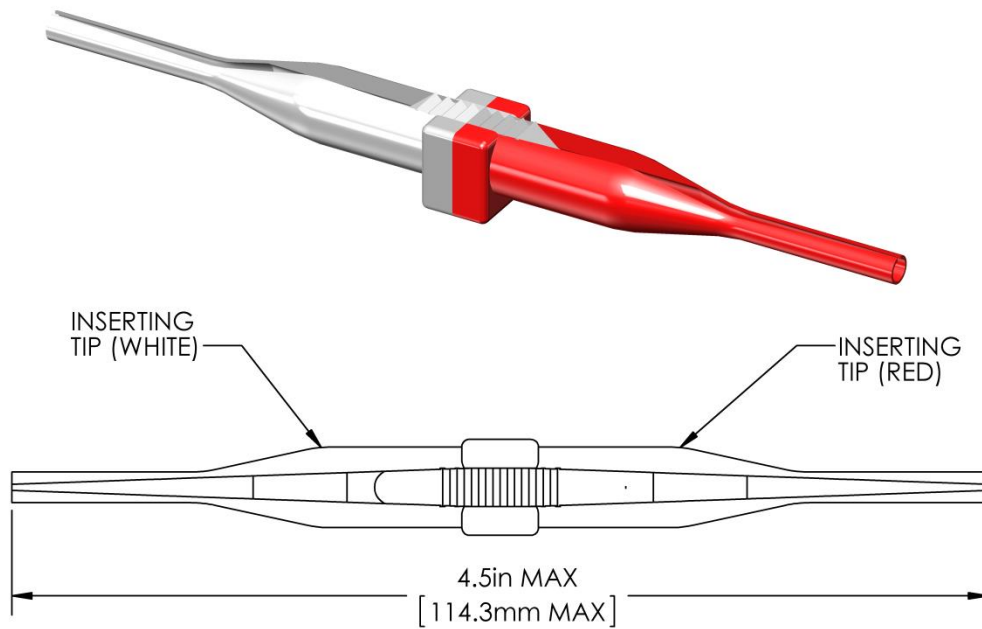


Figure 56: Wire Connector Insertion and Removal Tool

6.2.5. Insulator Plug (15177)

Unused terminal openings in termination receptacles of all crimp pins switches can be closed off by inserting standard MS27488-A20 plastic insulator plugs. The insulator plugs can be used with MIL-C-39029/22-192 compliant receptacles. See [Figure 57: Insulator Plug](#).

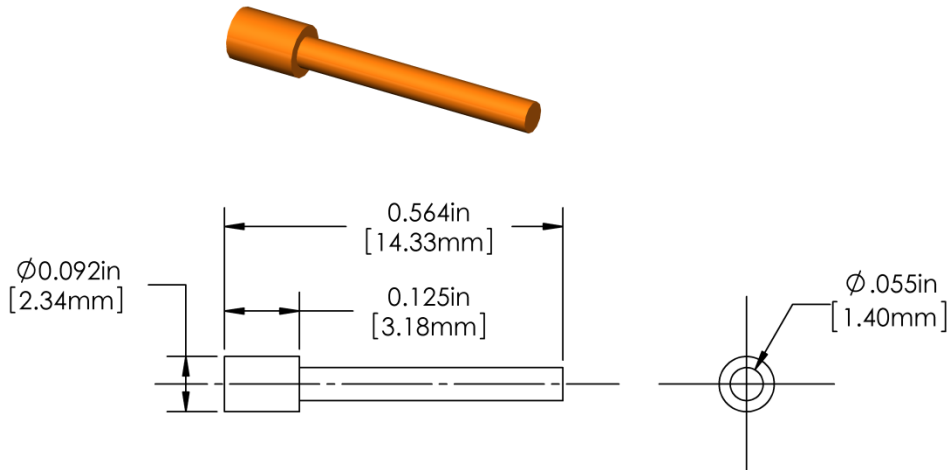


Figure 57: Insulator Plug

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6.2.6. Dress Bezel Mounting Cleat Assembly (156107)

The mounting cleat assemblies, as shown in [Figure 58: Cleat Assembly](#), are supplied as standard parts with the matrix housing. Additional cleat assemblies may be ordered, if desired, for applications of severe vibration or shock. They are packaged 5 to a plastic envelope.

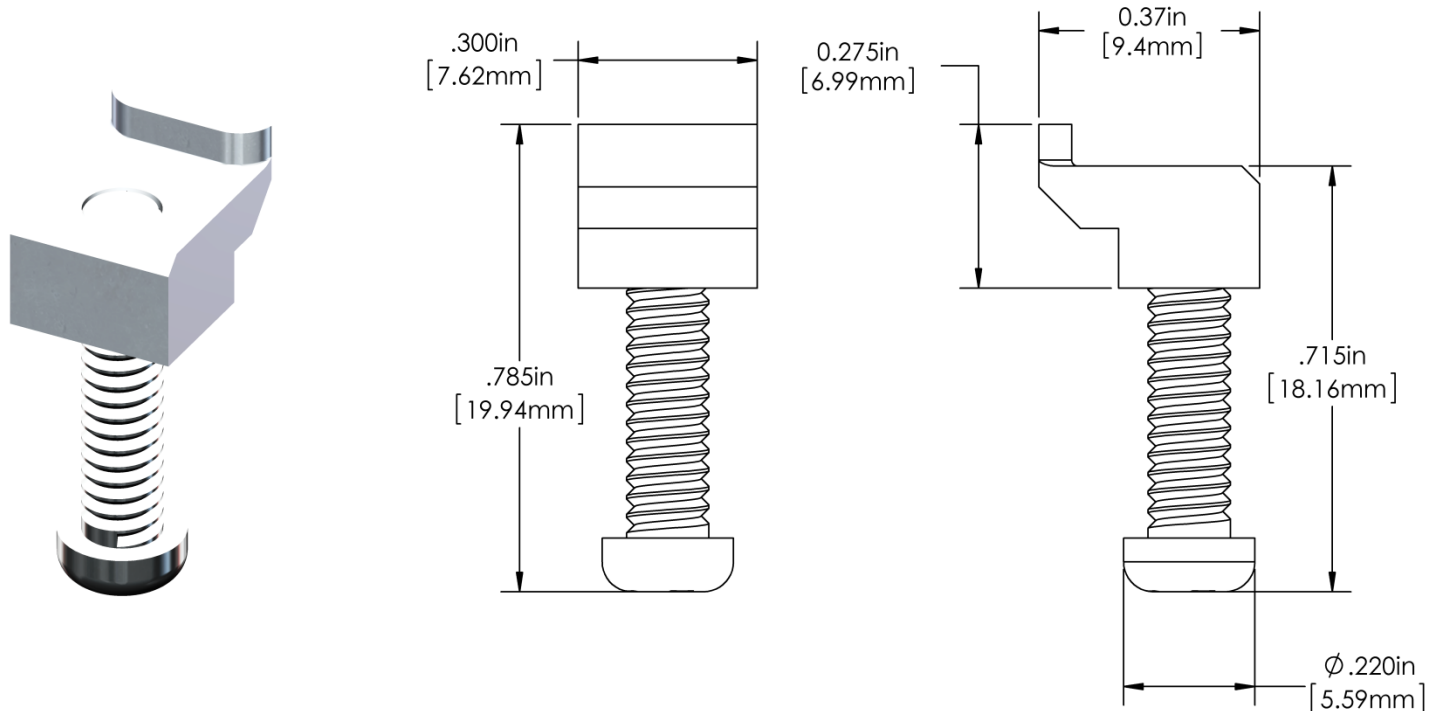


Figure 58: Cleat Assembly

6.2.7. Crimp Pin Wire Termination Receptacle (156106)

Additional receptacles may be ordered separately as replacement parts for use with S200 crimp pin switches/indicators. See [Figure 22: Crimp Termination](#).

6.2.8. Crimp Pin Wire Termination (15276)

Additional crimp pin wire termination can be ordered separately as replacement parts for use with crimp pin termination. See [Figure 23: Crimp Pin](#).

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6.2.9. Panel Seals (15097)

Additional panel seals may be ordered separately as replacement parts or for use with extended mount applications. See [Figure 2: Splash-Proof \(Solder Termination Extended Version Shown\)](#).

6.2.10. Watertight Panel Seals (12497)

Additional panel seals may be ordered separately as replacement parts or for use with extended mount applications. See [Figure 3: Watertight \(Solder Termination Version Shown\)](#).

6.2.11. Weight of Accessories

The typical weight of the switch accessories are given in [Table VII: Pushbutton Switch Weight](#).

Table XXVIII: Accessories Weight

Description	Ounces (max.)	Grams (max.)
15089 Switch Guard	0.061	1.9
15089-1 Switch Guard	0.064	2.0
15089-2 Switch Guard	0.064	2.0
15600-001 Switch Guard	0.064	2.0
15600-002 Switch Guard	0.064	2.0
15193 Pushbutton Extraction Tool	0.32	10
15056 Matrix Switch Extraction Tool	1.125	35
15278 Crimping Tool	9.32	290
15279 Positioner	0.35	11
15190 Wire Insertion and Removal Tool	0.007	.230
15177 Insulator Plug	0.002	.080
156107 Dress Bezel Cleat Assembly	0.06	2.1
156106 Crimp Wire Termination Receptacle	0.16	5
15276 Crimp Pins	0.004	.130
15097 Panel Seals	0.002	.075
12497 Water Panel Seals	0.003	.100

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7.0 Technical Bulletins

Table XXIX: Technical Bulletins

Technical Bulletin Number	Description
TB-207	Receptacle assembly installation procedure
TB-215	Installation Procedure for Series 200 Pushbutton Switches
TB-216	Installation Procedure for Series 200 Watertight Switch
TB-221	Installation and Removal Procedure for Series 200 Pushbutton Switches, PCB Type, In a Sub-Assembly

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