

REVISION HISTORY

REV.	DESCRIPTION	ER NUMBER	DATE	APPROVAL
1.2	REVISED PER ER	ER-48253	08/02/19	A.LETSO
1.1	REVISED PER ER	ER-41861	05/20/10	S.TRUONG
1.0	INITIAL RELEASE	ER-41141	06/04/09	T.N.

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TITLE
SPECIFICATION CONTROL DRAWING FOR SERIES 100
LIGHTED PUSHBUTTON SWITCHES/INDICATORS

SIZE A	CAGE CODE 12522	DWG NO SERIES 100 SCD	REV
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1.0 SCOPE

1.1 General Description

The Staco Systems Series 100 is a complete product line of lighted pushbutton switches, and indicators.

This Specification Control Document (SCD) covers the requirements for the Series 100 switch assemblies, pushbutton assemblies, pushbutton switch assemblies, and companion products (which are covered by their own specification control drawings).

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

The High Brightness LED and Incandescent lamp light source configurations are built in accordance with the applicable requirements of MIL-PRF-22885. Both high-brightness light-emitted diodes and incandescent lamps are qualified for NVIS under MIL-L-85762 (when applicable), MIL-STD-3009, and MIL-PRF-22885.

1.2 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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2.0 APPLICABLE DOCUMENTS

2.1 General

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.

2.2 Staco Systems Documents

SCD Series 100.

2.3 Government Documents

2.3.1 Military Specifications

MIL-PRF-22885	General specifications 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 (chem-film).
MIL-A-8625	Anodic Coatings for Aluminum Alloys.
MIL-P-13949	Plastic Sheet, Laminated, Metal Clad for Printed Wiring Boards.
MIL-R-25988	Oil and Fuel Resistant for Rubber, Fluorosilicone Elastomer.
MIL-P-27418	Soft Nickel Plating (Electrodeposited, Sulfamate Bath).
MIL-G-45204	Gold Plating, Electrodeposited.
MIL-I-45208	Inspection Systems Requirements.
MIL-S-901	Requirements for Shock Tests, High Impact Shipboard Machinery, Equipment, ad Systems.

2.3.2 Military Standards

MIL-STD-130	Identification and Marking of US Military Property.
MIL-STD-202	Test Method for Electronic and Electrical Component Parts.
MIL-STD-108	Definitions of, and Basic Requirements for Electric and Electronic Equipment Enclosure.
MIL-STD-454	General Requirements for Electronic Equipment.
MIL-STD-883	Test Methods and Procedures for Micro-Electronics.
MIL-STD-889	Dissimilar Metals.
MIL-STD-45662	Calibration System Requirements.
MIL-STD-3009	Lighting, Aircraft, Night Vision Imaging System (NVIS) Compatible.

2.3.3 Other Military Specifications

Federal Standards.
 QQ-S-571
 ZZ-R765

2.4 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 S100 (SCD 100).

Other referenced specifications, documents and drawings.

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3.0 THE SERIES 100 PRODUCT LINE

This section provides an overview of the S100 product characteristics, features, options, standard and customized product configurations, and accessories.

3.1 Pushbutton and Switch Characteristics

3.1.1 Switch Characteristics

3.1.1.1 Termination types

Double turrets solder.
Printed circuit board (PCB).
Crimp pin.

3.1.1.2 Switch poles configurations

Single Pole Double Throw (SPDT).
Double Pole Double Throw (DPDT).
Four Pole Double Throw (4PDT).
Indicator.

3.1.1.3 Switch contact material

Silver.
Gold.

3.1.1.4 Common bussed configurations

Standard – None.
Single common bussed.
Horizontal common bussed.
Vertical common bussed.
Bottom common bussed.
Top common bussed.

3.1.2 Pushbutton Characteristics

3.1.2.1 Light source

Incandescent lamps.
High brightness light-emitting diodes (HB LEDs), and HB LEDs with voltage dimming circuit.

3.1.2.2 Common circuitry

Single common.
Horizontal split common.
Vertical split common.

3.1.2.3 Light-emitted diode (LED) polarity

Current sourcing (common cathode).
Current sinking. (common anode).

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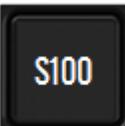
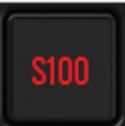
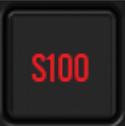
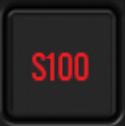
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3.1.2.4 Display Style

Full Screen	2-Way Display		3-Way Display				4-Way Screen
	Horizontal split	Vertical split	Horizontal Top-half	Horizontal Bottom half	Vertical Left half	Vertical Bottom half	
							

3.1.2.5 Display Types

TYPE CODE note /	MIL-PRF-22885 Code	DESCRIPTION	LIGHT AND COLOR SOURCES		Non- Illuminated	Illuminated
			INCANDESCENT LAMP	HIGH BRIGHTNESS LED		
1 <u>1/</u>	C	Visible opaque black legends on translucent color background. When illuminated, the background appears in color while the legends remain opaque black.	Flat Filter	Flat Filter		
2	B	Obscure legends on opaque black background. When illuminated, the background appears in color while the legends remain opaque black.	Lamp Cap	---		
3	H	Obscure legends on opaque black background. When illuminated, the legends appear in color while the background remains opaque black.	Lamp Cap	---		
4 <u>2/</u>	N	Visible trans-reflective white legends on an opaque black background. When illuminated, the legends appear in color while the background remains opaque black.	Lamp Cap	Flat Filter		
5 <u>2/ 3/</u>	W	Visible opaque black legends on trans-reflective white background. When illuminated, the background appears in color while the legends remain opaque black.	Lamp Cap	Flat Filter		
6 <u>2/ 4/</u>	S	Obscure legends on opaque black background. When illuminated, the legends are sunlight readable while the background remains opaque black.	Flat Filter	Flat Filter		
7 <u>2/ 5/</u>	S	Obscure legends on opaque black background. When illuminated, the legends are NVIS compatible while the background remains opaque black.	NVG Filter	NVG Filter		

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CUSTOMER REPLACEABLE LEGENDS

TYPE CODE note /	MIL-PRF-22885 Code	DESCRIPTION	LIGHT AND COLOR SOURCES		Non- Illuminated	Illuminated
			INCANDESCENT LAMP	HIGH BRIGHTNESS LED		
8 1/	B	Similar to a Type 2 display.	Lamp Cap	---		
9 1/	W	Similar to a Type 5 display.	Lamp Cap	---		
0 1/	S	Similar to a Type 6 display, except contrast ratio requirements do not apply.	Flat Filter	Flat Filter		

Notes:

- 1/ Type 1 – split display styles, including 2-way, 3-way, and 4-way splits, will have .026" black bars as visual split screen separators.
 - 2/ Available in High Brightness with voltage dimming.
 - 3/ Type 6 - Sunlight readable display applies to incandescent configurations. When illuminated, display shall be readily discernible under 10,000 foot-candles of direct light when tested per MIL-PRF-22885. Un-illuminated legends shall not be discernible. Recommended legend height is .100 inch. Incandescent colors Blue and Aviation Green are not recommended for displays required to operate in high-intensity sunlight environments. All LED colors are fully SLR.
 - 4/ Type 7 - Night Vision Imaging System (NVIS) compatible display. When illuminated, legends are compatible with NVIS (Gen III) night vision goggles. Applies to both incandescent and LED configurations. Incandescent versions are also sunlight readable. Non-illuminated legend shall not be discernible. (Available in "sealed" version only).
 - 5/ Pushbuttons with customer replaceable legends are Display Types 8, 9 and 0. Customers may specify legend text in the normal manner when ordering pushbuttons or assemblies of switches and pushbuttons. If no legend is specified by the customer, a temporary film legend with the words "Replace With Legend" will be installed at the factory in order to clarify positive/negative film type and to show the position of the legend plate within the pushbutton stack-up. Legends and faceplate assemblies which are produced in the field may not be of equal quality to those which are factory made.
- Type 8 Similar to Type 2.
 Type 9 Similar to Type 5.
 Type 0 Similar Type 6.

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3.1.2.6 Illuminated color

Staco Code	Color Code Non-NVIS			Color Code NVIS	
	MIL-PRF-22885 Code	High-brightness LED Color	Incandescent Color	MIL-PRF-22885 Code	LED / Incan. Color
0	W	White	White	-	Blue
1	R	Red	Red	L	Red
2	G	Green	Green	J	Green B
3	Y	Aviation yellow	Aviation yellow	-	Yellow B
4	D	Not available	Lunar white	-	White
5	-	Lemon yellow	Lemon yellow	K	Yellow A 2/.
6	B	Blue	Blue 1/.	H	Green A
7	Z	Not available	Aviation green 1/.	-	

Notes:

- 1/. May not be suitable for high intensity light applications.
- 2/. Meets both NVIS Yellow Class-A and Class-B. Type I Class-A is primarily used in Helicopters. Type II Class-B is primarily used in fixed wing aircraft. Please contact factory for additional assistance/ or refer to technical manual of MIL-STD-3009 for further information.
3. Colors of incandescent lamp and High Brightness LED are slightly different.

3.2 Standard 'Coded' Configurations

The following "coded" models are Series 100 standard assemblies:

Model A "coded" – Switch / indicator with pushbutton assembly ([Figure 2: Model A – exploded view - Drip-proof and PC termination version](#))

Model C "coded" – Switch / indicator assembly (without pushbutton ([Figure 1: Model C – exploded view - Drip-proof and PC termination version shown](#))

Model 92 "coded" – Pushbutton assembly ([Figure 3: Model 92 "coded" – Incandescent version shown](#) and [Figure 4: Model 92 "coded" – LED version shown](#))

Bill of Materials of standard "coded" models C and 92 are shown in [Table I: Switch and Pushbutton BOM.](#)



Figure 1: Model C – exploded view - Drip-proof and PC termination version shown

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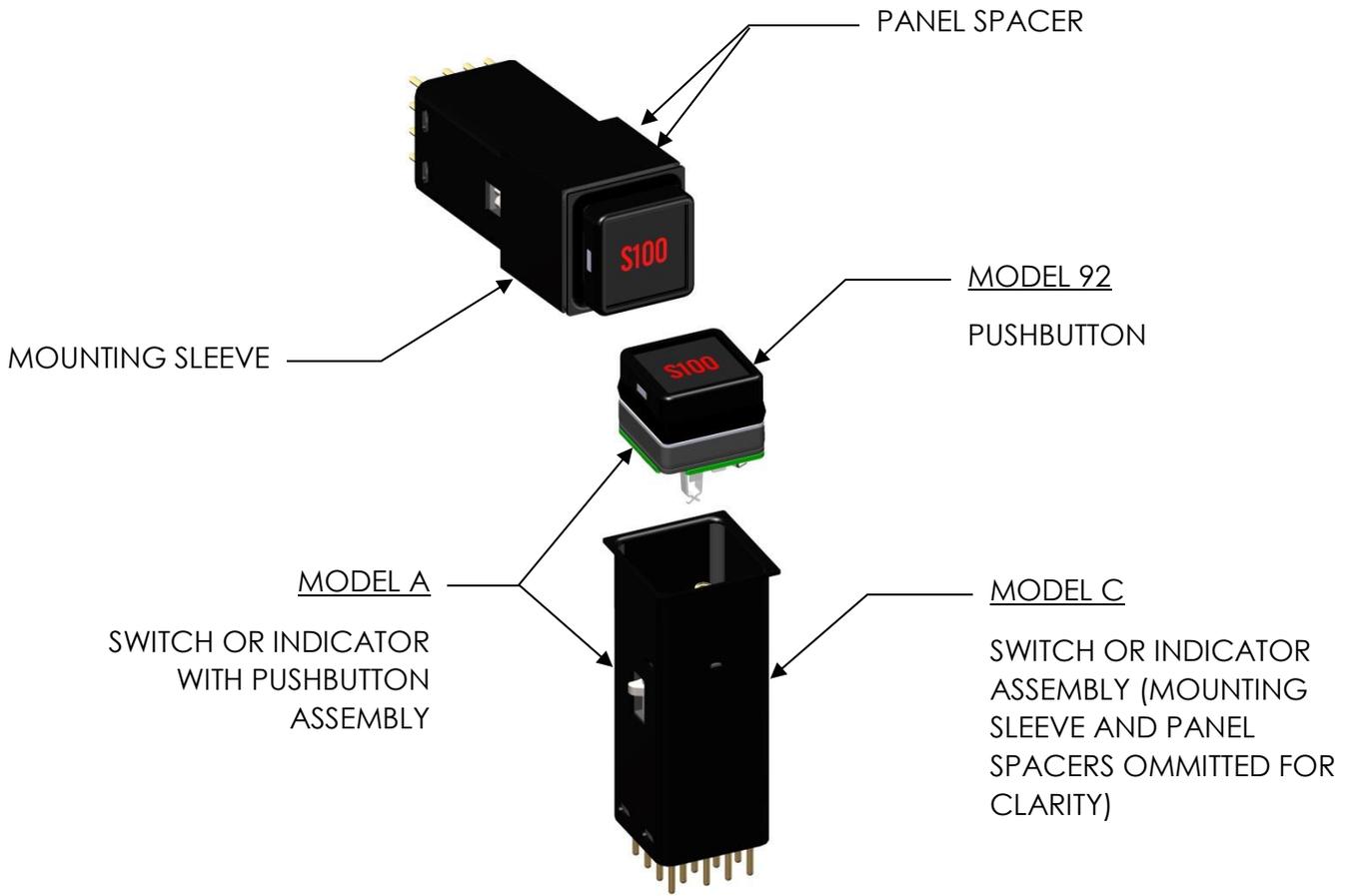


Figure 2: Model A – exploded view - Drip-proof and PC termination version



Figure 3: Model 92 "coded" – Incandescent version shown

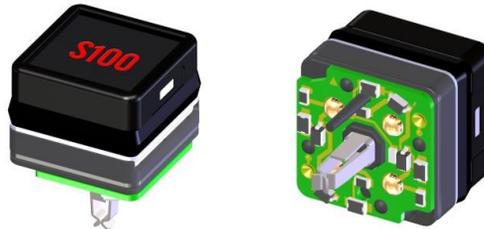


Figure 4: Model 92 "coded" – LED version shown

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Table I: Switch and Pushbutton BOM

Model 92 "coded" BOM	Model C "coded" BOM	
Pushbutton Assembly	Switch / Indicator Assembly	
Sealed	Solder / PCB terminal	Crimp pin terminal
1 - Pushbutton assembly. 1 - Outer seal.	1 - Switch housing assembly. 1 - Panel seal. 2 - Panel spacers. 1 - Mounting sleeve.	1 - Switch housing assembly. 1 - Panel seal. 2 - Panel spacers. 1 - Mounting sleeve. 1 - Receptacle assembly.

3.3 Customized Configurations

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

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

3.3.1 Model 92P Pushbutton Assembly

92PXXXX-TAB numbers shall be used when define unique pushbutton assembly with customized artworks or non-standard requirements.

The XXXX in this model number is a four-digit, sequentially assigned number. All of these numbers are tabulated and have a three-digit or, under special circumstances, a four-digit sequential TAB number. (Typical example would be 92P1234-010).

3.3.2 Model 730XXX Pushbutton Switch Assemblies

730XXX-TAB numbers shall be used when define non-standard pushbutton switch assembly. Unique requirements such as:

- a. Standard switches in use with model 92P type pushbutton; and/or
- b. Non-standard switch in use with model 92 "coded" pushbutton; and/or
- c. Switches require non-standard marking or construction; and/or
- d. When the customers/sales require that a non-coded part number to be used.

3.4 Matrix Frame Assemblies

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

Model C95 – Rear mount flange matrix in solder, PCB, and crimp pin terminations.

Model C97 – Front mount dress bezel matrix in solder, PCB, and crimp pin terminations.

Details on these units are found in the Matrix Frame Assembly Specification Control Drawing, Model 94 - 97 Coded.

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

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3.5 Accessories

Guards

Switch guards.
Watertight seal switch guards.

Seals

Watertight seals.
Solvent resistant seals.

Tool

Pushbutton extraction tool.
Matrix switch extraction tool.

Crimp pin tool and positioned.
Wire connector insertion & removal tool.

Socket contact wire termination crimp pin.

Others

Color filter caps.

Dress bezel mounting cleat assemblies.

Dummy lamps.

Digital dimming module.

Insulator plugs.

Panel seals.

Please refer to section 5. 1 for more information and part number.

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4.0 GENERAL SPECIFICATIONS

4.1 Enclosure Designs

The following enclosures defined in MIL-PRF-22885 are available in the Series 100 Product line and are shown in [Table II: Enclosure Designs](#).

Typical type II & V enclosure design are shown in [Figure 5: S100 exploded view \(solder termination version shown\)](#) and [Figure 6: S100 exploded view \(PCB termination version shown\)](#), respectively. Splash-proof and Watertight details are shown in [Figure 8: Splash-proof/Watertight details](#).

Table II: Enclosure Designs

MIL-PRF-22885 code	Seal Description	
2	Drip-proof 1/	II (solder / PCB terminal) & V (Crimp pin terminal)
3	Watertight 1/	III (solder / PCB terminal) & VI (Crimp pin terminal)
4	Splash-proof 1/	

1/ In accordance to MIL-STD-108.

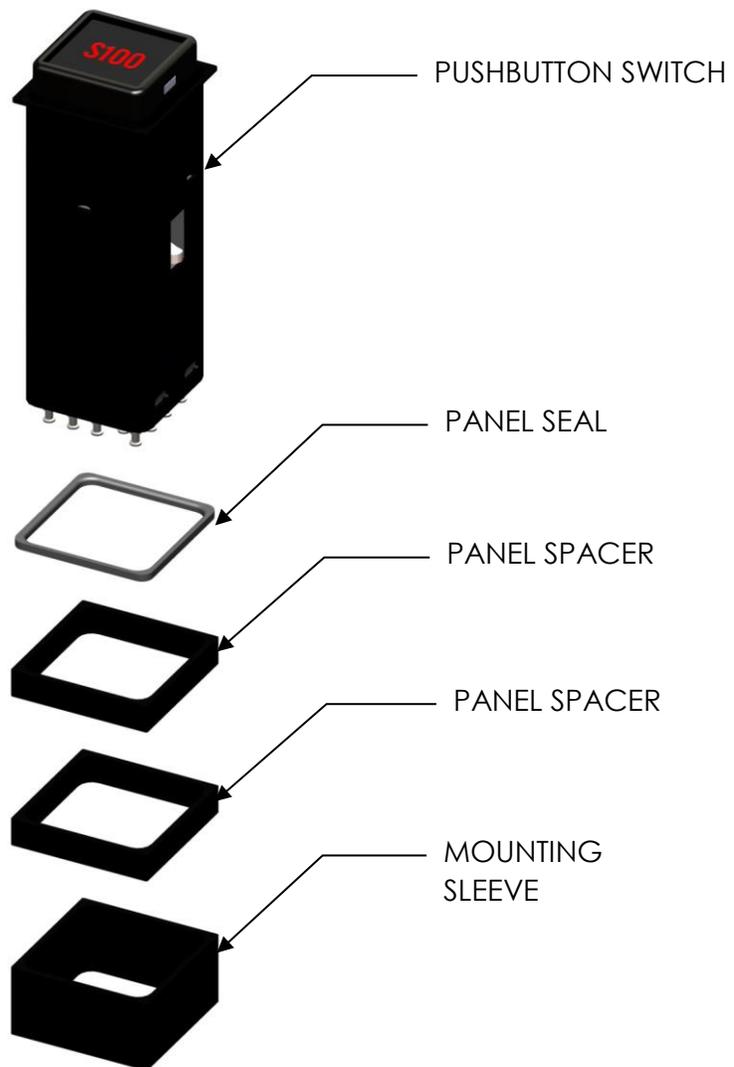


Figure 5: S100 exploded view (solder termination version shown)

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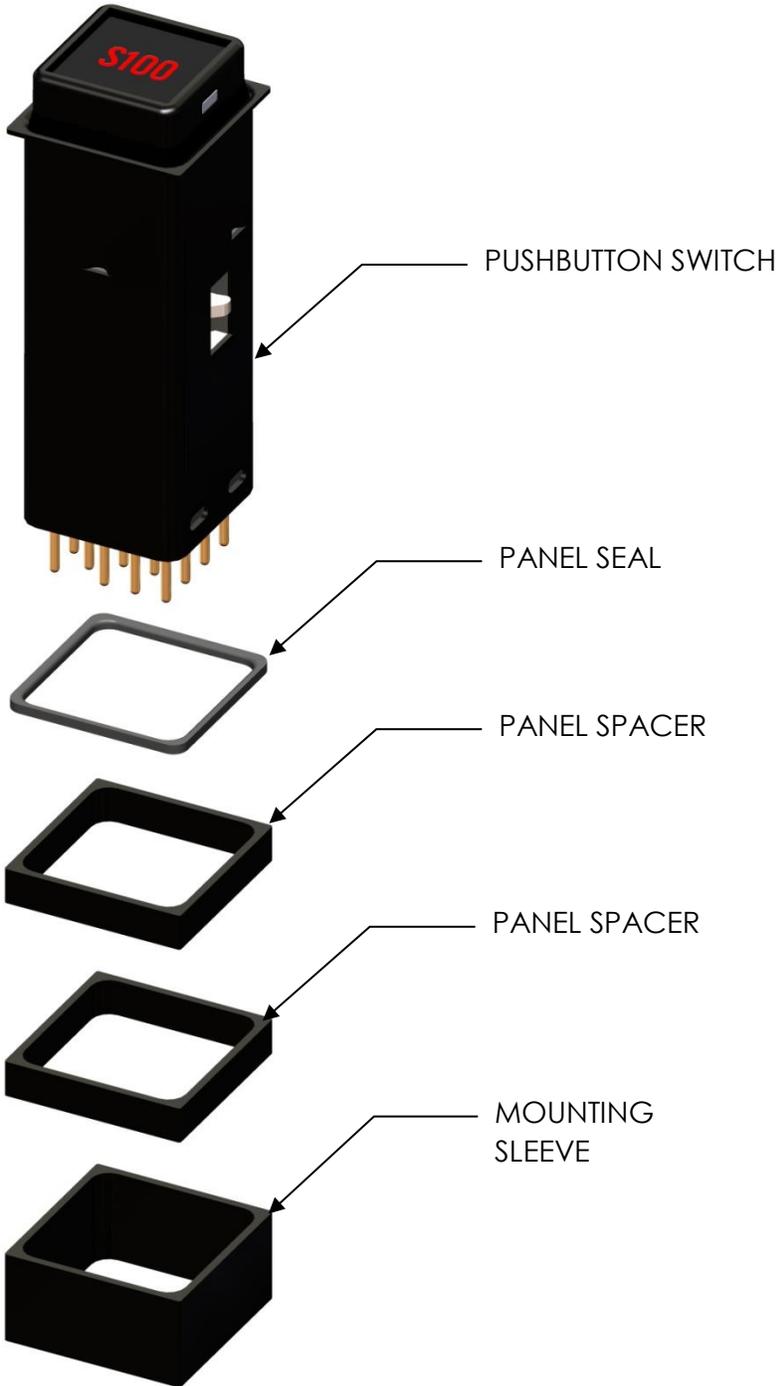


Figure 6: S100 exploded view (PCB termination version shown)

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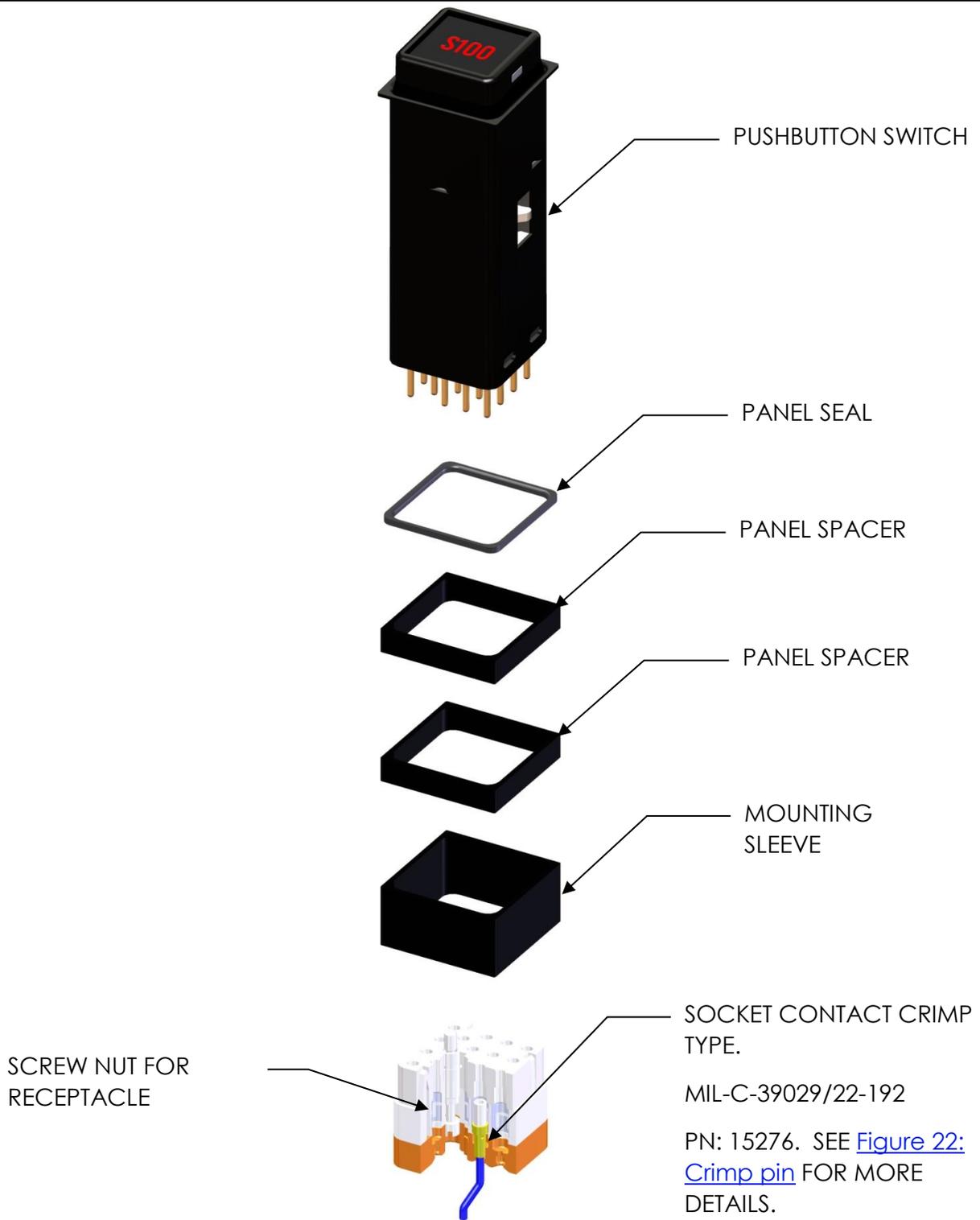


Figure 7: S100 exploded view (Crimp termination version shown)

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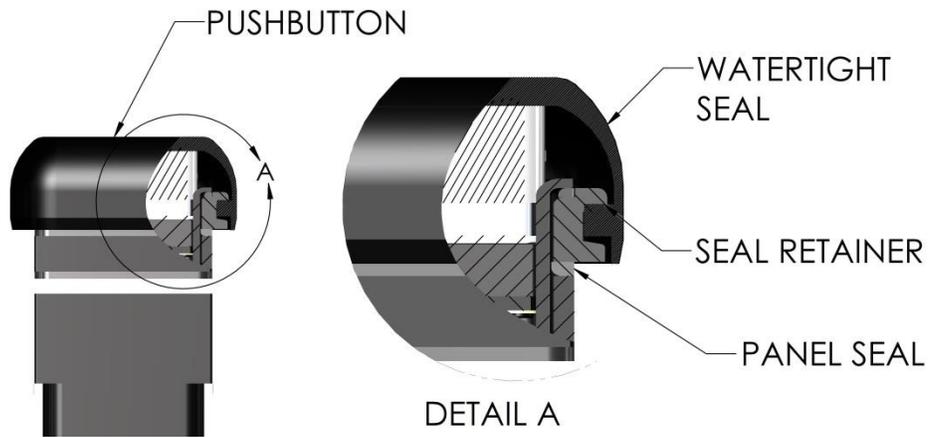


Figure 8: Splash-proof/Watertight details

4.2 Outline Dimensions

Outline dimensions of the various enclosure designs are shown in: [Table III: Outline Dimensions](#).

Table III: Outline Dimensions

Seal Description/Option	Enclosure Type	View	Figure
Drip-proof – Solder/PCB	II	Front	Figure 9: Drip-Proof – Solder/PCB and Crimp switches – Enclosure Type II solder and PCB termination and Enclosure Type V crimp termination (front view)
Drip-proof – Solder/PCB	II	Top	Figure 10: Drip-Proof – Solder/PCB switches – Enclosure Type II solder and PCB termination (top view)
Drip-proof – Solder/PCB	II	Side	Figure 11: Drip-Proof – Solder/PCB switches – Enclosure Type II solder and PCB termination (side view)
Drip-proof – Crimp	VI	Front	Figure 9: Drip-Proof – Solder/PCB and Crimp switches – Enclosure Type II solder and PCB termination and Enclosure Type V crimp termination (front view)
Drip-proof – Crimp	V	Top	Figure 12: Drip-proof-proof switches – Enclosure Type V crimp pin termination (top view)
Seal Description/Option	Enclosure Type	View	Figure

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Seal Description/Option	Enclosure Type	View	Figure
Drip-proof – Crimp	V	Side	Figure 13: Drip-proof switches – Enclosure Type V crimp pin termination (side view)
Splash-proof/Watertight – Solder/PCB	III	Front	Figure 14: Splash-Proof/ Watertight switches – Enclosure Type III solder and PCB terminations and Enclosure Type VI crimp termination (front view)
Splash-proof/Watertight – Solder/PCB	III	Top	Figure 15: Splash-Proof/Watertight switches – Enclosure Type III solder and PCB terminations (top view)
Splash-proof/Watertight – Solder/PCB	III	Side	Figure 16: Splash-Proof/Watertight switches – Enclosure Type III solder and PCB terminations (side view)
Splash-proof/Watertight – Crimp	VI	Front	Figure 14: Splash-Proof/ Watertight switches – Enclosure Type III solder and PCB terminations and Enclosure Type VI crimp termination (front view)
Splash-proof/Watertight – Crimp	VI	Top	Figure 17: Splash-Proof/Watertight switches – Enclosure Type VI crimp termination (front view)
Splash-proof/Watertight – Crimp	VI	Front	Figure 18: Splash-Proof/Watertight switches – Enclosure Type VI crimp termination (top view)

4.2.1 Switch Assembly and Mounting Hardware

4.2.1.1 Switch Assembly

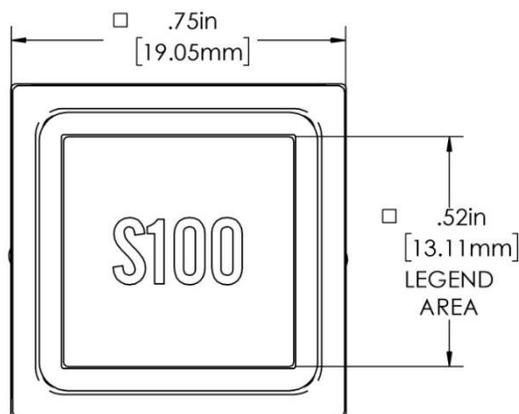


Figure 9: Drip-Proof – Solder/PCB and Crimp switches – Enclosure Type II solder and PCB termination and Enclosure Type V crimp termination (front view)

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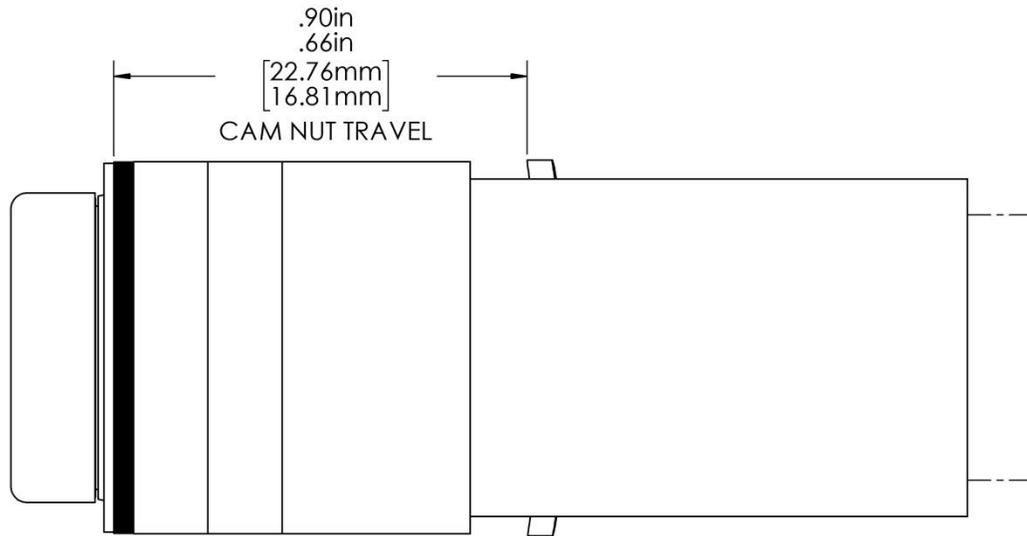


Figure 10: Drip-Proof – Solder/PCB switches – Enclosure Type II solder and PCB termination (top view)

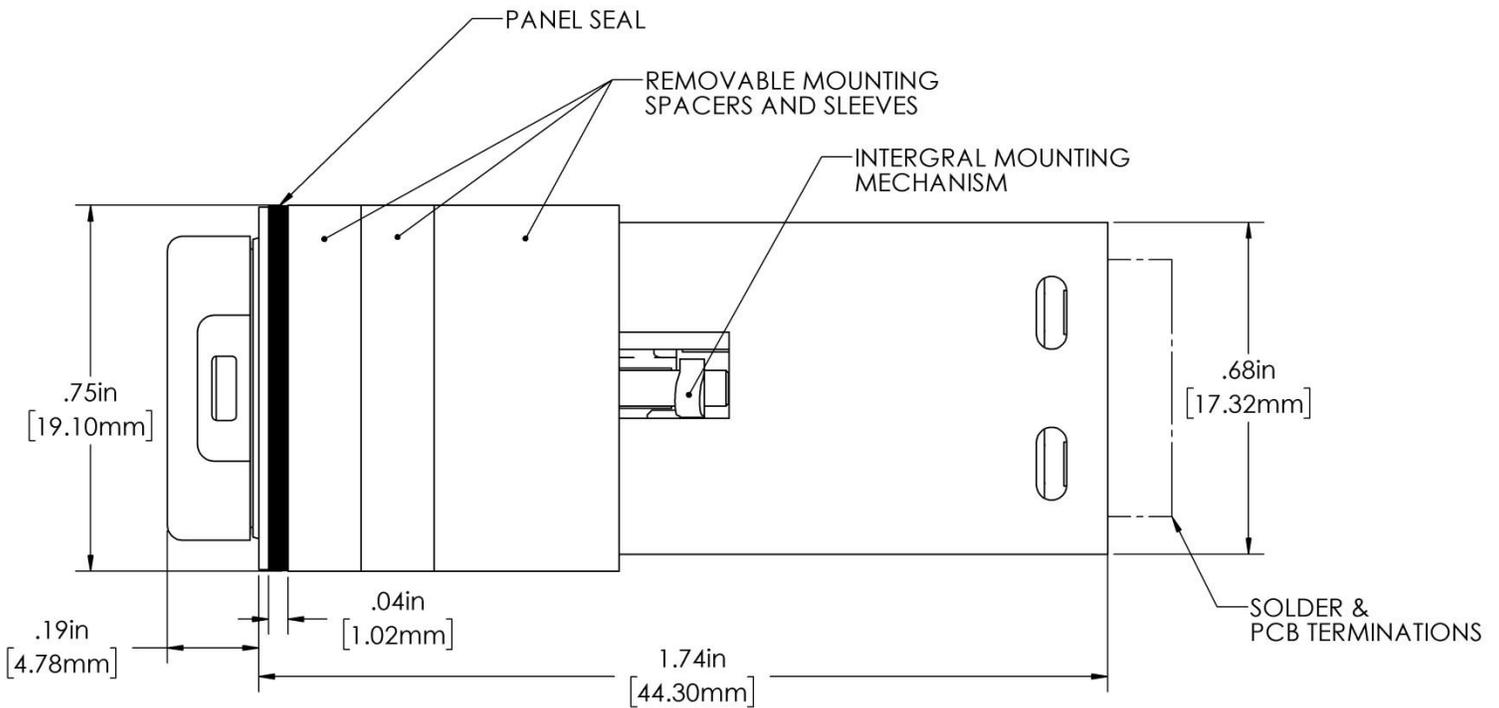


Figure 11: Drip-Proof – Solder/PCB switches – Enclosure Type II solder and PCB termination (side view)

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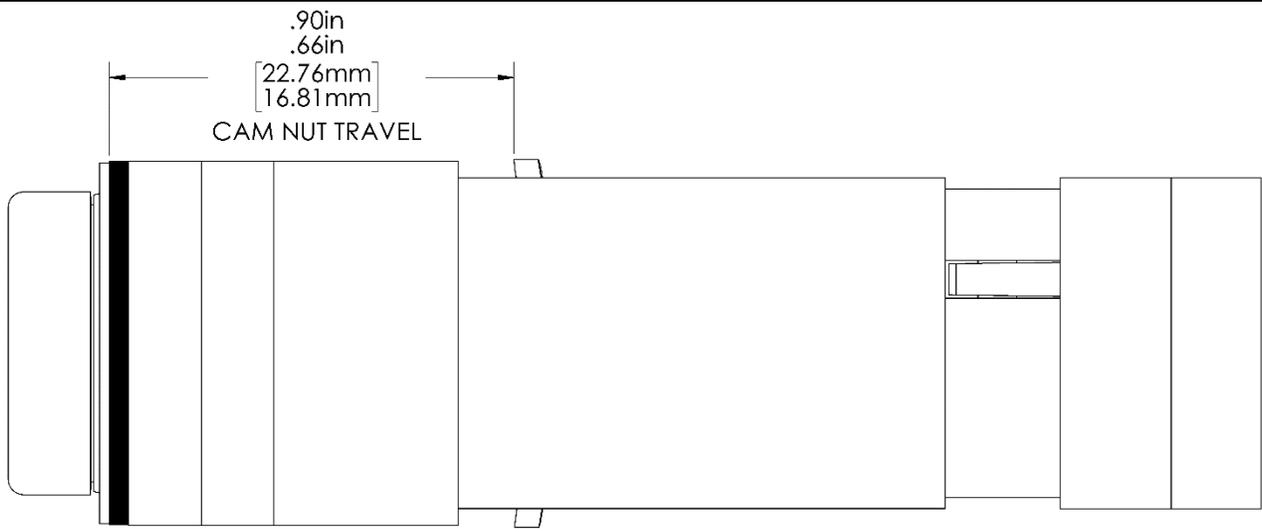


Figure 12: Drip-proof switches – Enclosure Type V crimp pin termination (top view)

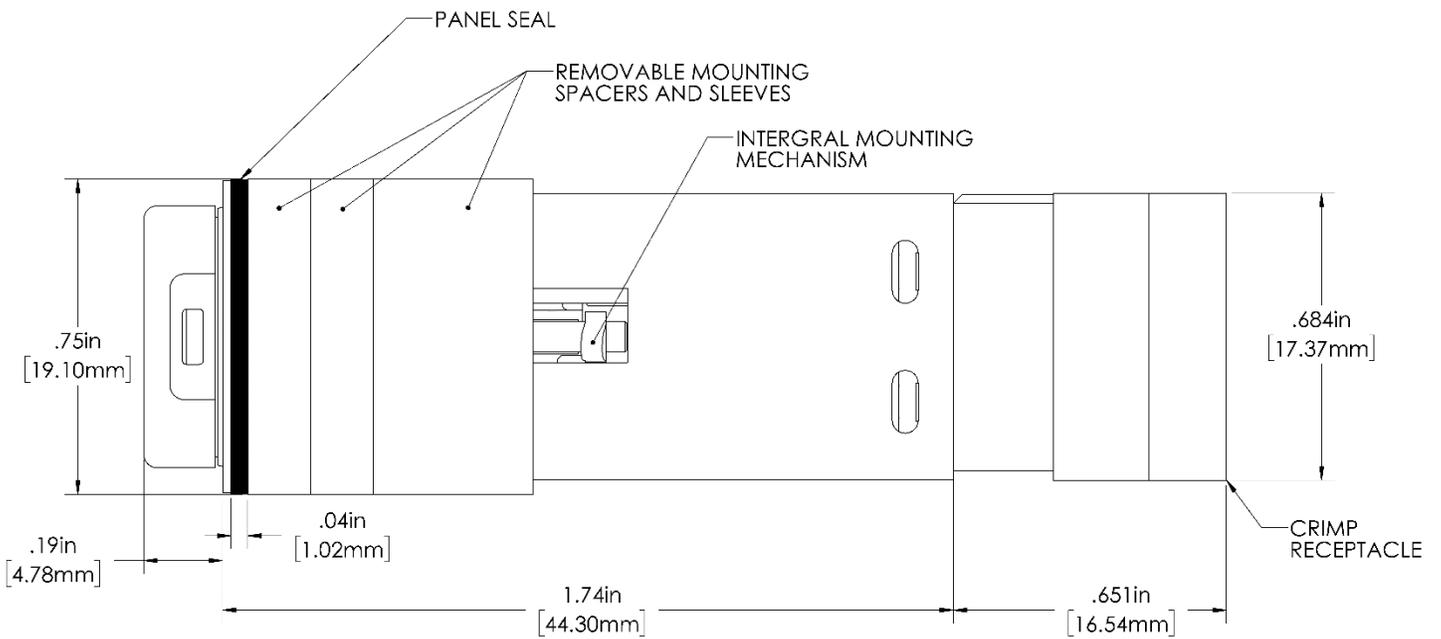


Figure 13: Drip-proof switches – Enclosure Type V crimp pin termination (side view)

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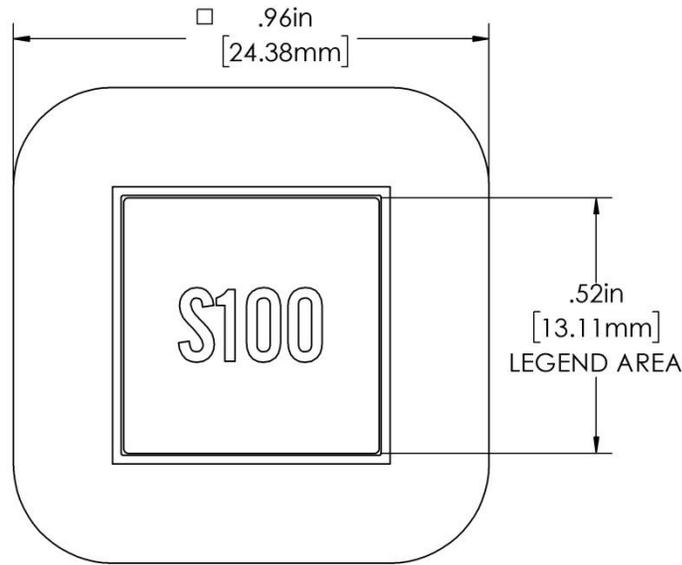


Figure 14: Splash-Proof/ Watertight switches – Enclosure Type III solder and PCB terminations and Enclosure Type VI crimp termination (front view)

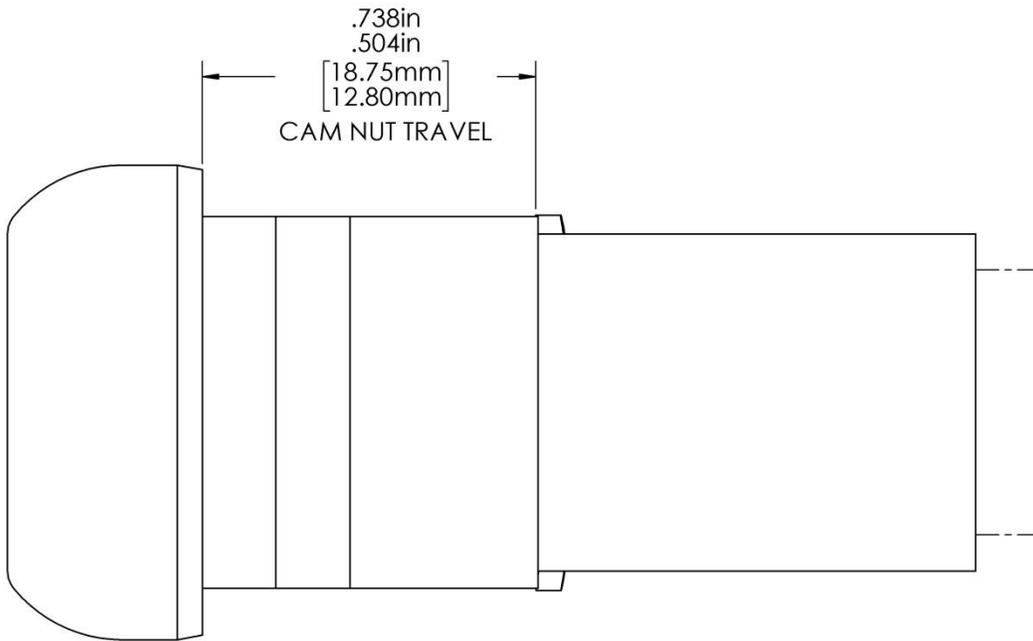


Figure 15: Splash-Proof/Watertight switches – Enclosure Type III solder and PCB terminations (top view)

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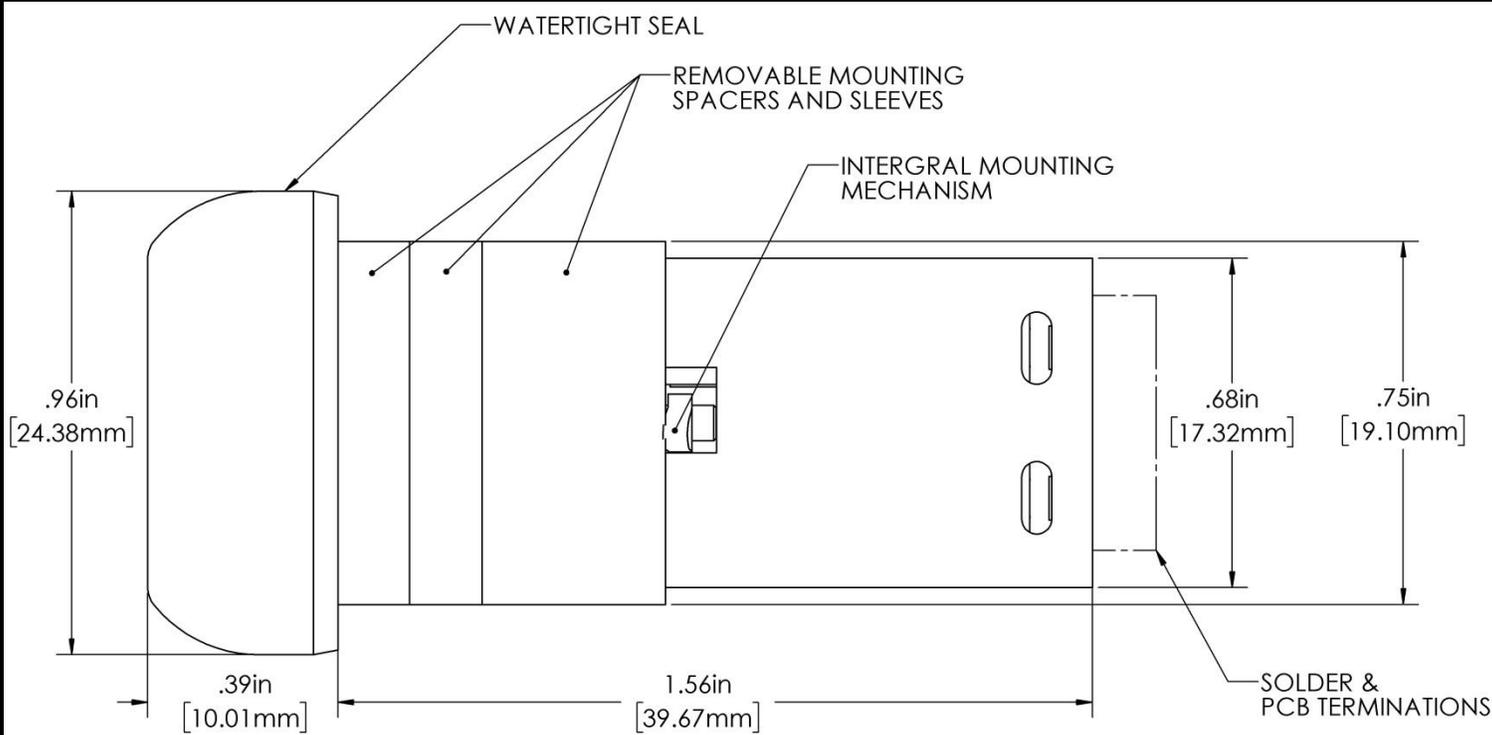


Figure 16: Splash-Proof/Watertight switches – Enclosure Type III solder and PCB terminations (side view)

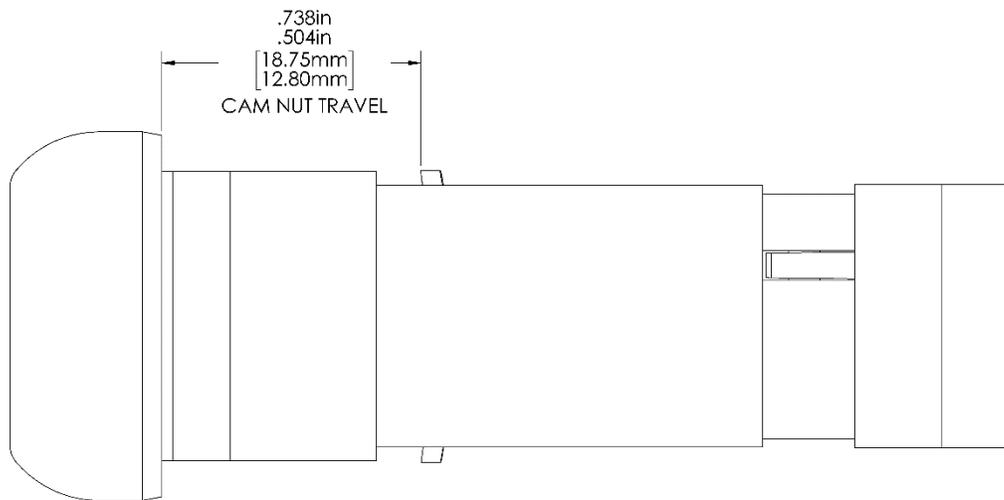


Figure 17: Splash-Proof/Watertight switches – Enclosure Type VI crimp termination (front view)

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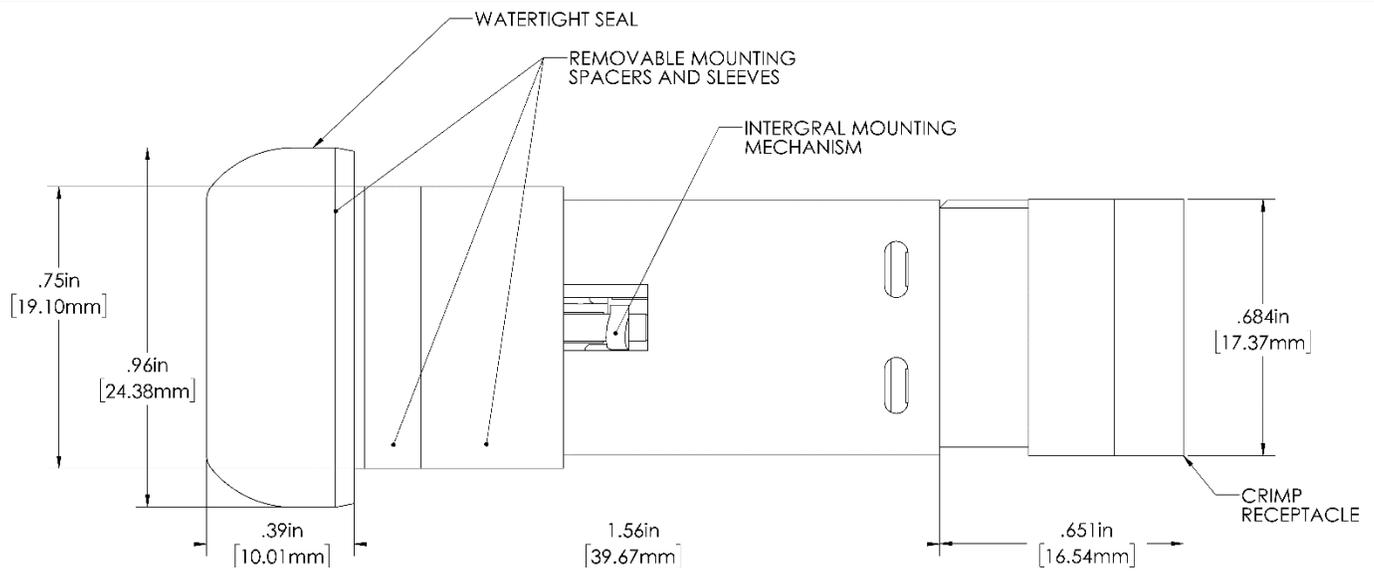


Figure 18: Splash-Proof/Watertight switches – Enclosure Type VI crimp termination (top view)

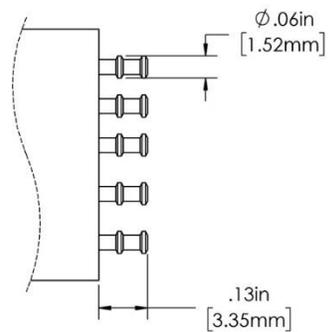


Figure 19: Solder termination

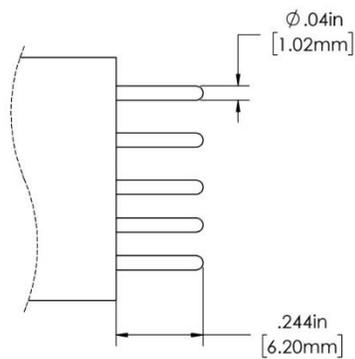


Figure 20: PC termination

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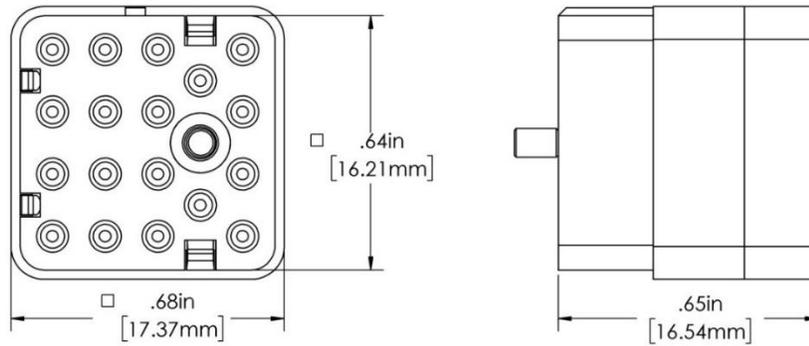
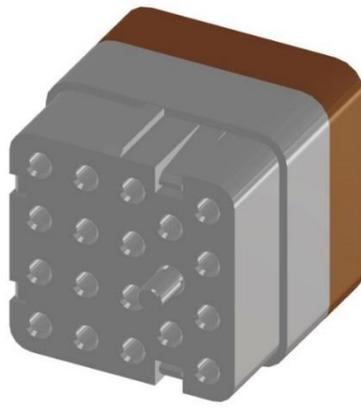


Figure 21: Crimp termination

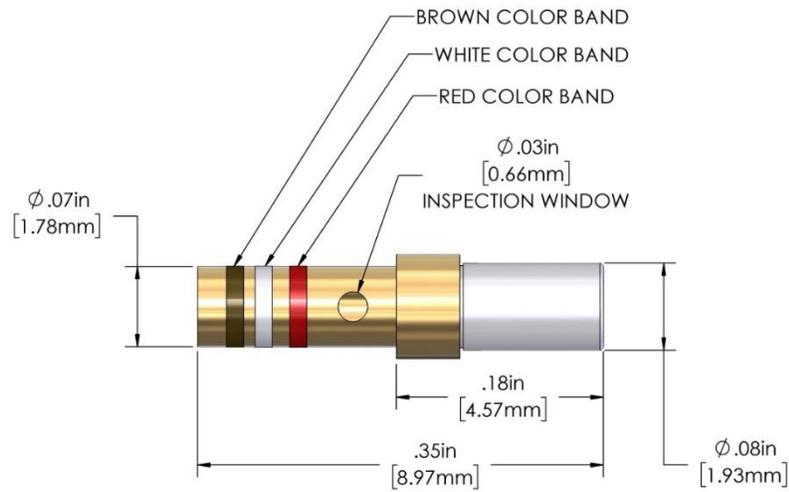


Figure 22: Crimp pin

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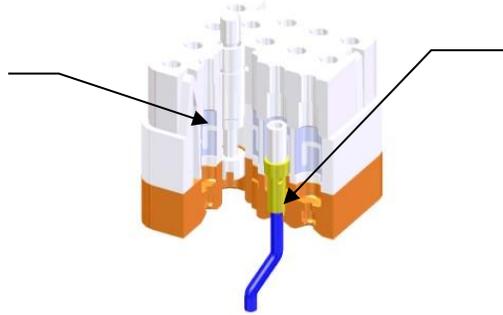
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SCREW NUT FOR RECEPTACLE



SOCKET CONTACT CRIMP TYPE.

MIL-C-39029/22-192

PN: 15276. SEE [Figure 22: Crimp pin](#) FOR MORE DETAILS.

Figure 23: Crimp Receptacle Detail

4.2.1.2 Mounting Hardware

The panel spacer may be used for extended mount applications. This feature is to enable the pushbutton to align with commonly used edge-lighted panels when applicable. Please note, a second panel seal is recommended for drip-proof when use with extended mounted applications and is sold separately.

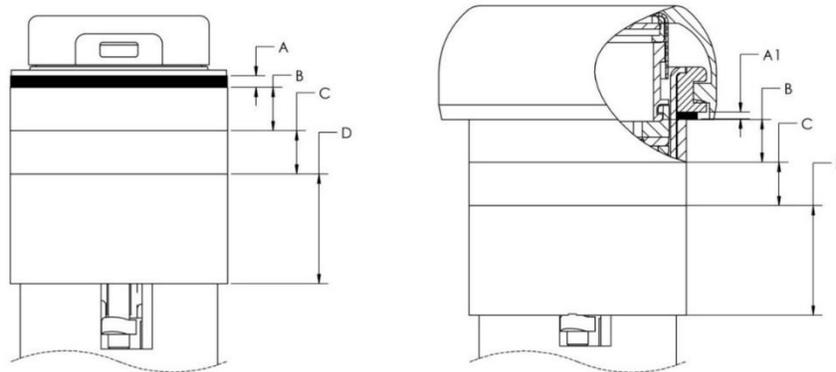


Figure 24: Hardware (splash-proof and watertight)

Table IV: Mounting hardware dimension

Symbol	Description	Dimension
A	Drip-proof panel seal*	0.040" [1.02 mm]
A1	Watertight panel seal**	0.024" [0.61 mm]
B	Panel spacer	0.150" [3.81 mm]
C	Mounting sleeve 1	0.150" [3.81 mm]
D	Mounting sleeve 2	0.380" [9.65 mm]

* Free height or uncompressed, splash-proof panel seal

** Free height or uncompressed, watertight panel sea

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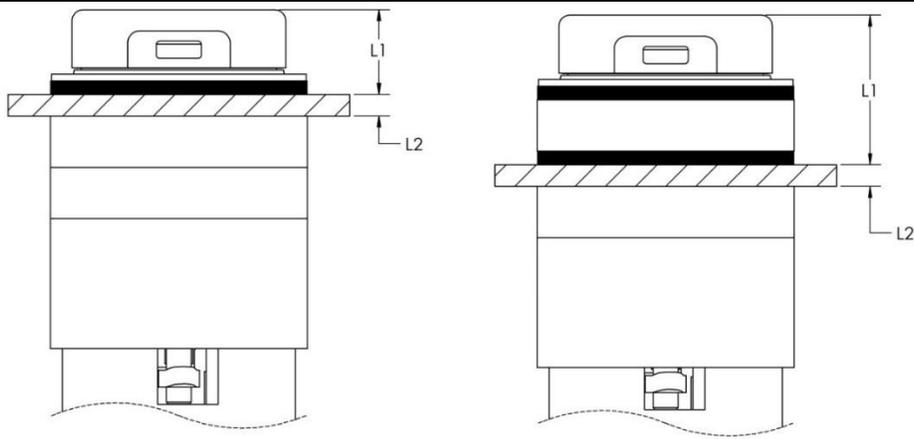


Figure 25: Hardware (drip-proof, types II and V)

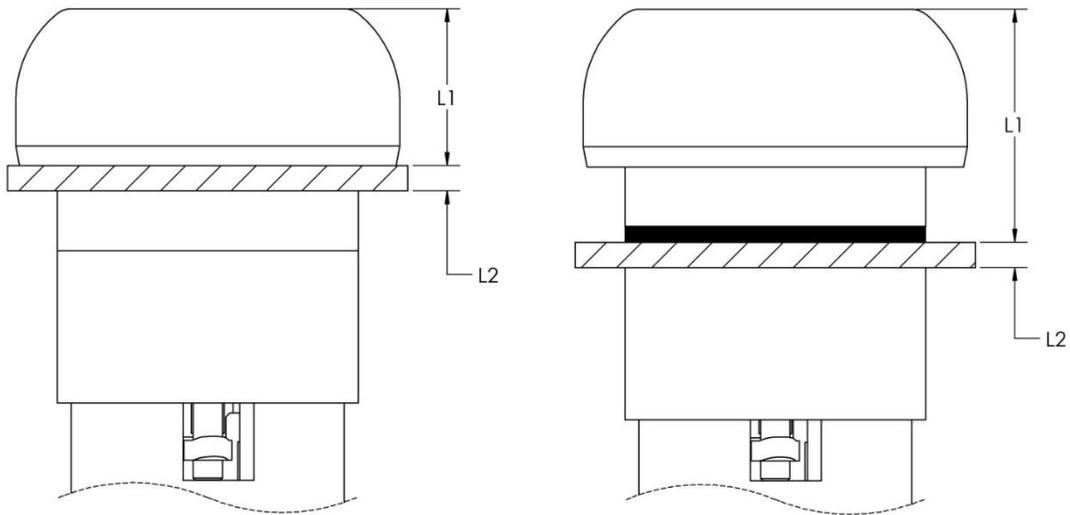


Figure 26: Hardware (splash-proof/watertight, types III and VI)

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Table V: Mounting panel thickness maximum

Description	Flushed Mount		Extended Mount	
	Drip-Proof (types II and V)	Watertight (types II and VI)	Drip-Proof (types II and V)	Watertight (types II and VI)
Cap protrusion (L1)	0.24" [4.82mm]	0.39" [9.90mm]	0.43" [10.69mm]	0.58" [17.78mm]
Panel thickness Max. (L2)	0.85" [22.35mm]	0.73" [19.81mm]	0.66" [17.78mm]	0.54" [17.78mm]

*See Figure 25 and Figure 26 for flushed and extended mounts details.

4.2.2 Pushbutton Assembly

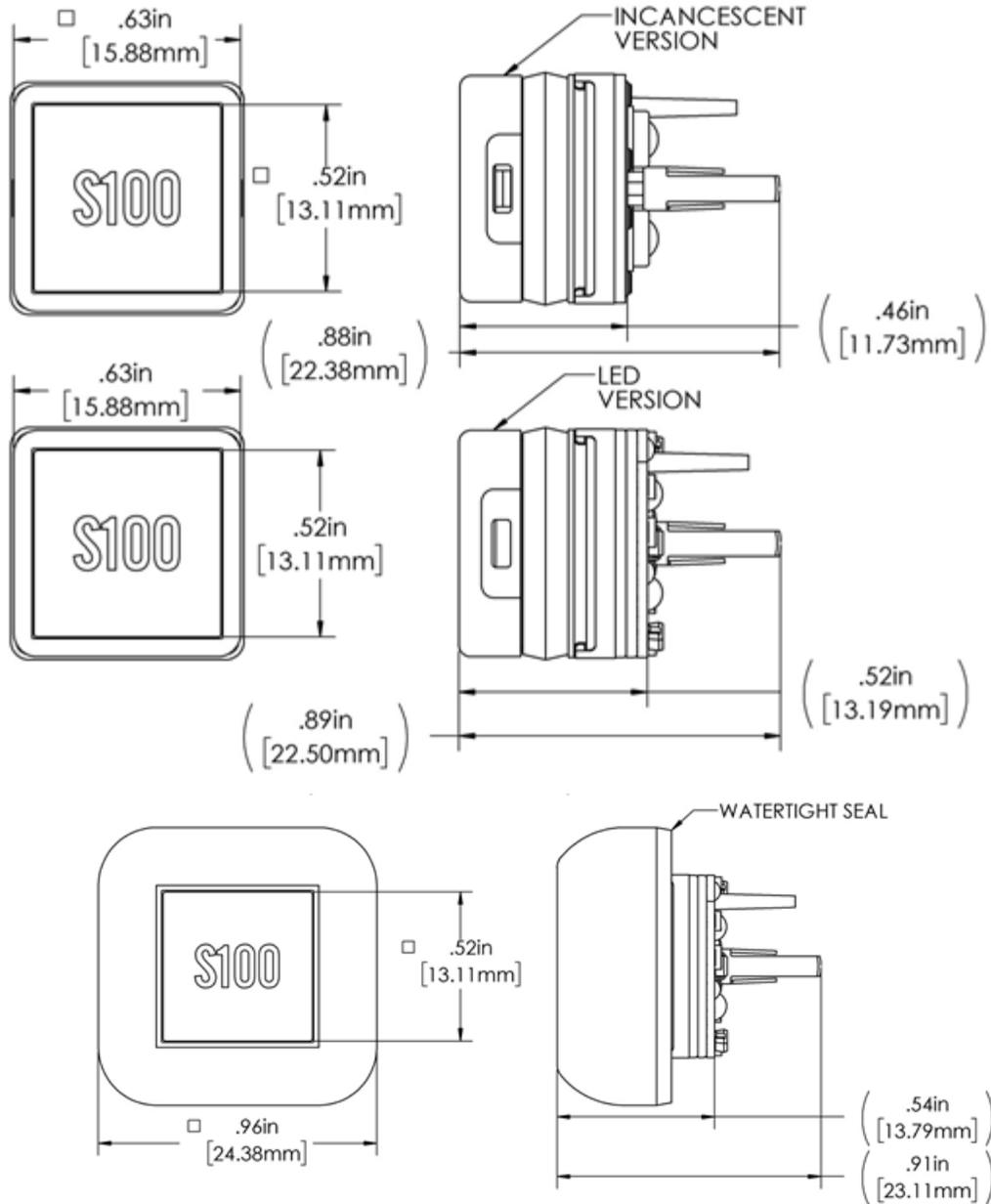


Figure 27: Pushbutton Assembly types (Incandescent/LED)

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4.2.3 Panel Cutout Dimensions

4.2.3.1 Pushbutton switch assemblies

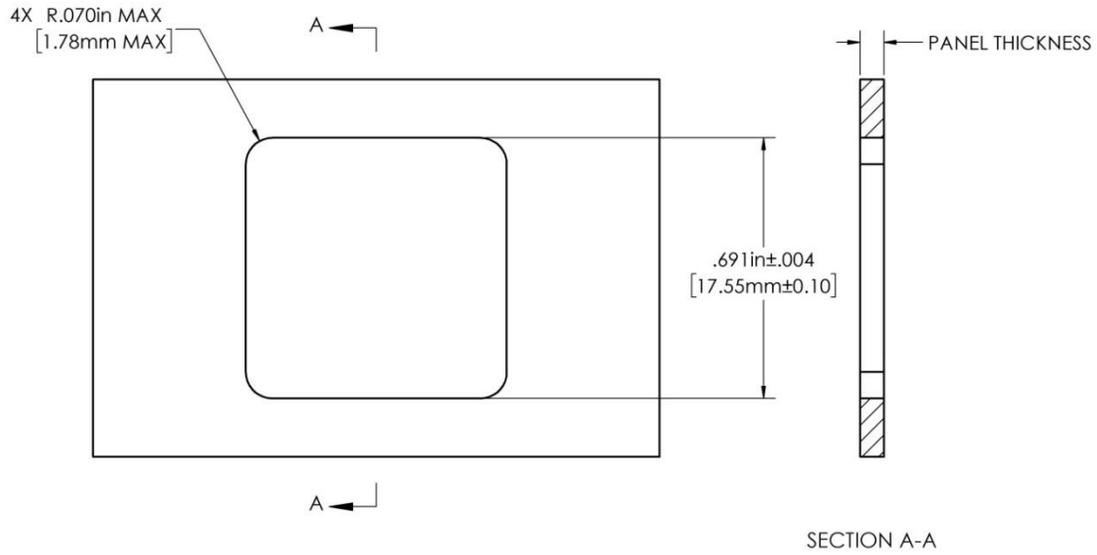


Figure 28: Panel cutout and thickness

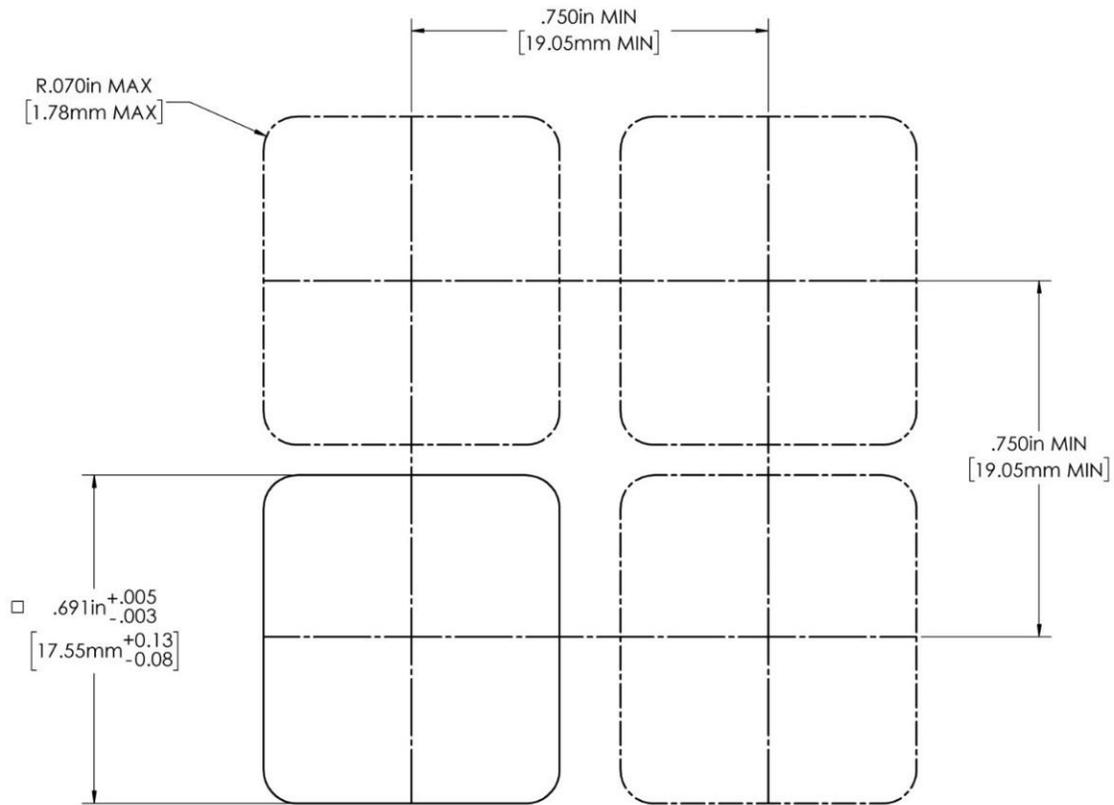


Figure 29: Matrix mount for type II & VI

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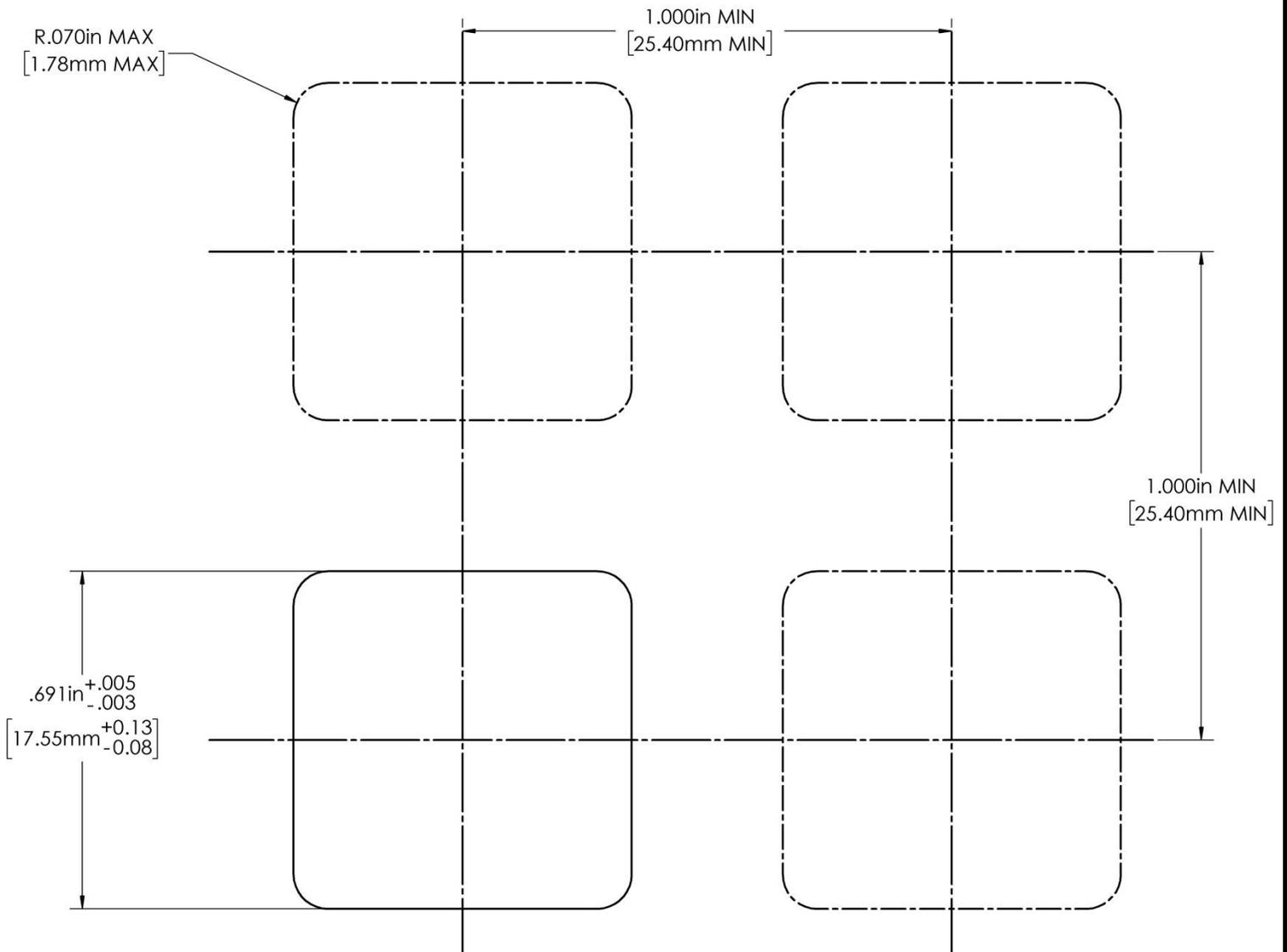


Figure 30: Matrix mount for type III & VI

4.2.3.2 Slot mounting

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.

$$L \text{ (inches)} = 0.752'' \times (n-1) + 0.690''$$

$$L \text{ (mm)} = 19.10 \text{ mm} \times (n-1) + 17.53 \text{ mm.}$$

Where:

L = length of horizontal or vertical mounting slot.

N = number of units in a row or column.

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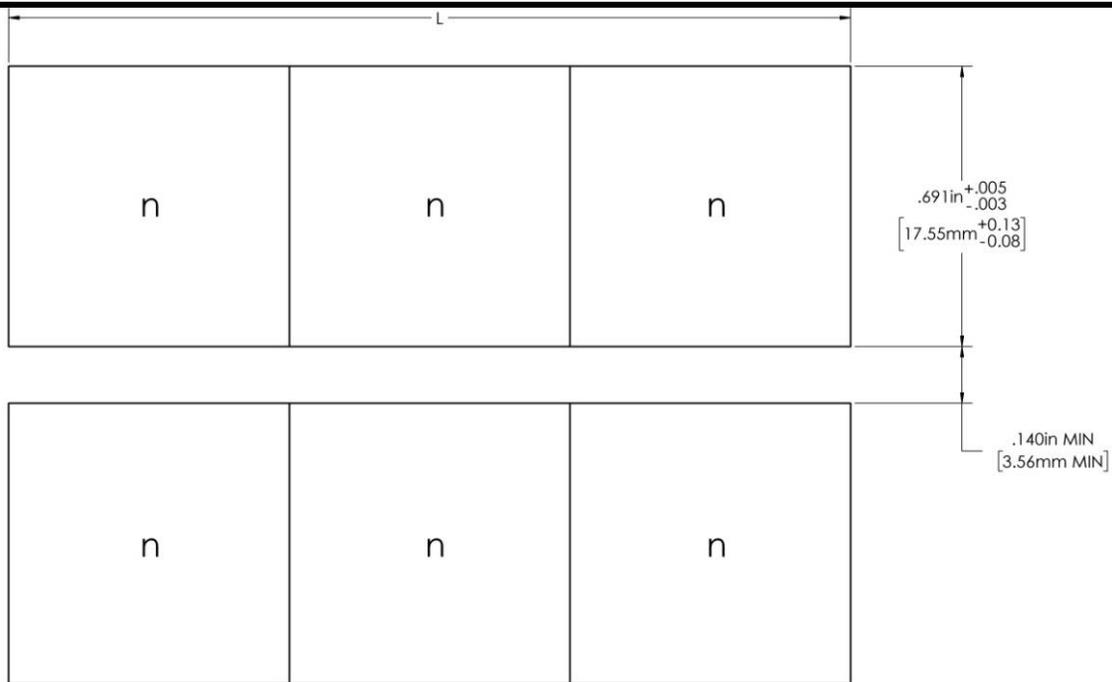


Figure 31: Slot mount for type I & III

4.2.3.3 Pushbutton switch assemblies with guards

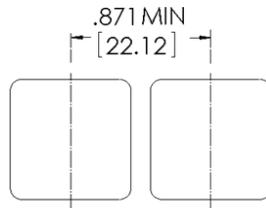


Figure 32: Switch guards (P/N 15089 & 156103) type II, V

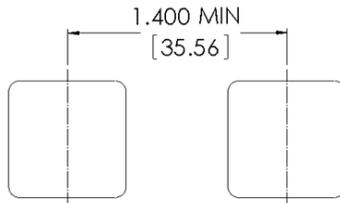


Figure 33: Switch guard (P/N 15204) type III, VI

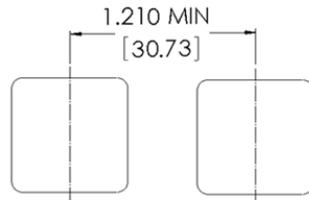


Figure 34: Switch guard (P/N 156104) type III, VI

4.3 Display Specifications

4.3.1 Field of View

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The pushbutton switch displays are tested in accordance to the requirements of MIL-PRF-22885 (see [Table VI: Viewing Area](#)).

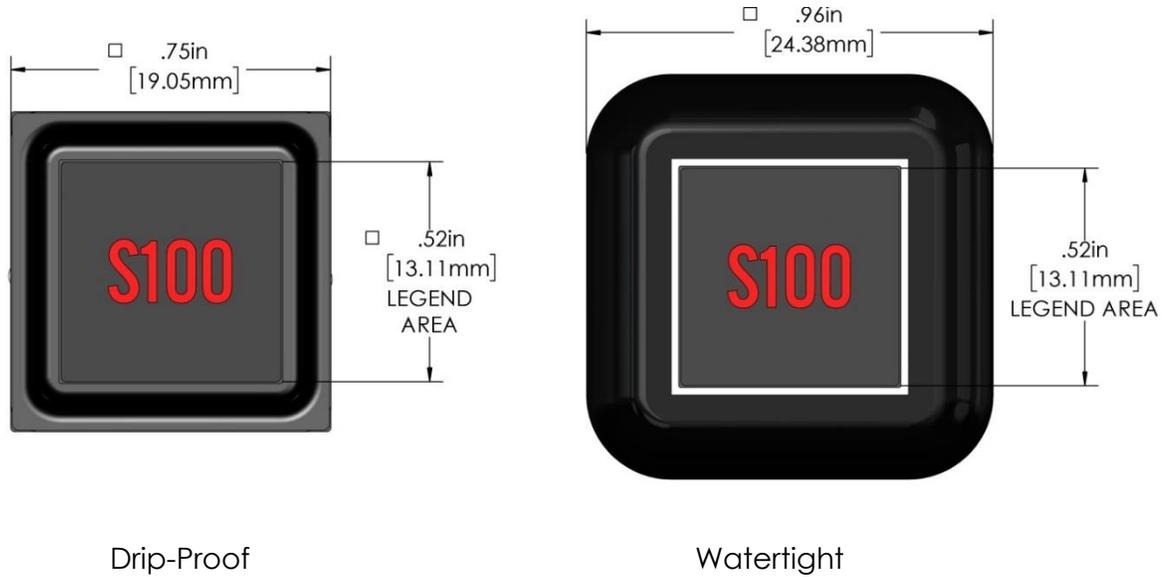


Figure 35: Legend Area

Table VI: Viewing Area

Viewing area	Drip-Proof dimensions - Inch (mm)	Watertight dimensions - Inch (mm)
Full screen	0.52" x 0.52" [13.11 mm x 13.11 mm]	0.52" x 0.52" [13.11 mm x 13.11 mm]
Half screen – horizontal	0.52" x 0.26" [13.11 mm x 6.60 mm]	0.52" x 0.26" [13.11 mm x 6.60 mm]
Half screen – vertical	0.26" x 0.52" [6.60 mm x 13.11 mm]	0.26" x 0.52" [6.60 mm x 13.11 mm]
Quarter screen	0.26" x 0.26" [6.60 mm x 6.60 mm]	0.26" x 0.26" [6.60 mm x 6.60 mm]

4.3.2 Light Sources

There are two different light sources available for S100 product line. The two light sources are high-brightness light-emitted diodes (HB LEDs) and incandescent lamps.

High-brightness light emitted diodes.

The High Brightness LEDs are offered in two configurations. The first configuration is High Brightness LEDs with current regulating resistors, and the second configuration is High Brightness LEDs with voltage dimming circuit (only available on 28 V).

Incandescent lamps

All lamps shall be flange based, incandescent, T-1 sub-miniature type. They shall be field replaceable from the front panel. When lamps are not furnished with the pushbuttons, a removable fiberboard plate shall be installed at the factory. This plate is removed when lamps are installed in the field. For proper operation, four T-1 lamps, or a combination of lamps and 'dummy plugs' (a device which simulate the specified lamps) must be used to prevent damage to the unit.

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4.3.3 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 36: Standard font size and style](#).



Figure 36: 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.

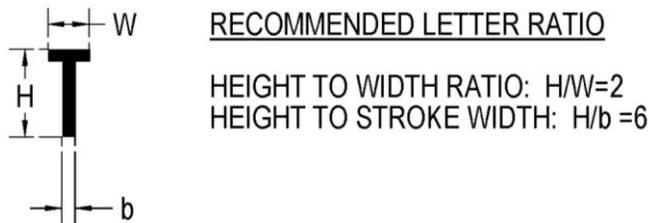


Figure 37: Character height

The character height, as defined in [Figure 37: 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 VII: Recommended Line and Character per Display Area](#). 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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Table VII: Recommended Line and Character per Display Area

CODE NO.	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		5X12				
12	0.087		4X10				
13	0.100		4X9				
14	0.125		3X7				
15	0.145	2X6					
20	NONE		NONE	NONE	NONE	NONE	2-WAY HORIZONTAL SPLIT SCREEN DISPLAY
21	0.072		2X12	2X12			
22	0.087		2X10	2X10			
23	0.100		1X9	1X9			
24	0.125		1X7	1X7			
25	0.145	1X6	1X6				
30	NONE		NONE	NONE	NONE	NONE	2-WAY VERTICAL SPLIT SCREEN DISPLAY
31	0.072		5X6	5X6			
32	0.087		4X4	4X4			
33	0.100		4X4	4X4			
34	0.125		3X3	3X3			
35	0.145	2X2	2X2				
40	NONE		NONE	NONE	NONE	NONE	3-WAY SPLIT SCREEN DISPLAY HORIZONTAL TOP HALF
41	0.072		2X12	2X6	2X6		
42	0.087		2X10	2X4	2X4		
43	0.100		1X9	1X4	1X4		
44	0.125		1X7	1X3	1X3		
45	0.145	1X6	1X2	1X2			
50	NONE		NONE	NONE	NONE	NONE	4-WAY SPLIT SCREEN DISPLAY
51	0.072		2X6	2X6	2X6		
52	0.087		2X4	2X4	2X4		
53	0.100		1X4	1X4	1X4		
54	0.125		1X3	1X3	1X3		
55	0.145	1X2	1X2	1X2			
60	NONE		NONE	NONE	NONE	NONE	3-WAY SPLIT SCREEN DISPLAY VERTICAL LEFT HALF
61	0.072		5X6	2X6	2X6		
62	0.087		4X4	2X4	2X4		
63	0.100		4X4	1X4	1X4		
64	0.125		3X3	1X3	1X3		
65	0.145	2X2	1X2	1X2			
70	NONE		NONE	NONE	NONE	NONE	3-WAY SPLIT SCREEN DISPLAY HORIZONTAL BOTTOM HALF
71	0.072		2X6	2X6	2X12		
72	0.087		2X4	2X4	2X10		
73	0.100		1X4	1X4	1X9		
74	0.125		1X3	1X3	1X7		
75	0.145	1X2	1X2	1X6			
80	NONE		NONE	NONE	NONE	NONE	3-WAY SPLIT SCREEN DISPLAY VERTICAL RIGHT HALF
81	0.072		2X6	5X6	2X6		
82	0.087		2X4	4X4	2X4		
83	0.100		1X4	4X4	1X4		
84	0.125		1X3	3X3	1X3		
85	0.145	1X2	2X2	1X3			

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.

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4.3.4 Lens and Faceplate Assemblies

The lens and faceplate assemblies are part of the pushbutton assembly. These pushbuttons are removable from the front of the panel to allow the replacement of incandescent lamps without the need for special tools. Multi-chip LEDs are not replaceable. The light source assembly of pushbutton with High Brightness LEDs can be replaced in the field if required.

4.3.4.1 Color Filters

Incandescent lamp-based pushbuttons that have display type 2, 3, 4, 5, 8 or 9 utilize color filter caps which may be interchanged among the four-color cell areas or replaced with color caps ordered from the factory. Incandescent lamp-based pushbuttons that have display types 1, 6, 7 or 0 utilize flat color filters which are an integral part of the faceplate assembly and are not replaceable in the field.

On all configurations of multi-chip LED based pushbuttons, the color is derived from the multi-chip LEDs (and, in the case of type 7 displays, the color is derived from the combination of the multi-chip LEDs and the NVG-compatible filter). Multi-chip LED colors are not changeable in the field.

On all configurations of High Brightness LED based pushbuttons, color is derived from color filters, and in the case of type 7 displays, the color is derived from the NVG-compatible filter. High Brightness LED based pushbuttons that have display types 0, 1, 4, 5, 6, or 7 utilize flat color filters which are an integral part of the faceplate assembly and are not replaceable in the field.

4.3.4.2 Customer Replaceable Legends

Display types 8, 9 and 0 allow for customer replaceable legends. Each type is available for configurations with incandescent lamps pushbuttons. Display type 0 is available for High Brightness LED based pushbuttons. For multi-chip LED-lighted pushbuttons display types 9 and 0 are available. The overall size of the replaceable faceplate is .575" (14.61 mm) square, with a viewing area of .495" (12.57 mm) square. Displays with customer installed legends may not be of equal quality to that of factory installed assemblies with laminated legends. Section [6.0](#), TB-12-A-29 illustrates the stack-up and surface orientation for these display types.

NOTE: Factory supplied replaceable legends are available by indicating the desired text in the normal manner. If no specific legend is identified, a temporary film chip (REPLACE;WITH;LEGEND) will be installed in the pushbutton at the factory.

4.4 Mechanical Specifications

4.4.1 Mechanical Endurance

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

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Mechanical life

Switches are tested and exceeded MIL-PRF-22885 life cycle requirement. MIL-PRF-22885 required 50,000 cycles. Staco S100 test consists of 5,000 cycles of operation at $-55^{\circ}\text{C} \pm 2^{\circ}\text{C}$, 10,000 cycles at $+85^{\circ}\text{C} \pm 2^{\circ}\text{C}$, and 85,000 cycles at room temperature.

Note: Mechanical life tests have been completed in excess of 1,000,000 cycles.

4.4.2 Operating Characteristics

Below are switch actions available for S100 product line. The pushbutton switches are tested in accordance with the requirements of MIL-PRF-22885 ([Table VIII: Action Characteristic](#)).

Table VIII: Action Characteristic

MIL-PRF- 22885 Code	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 original position when the pushbutton is released.

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

Below are actuation force, pushbutton travel and alternate action displacement as shown in [Table IX: Actuation and Pushbutton Travel](#)

Table IX: Actuation and Pushbutton Travel

Actuation force	2 to 5 pounds (9 to 22.2N)	
Pushbutton extraction force	2 to 5 pounds (9 to 22.2N)	
Pushbutton travel	0.130 \pm .010 inch	
Alternate displacement	0.065 inch (latched) Δ	Pushbutton travel and alternate action displacement are shown in Figure 38: Pushbutton displacement for splash-proof switches .

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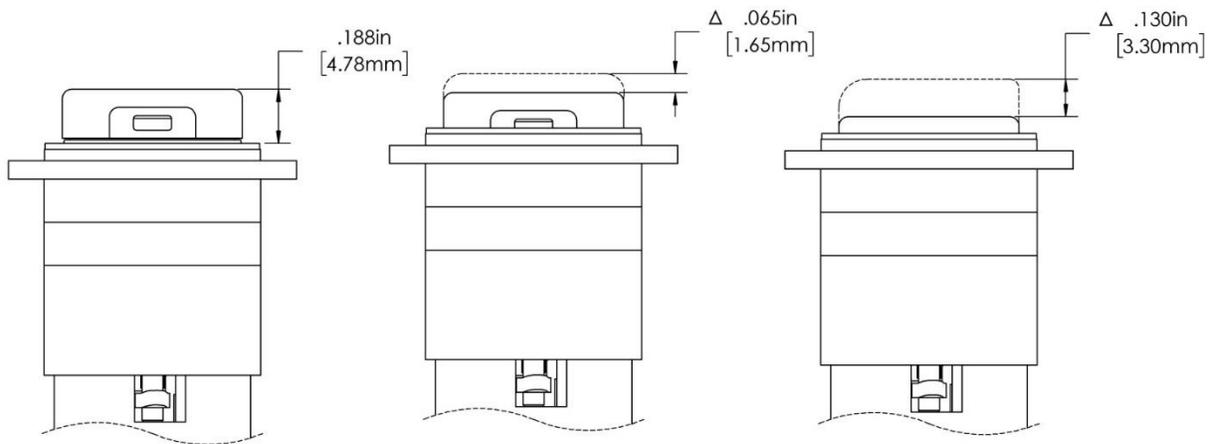


Figure 38: Pushbutton displacement for splash-proof switches

4.4.3 Mounting Provision

Switch / indicator mounting screw location

The location of the mounting screws within the switch housing is shown in figure 31. Mounting instructions for switches are in technical bulletin TB-206.

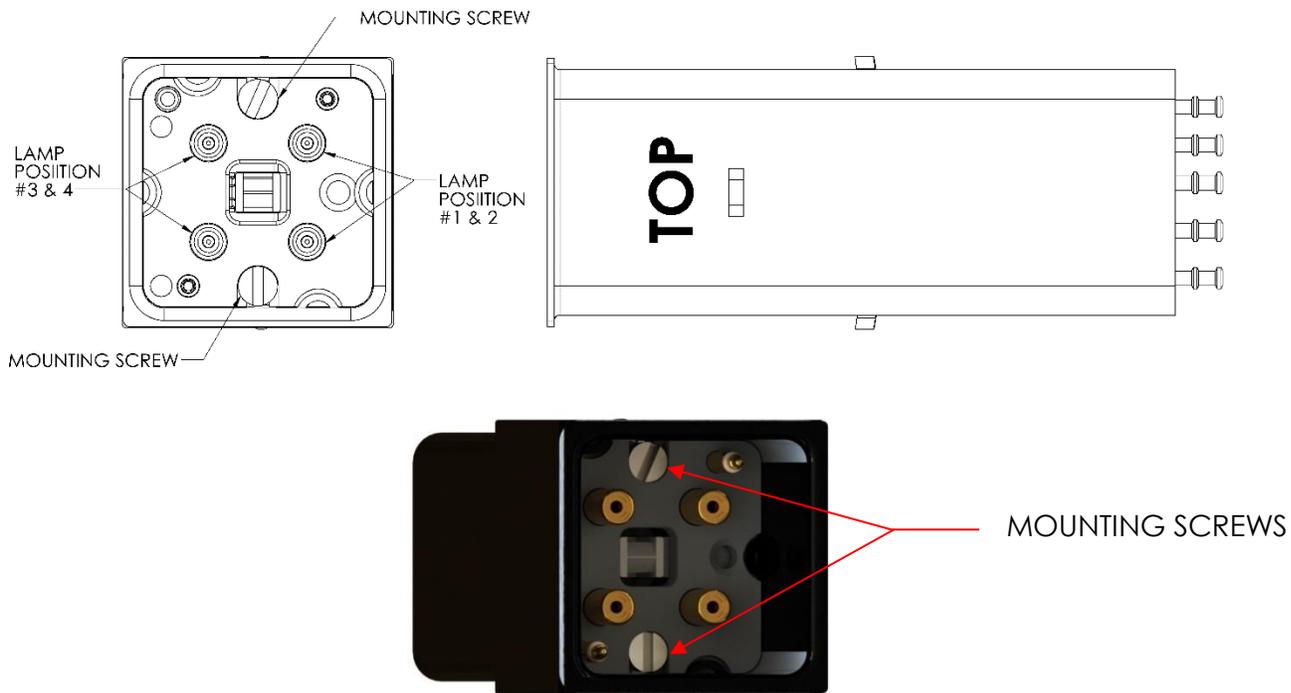


Figure 39: Mounting Provision (solder termination shown)

Each switch or indicator assembly intended for individual mount application is provided with a set of mounting hardware. This consists of a mounting sleeve, two panel spacers, and a panel seal, which are used in conjunction with the mounting screws and cam nuts, to install the switch / indicator to the panel.

4.4.3.1 Mounting torque

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The recommended torque to be applied to the mounting screws during installation is 10 ± 2 ounce-inches (0.071 ± 0.014 Nm). This torque value is applicable to both, the switch panel mounting and to receptacle assembly installation.

4.4.4 Terminal Strength

Solder terminals. Switch is tested in accordance to the requirements of MIL-PRF-22885, MIL-STD-202, Method 208. Terminal strength tests are conducted as prescribed by MIL-STD-211, test condition A. See figure 10 for details and outline dimensions.

PCB terminals. Printed circuit board (PCB) terminals 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. See figure 11 for details and outline dimensions.

Crimp pin terminals. Crimp pin terminals are gold plated per MIL-G-45204. Crimp on wire terminations per MIL-C-39029/22-129 shall withstand a pull force of 5 pounds along the axis of the terminals. See figures 12 and 13 for details and outline dimensions.

4.4.5 Switch and Pushbutton Weight

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

Table X: Pushbutton switch weight

Description	Termination	Ounces (max.)	Grams (max.)
Model C coded Switch 4PDT	Solder / PC	0.70	20.0
	Crimp pin	0.92	26.0
Model C coded Indicator	Solder / PC	0.60	17.0
	Crimp pin	0.81	23.0
Model 92 coded	Incandescent	0.14	4.0
	LED	0.11	3.0
Mounting hardware	Panel seal, panel	0.11	3.0

4.5 Electrical Specifications

4.5.1 Switch Schematics

Switch terminal location & identification

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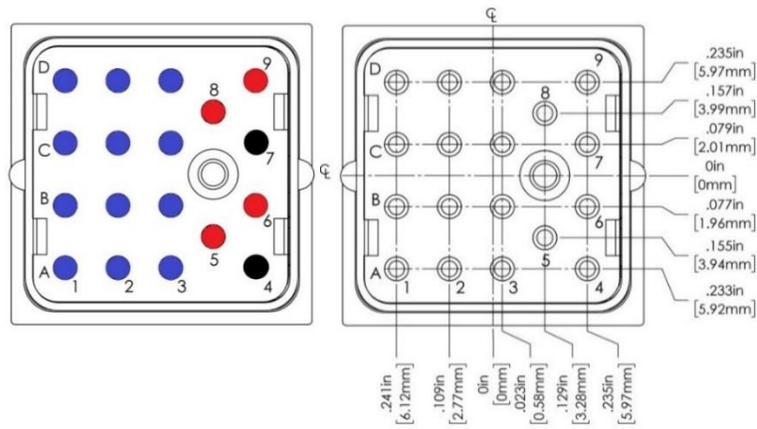


Figure 40: Switch terminal identification

Notes:

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

Table XI: Switch and termination diagram

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

Note: Shown in normal position.

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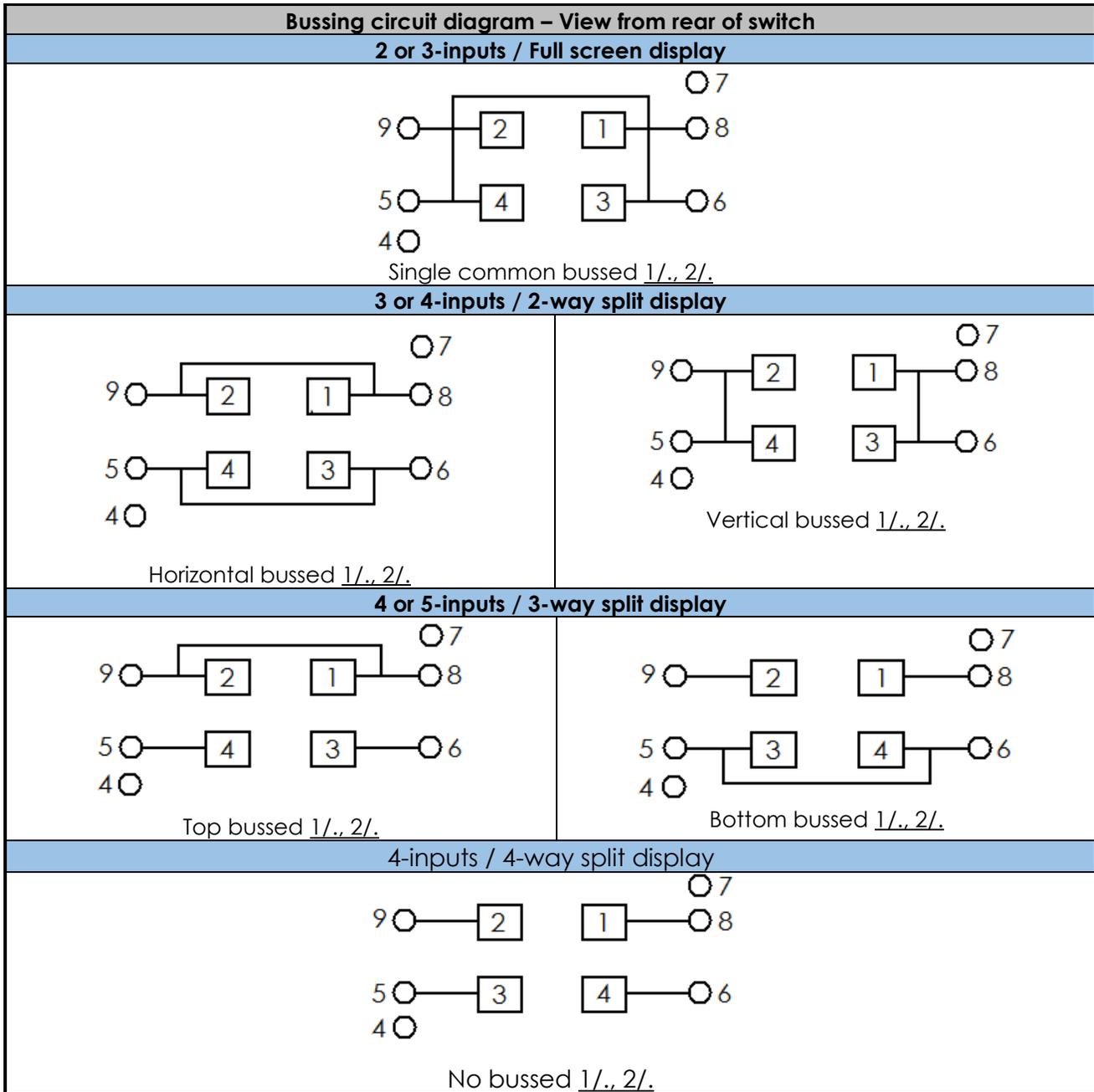
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Refer to [Figure 40: Switch terminal](#) identification for terminal designations. Shown in normal positions

4.5.2 Switch Common Bus Schematic

To reduce the number of input wires, a common bussed option is available for switch / indicator assembly as shown below.

Table XII: Bussing Circuit Diagram



- 1/. Applicable to incandescent versions of the Series 100, Note: bussing is completed in the switch, not the pushbutton. When converting to HB-LED where the bussing is completed in the pushbutton there may be a conflict.
- 2/. Applicable to HB-LED version of the Series 100.

4.5.3 Pushbutton Schematics

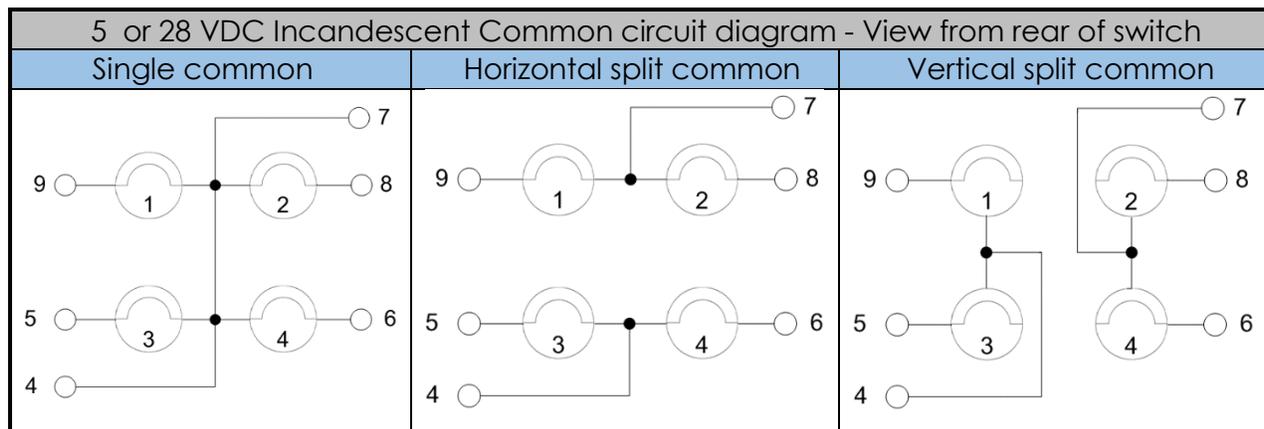
4.5.3.1 Incandescent lamps.

The following schematics depict three different standard common (ground) configurations for incandescent light sources.

- Common lamp ground for all four lamps – single common.
- Horizontally split ground plate – Horizontal split common.
- Vertically split ground plate – Vertical split common.

Unlike LED termination wiring, each incandescent lamp is lighted independently from the other three by applying power to the pin designated. The power may be DC or low-voltage AC, as long as it is within the rating of the lamp. Standard lamp selections are listed in [Table XIII: Common Circuit diagrams](#).

Table XIII: Common Circuit diagrams



4.5.3.2 High-brightness lighted-emitted diodes.

The HB LED pushbuttons have three individual LED's per quadrant. Unlike the incandescent versions, power need to be applied to only one pin to control the lighting of a half-screen LED display, if the display style is either full-screen or one which includes half-screen displays.

For common (ground) configuration, it is recommended to the end user that both ground terminals (typically pins 4 and 7) be used as the common return circuit for redundancy.

It's to be noted that for 5 VDC applications, the LEDs are connected in parallel and uses 45 mA per quadrant when illuminated. Thus, a full-screen unit would use 180 mA, a two-way split with one half lighted would use 90 mA, etc.

For 28 VDC operating voltage applications, the LEDs are connected in series. The current requirements depend upon the configuration. When operated at 28 volts DC, either for a full-screen or two-way split configuration, the maximum forward current is 40 mA for each half screen when illuminated (80 mA with both illuminated). Maximum current usage for each configuration is shown in table J.

The following schematics show the standard LED configuration for different display style and common configuration.

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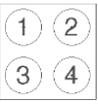
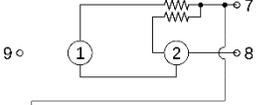
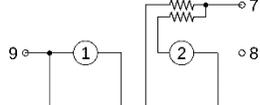
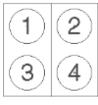
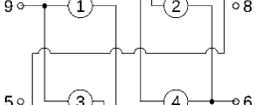
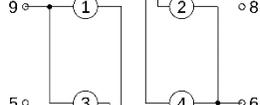
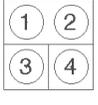
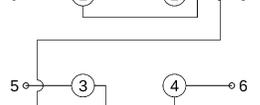
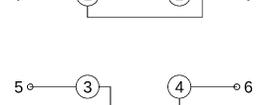
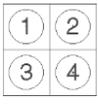
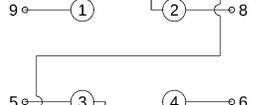
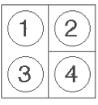
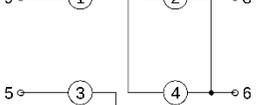
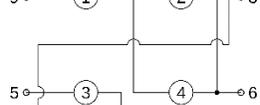
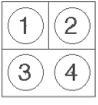
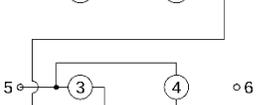
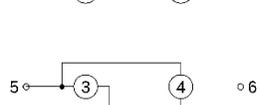
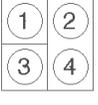
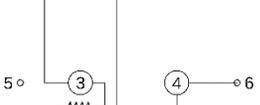
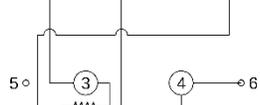
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Table XIV: 5 VDC High Bright LED Circuit Diagram

CODE	DISPLAY STYLE (FRONT VIEW)	COMMON CIRCUIT DIAGRAM (REAR VIEW)	COMMON CIRCUIT CODE				SPLIT CIRCUIT DIAGRAM (REAR VIEW)	SPLIT CIRCUIT CODE			
			A		B			C		D	
			[SOURCING]	[SINKING]	[SOURCING]	[SINKING]		[SOURCING]	[SINKING]	[SOURCING]	[SINKING]
SEALED											
1	 FULL		31	41	54	61		31	41	54	61
3	 VERT SPLIT		31	41	54	61		31	41	54	61
4	 3-WY HZ TOP SPLIT		33	43	53	63		33	43	53	63
5	 4-WY SPLIT		53	45	55	65		53	45	55	65
6	 3-WY VERT LEFT SPLIT		33	43	53	63		33	43	53	63
7	 3-WY HZ BOTTOM SPLIT		33	43	53	63		33	43	53	63
8	 3-WY VERT RIGHT SPLIT		33	43	53	63		33	43	53	63

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Table XV: 28 VDC High Bright LED Circuit Diagram

CODE	DISPLAY STYLE (FRONT VIEW)	COMMON CIRCUIT DIAGRAM (REAR VIEW)	COMMON CIRCUIT CODE				SPLIT CIRCUIT DIAGRAM (REAR VIEW)	SPLIT CIRCUIT CODE			
			A		B			C		D	
			[SOURCING]	[SINKING]	[SOURCING]	[SINKING]		[SOURCING]	[SINKING]	[SOURCING]	[SINKING]
SEALED											
1	 FULL		32	42	52	62		32	42	52	62
3	 VERT SPLIT		32	42	52	62		32	42	52	62
4	 3-WY HZ TOP SPLIT		34	44	54	64		34	44	54	64
5	 4-WY SPLIT		36	46	56	66		36	46	56	66
6	 3-WY VERT LEFT SPLIT		34	44	54	64		34	44	54	64
7	 3-WY HZ BOTTOM SPLIT		34	44	54	64		34	44	54	64
8	 3-WY VERT RIGHT SPLIT		34	44	54	64		34	44	54	64

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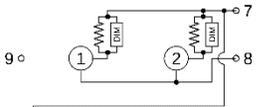
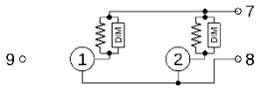
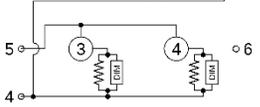
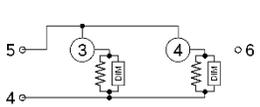
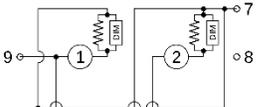
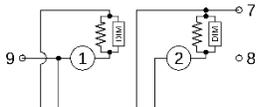
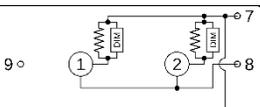
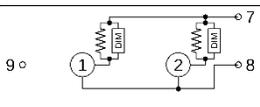
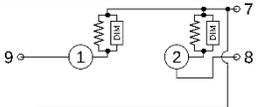
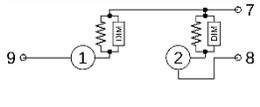
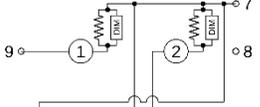
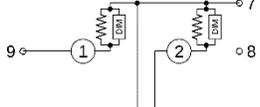
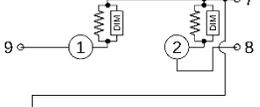
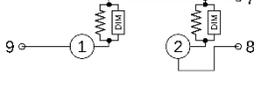
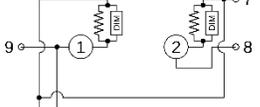
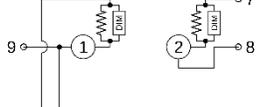
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Table XVI: 28 VDC High Bright LED Circuit Diagram (Voltage Dimming)

CODE	DISPLAY STYLE (FRONT VIEW)	COMMON CIRCUIT DIAGRAM (REAR VIEW)	COMMON CIRCUIT CODE				SPLIT CIRCUIT DIAGRAM (REAR VIEW)	SPLIT CIRCUIT CODE			
			E		F			G		H	
			[SOURCING]	[SINKING]	[SOURCING]	[SINKING]		[SOURCING]	[SINKING]	[SOURCING]	[SINKING]
SEALED											
1	 FULL		32	42	52	62		32	42	52	62
2	 HZ SPLIT		32	42	52	62		32	42	52	62
3	 VERT SPLIT		32	42	52	62		32	42	52	62
4	 3-WY HZ TOP SPLIT		34	44	54	64		34	44	54	64
5	 4-WY SPLIT		36	46	56	66		36	46	56	66
6	 3-WY VERT LEFT SPLIT		34	44	54	64		34	44	54	64
7	 3-WY HZ BOTTOM SPLIT		34	44	54	64		34	44	54	64
8	 3-WY VERT RIGHT SPLIT		34	44	54	64		34	44	54	64

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4.5.3.3 LED polarity

LED light sources may be configured for either current sourcing or current sinking. In current sourcing, the LED is energized by applying current to the LED anode (positive) terminals, LED cathode (negative) leads are in common. In current sinking, the LED is energized by applying current to the LED cathode (negative) terminals and the LED anode (positive) leads are in common. Current sourcing and sinking are shown in the following schematics.

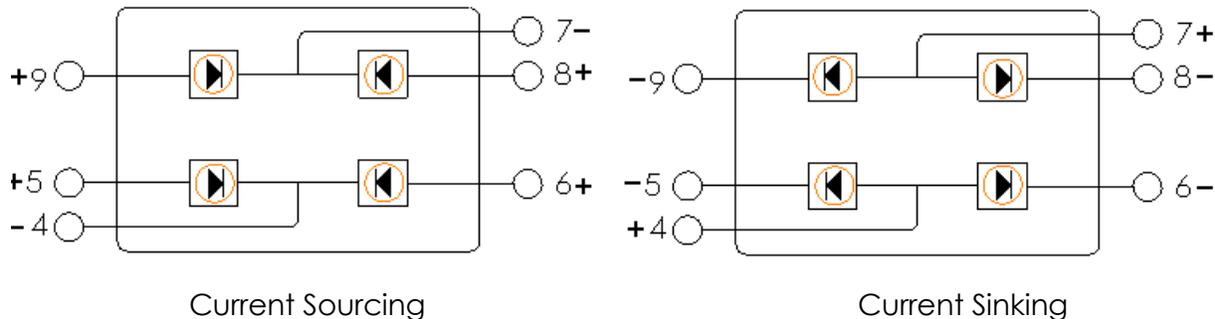


Figure 41: Pushbutton LED Polarity

One characteristic of current sourcing is that it can be used to isolate the lamp load from direct power connection if desired. For this, the cathode side of the LED is always grounded through a current-regulating resistor. The driving circuits supply voltage to the anode side of the LEDs to illuminate them.

Current sinking, on the other hand, enables the controlling circuits to switch the cathodes to ground to light the LEDs. This is a simpler control circuit to implement if MOSFET logic is being used. Also, multi-channel output driver ICs with common grounded emitters are readily available.

4.5.4 Switch Contact Rating

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

Table XVII: Contact Rating

		Sea level	50,000 feet
Silver contacts 28 VDC	Resistive	7.0 Amperes	5.0 Amperes
	Inductive	4.0 Amperes	2.5 Amperes
	Lamp	2.5 Amperes	2.5 Amperes
Silver contacts 115 VAC, 60Hz	Resistive	7.0 Amperes	
	Inductive	7.0 Amperes	
	Lamp	2.0 Amperes	
Gold plated contacts 28 VDC	Resistive	1.0 Amperes	
	Inductive	0.5 Amperes	

4.5.5 Light-Emitted Diodes Current Performance

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Table XVIII: LED Current Performance

Display style	5 V DC	28 V DC
Full screen	180 mA	80 mA
2-way split screen		
3-way split screen		
4-way split screen		

4.5.5.1 Voltage dimming control

Applicable to 28VDC lighting circuits with dimming device only. These control circuits allow to adjust LED backlight luminance with variable voltage, similar to incandescent lamps light source. Visible luminance starts at about 7.6 V where LED current is approximately 0.020 mA and continues to 28 V where current reaches 20 mA \pm 2 mA.

4.5.6 Incandescent Lamp Option

Table XIX: Incandescent Lamp Option

Lamp type	Voltage Max	Maximum	Power (W)	Average M.S.C.P.	Life (Hr)	Note
3071	5	240	1.2	0.15	5,000	-
718	5	460	2.3	0.15	40,000	-
3335	28	64	1.8	0.08	10,000	1/, 2/
3042	6	240	1.4	0.13	3,000	1/
1099	12	240	2.9	0.15	16,000	-
3229	14	160	2.2	0.15	16,000	-
6839	28	96	2.7	0.15	16,000	-

Notes:

- 1/. SLR performance may be degraded with these lamps.
- 2/. Recommended for low faceplate temperature.
3. Unless otherwise specified, M.S.C.P. values are \pm 25%.
4. When lamps are not furnished with pushbuttons, a removable fiberboard plate is installed at the factory, to ensure, that the pushbutton returns to full normal position. This plate is removed and discarded when lamps are installed.
5. Caution: Do not install pushbutton without lamps or dummy lamps in all four positions, or a fiberboard plate in place. Otherwise, when power is connected, a short circuit will result.

4.5.7 Other Electrical Specifications

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

Low level circuit - The switches are tested in accordance to the requirements of MIL-PRF-22885 and ML-STD-202, Method 311.

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

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.

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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, and MIL-STD-202F, Method 301.

Dielectric withstanding voltage at reduced pressure - the switches are tested in accordance to the requirements of MIL-PRF-22885 and MIL-STD-202F, Method 105C, Cond. C.

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

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

4.6 Optical Performance

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

4.6.1 HB LED and Incandescent Luminance Performance

The pushbutton luminance is tested in accordance to the requirements of MIL-PRF-22885.

Luminance measurements for a given legend type may vary depending on the shape of the lamp filament required for its design voltage, the orientation of the filament within the lampbox, and the legend used in the test. QPL tests are conducted with a standard test legend, AG2, the specified lamp box configuration and utilize lamp type 3071 (5 volt, with a Kelvin temperature of 2350 °K). Results with other legends, lampbox configurations or lamps may be different. See tables L and M for the minimum average luminance for LEDs and incandescent light sources.

Table XX: Incandescent Luminance Performance (Non-NVIS)

22885 Code	Minimum Luminance (footlamberts)			
	C	N	W	S
S100 Code	1	4	5	6
White	350/175	300/150	350/175	275/225
Red	80/40	50/25	70/35	185/150
Green	60/30	40/20	50/25	185/150
Aviation Yellow	350/175	200/100	350/175	275/225
Lunar White	300/175	250/150	300/175	250/200
Blue	40/20	25/12	30/12	2/
Aviation Green	60/30	40/20	50/25	250/200

1. EMI/without EMI
2. Not recommended in blue.

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Table XXI: HB-LED Luminance performance (Non-NVIS)

22885 Code	Minimum Luminance (footlamberts)			
	C	N	W	S
S100 Code	1	4	5	6
White	240	530	530	740
Red	40	75	75	180
Green	180	170	170	490
Aviation Yellow	185	410	410	630
Lemon Yellow	350	850	850	990
Blue	166	85	85	220

Chromaticity diagram and illuminated color limits chart.

The chromaticity of illuminated colors is tested in accordance to the requirements of MIL-PRF-22885.

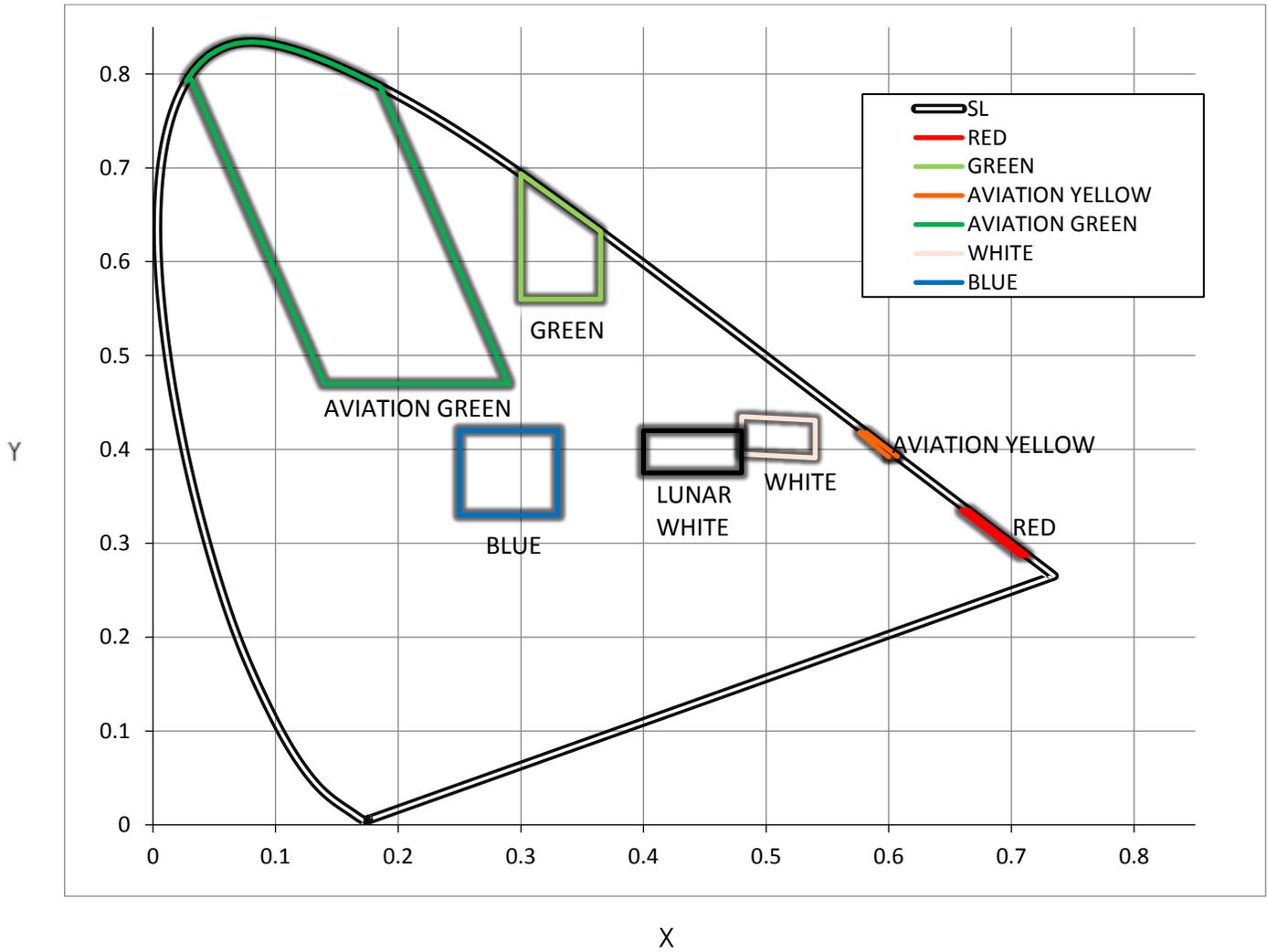


Figure 42: Incandescent Color – CIE 1931 Chromaticity Diagram

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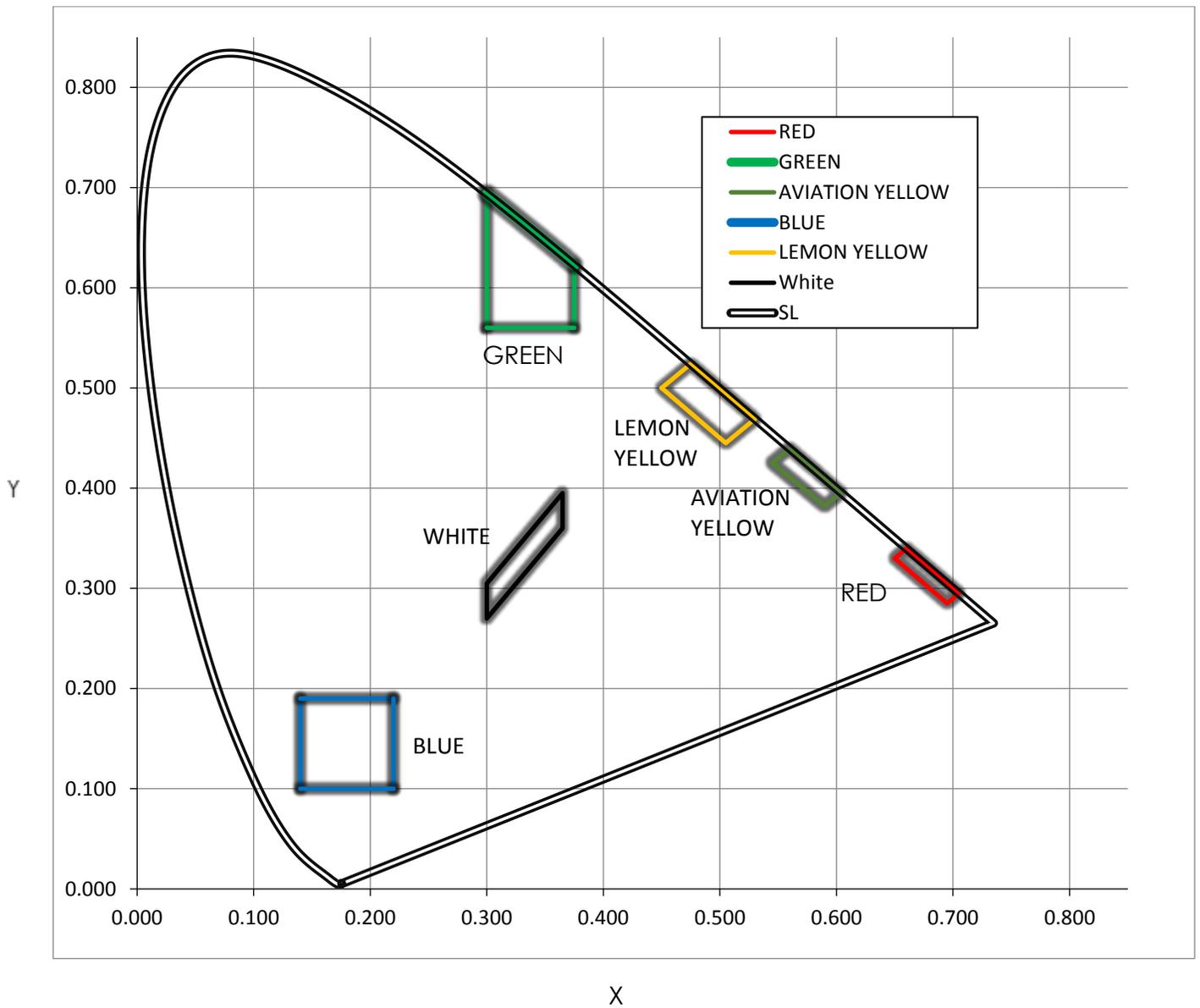


Figure 43: High Brightness LED Colors – CIE 1931 Chromaticity Diagram

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Table XXII: Color Limits (Non-NVIS)

Non-NVIS Color	High brightness LED		Incandescent lamp	
	X	Y	X	Y
White	0.300	0.270	0.480	0.395
	0.300	0.305	0.480	0.435
	.0365	0.395	0.540	0.431
	0.365	0.360	0.540	0.391
Red	0.695	0.285	0.665	SL 2/
	0.705	SL 2/	0.659	0.335
	0.650	0.330	0.707	0.287
	0.660	SL 2/	0.713	SL 2/
Green	0.300	0.560	0.300	0.560
	0.300	SL 2/	0.300	SL 2/
	0.375	0.560	0.365	0.560
	0.375	SL 2/	0.365	SL 2/
Aviation Yellow	0.545	0.425	0.568	0.425
	.0560	SL 2/	0.575	SL 2/
	0.590	0.382	0.630	SL 2/
	0.604	SL 2/	0.623	0.370
Lunar White	---	---	0.400	0.375
	---	---	0.400	0.420
	---	---	0.480	0.375
	---	---	0.480	0.420
Lemon Yellow	0.450	0.500	---	---
	0.475	SL 2/	---	---
	0.505	0.445	---	---
	0.530	SL 2/	---	---
Blue	0.140	0.100	0.250	0.330
	0.140	0.190	0.250	0.420
	.0220	0.100	0.330	0.330
	0.220	0.190	0.330	0.420
Aviation Green	---	---	0.140	0.470
	---	---	0.290	0.470
	---	---	0.030	SL 2/
	---	---	0.185	SL 2/

Notes:

1. 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 (see figures 32 and 33).
- 2/. The term "SL" indicates where intersections occur with the spectrum locus on the CIE chromaticity diagram.

4.6.1.1 Voltage dimming control Luminance performance.

Staco's LED light source with built-in voltage dimming circuit, adjusting the brightness to the desired level can be accomplished by simply vary the applied voltage between 28 V (where current is reaches 20mA ± 2 mA) down to 7.6V (where the current is approximately 0.020 mA).

The output normalized luminance vs. input voltage of a voltage dimming circuit is shown in figure 33.

Note, voltage dimming control is only available in 28 V DC option.

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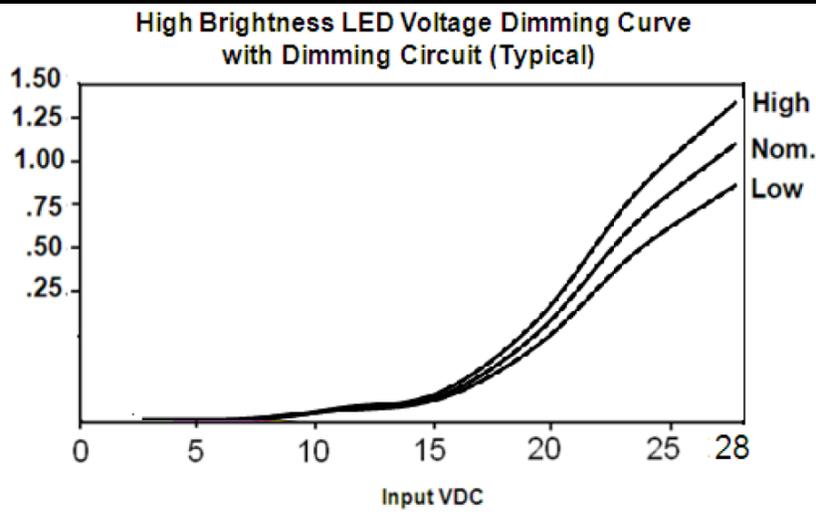


Figure 44: Voltage Dimming Curve

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

Example:

Using the luminance data of NVIS yellow from table L.

Minimum average luminance = 250 fL.

250 fL x 1.5 (high) = 375 fL.

250 fL x .75 (low) = 188 fL.

4.6.2 NVIS Compatibility

NVIS compatibility is tested in accordance to the requirements of MIL-PRF-22885, MIL-STD-3009, and MIL-L-85762 (when applicable).

NVIS-compatible colors are tested in accordance with MIL-STD-3009. Available NVIS colors are Green A, Green B, Yellow, and Red for incandescent. Green A, green B, yellow, white, blue and red are available in high-brightness LEDs light sources.

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 A
 $U' = .088$
 $V' = .543$
 $R = .037$

NVIS GREEN B
 $U' = .131$
 $V' = .632$
 $R = .057$

NVIS YELLOW
 $U' = .274$
 $V' = .622$
 $R = .083$

NVIS RED
 $U' = .450$
 $V' = .550$
 $R = .060$

NVIS WHITE
 $U' = .190$
 $V' = .490$
 $R = .040$

NVIS BLUE
 $U' = .175$
 $V' = .167$
 $R = .040$

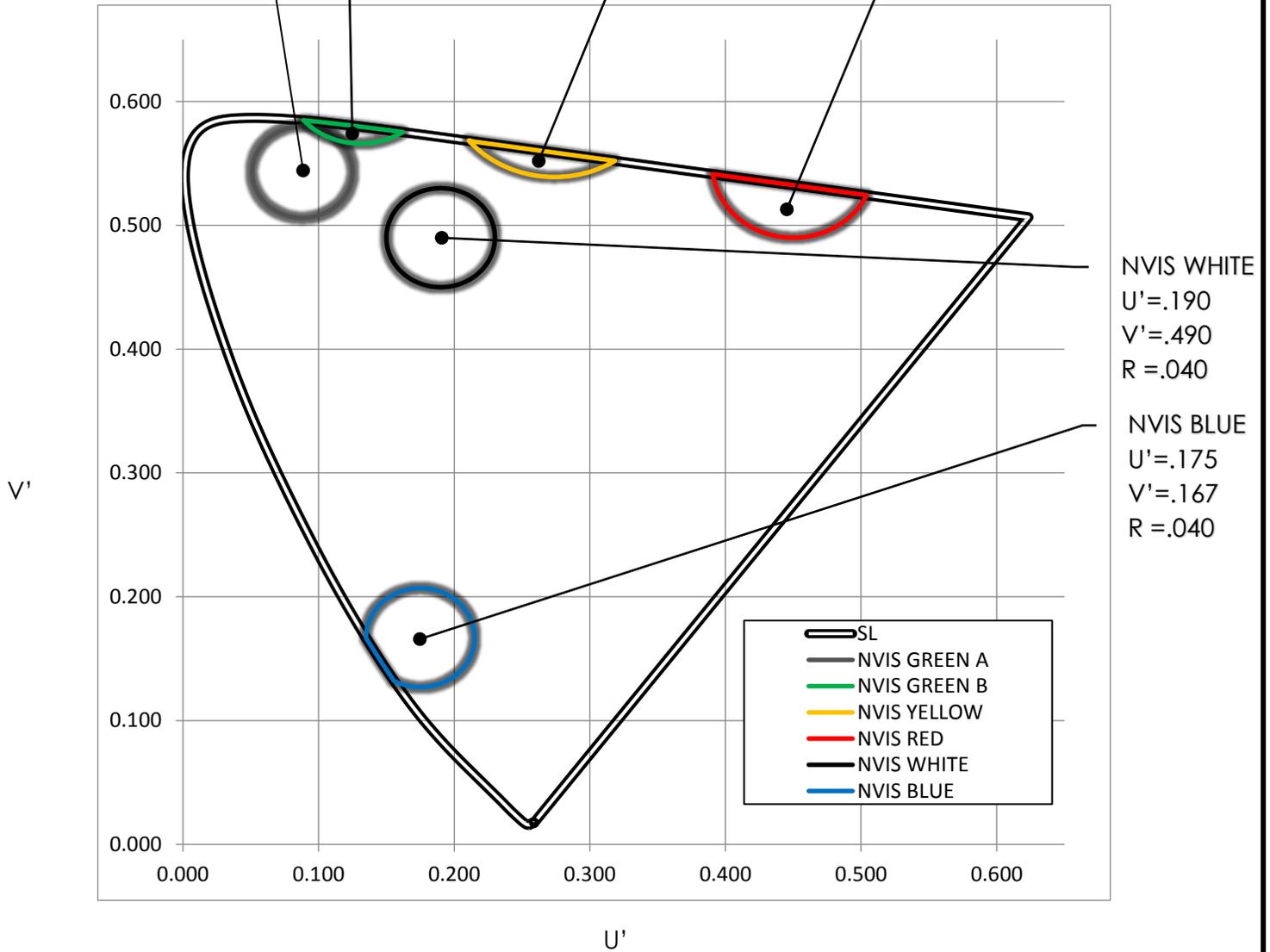


Figure 45: NVIS Compatible Colors – CIE 1976 Chromaticity Diagram

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Table XXIII: Chromaticity Requirements of NVIS Compatible Light Sources

NVIS COLOR	1976 UCS CHROMATICITY COORDINATES			LUMINANCE fL
	u'	v'	r	
Green A	0.088	0.543	0.037	0.1
Green B	0.131	0.623	0.057	0.1
Yellow	0.274	0.622	0.083	15
Red	0.450	0.550	0.060	15
White	0.190	0.490	0.040	0.1
Blue	0.175	0.167	0.040	0.1

Where:

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

r = radius of the allowable circular area for the color.

fL = footlamberts

NOTES:

1. All values are per MIL-L-85762, Table VIII, and MIL-STD-3009.

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 footlamberts.

NVIS spectral radiance measurements for the Series 100 shall be made on a calibrated spectroradiometer. The luminance setting for these measurements 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 XLVI: [NVIS Illuminated Color](#) has the summary of the NVIS radiance specification for configurations which are applicable to the Series 100 Product Line.

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Table XLVI: NVIS Illuminated Color

NVIS Illuminated color									
Color	Minimum Luminance (fL)	Chromaticity Coordinates			Contrast - 0°/45° Degrees @10,000 FC		Radiance		
		u'	v'	r	"ON"	"OFF"	Nra	Nrb	Scaled Luminance (fL)
Green A	100/350	0.088	0.543	0.037	0.60	0.10	1.7 E-10	1.7 E-10	0.10
Green B	150/180	0.131	0.623	0.057	0.60	0.10	1.7 E-10	1.7 E-10	0.10
Yellow A	150/250	0.274	0.622	0.083	0.60	0.10	1.7 E-10	-	0.10
Yellow B	150/350	0.274	0.622	0.083	0.60	0.10	-	1.5 E-7	15.0
Red	80/180	0.450	0.550	0.060	0.30	0.10	-	1.4 E-7	15.0
White	-/600	0.190	0.490	0.040	0.30	0.10	-	2.2 E-10	0.10
Blue	-	0.175	0.167	0.040	N/A	0.10	-	1.00 E-08	0.10

1. Incandescent luminance/HB-LED luminance

Performance of NVGC Light Sources

[Table XLVII: Type 6 Contrast](#), compares the performance of incandescent, and High Brightness LED lighted pushbuttons to the values of

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Table XLVI: NVIS Illuminated Color.

4.6.3 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.

Sunlight readable displays in the Series 100 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 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 follow:

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 Drip-proof, Splash-proof or Watertight seals. SLR requirements do not apply to Solvent Resistant or Hazardous Environment Seals.

Table XLVII: 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

4.7 Environmental Specifications

Temperature Characteristics

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

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Table XLVIII: Operating Temperature Range

Condition	Temperature
Operating with lamps un-energized	-55 °C to +85 °C
Operating with lamps energized	-55 °C to +71 °C
Storage	-65 °C to +100 °C

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, MIL-STD-202F, Method 101D, Cond. A.

Thermal Shock: The pushbutton switches are tested in accordance to the requirements of MIL-PRF-22885, MIL-STD-202, Method 107, 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 213.

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, MIL-STD-202F, Method 106F.

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

Drip 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-PRF-22885 and 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.

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.

4.8 Material Requirements

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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.

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, which meet flammability requirements of 94V-0 in accordance with UL 94.

Non-Toxic: All components contained in S100 product lines are classified as non-toxic materials.

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-5541F, Type II, Class 3.

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

Fluorosilicone: Fluorosilicone Rubber and Elastomer, Oil and Fuel Resistant per MIL-R-25988.

Tin Plated Finish: Lead content is 3% minimum.

Ozone Depleting Chemicals and Cadmium plated finishes: Neither Cadmium plating nor ozone depleting chemicals (ODC's) are used in any products or manufacturing processes for this product line. ODC's include chlorofluorocarbons (CFC's), hydrochlorofluorocarbons (HCFC's), methyl chloroform, carbon tetrachloride and halons.

4.9 Other Requirements

4.9.1 Marking

Pushbutton and Switch are marked in accordance to MIL-STD-22885 and MIL-STD-130.

Identification of terminal: Lamp and switch terminal numbers shall be identified on header base and receptacle assembly.

Identification of product: Switches and/or individual packaging shall be permanently and legibly marked per MIL-STD-130, spec 73112. For non-MIL specification parts, the following shall be provided as a baseline:

- a. Stacosystems.

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- b. Irvine, CA.
- c. Cage code (12522).
- d. Switch part number (Cxxxxx).
- e. Date code (YYWW).
- f. Switch schematic.
- g. Pushbutton schematic.
- h. Assembly part number (or customer P/N).

For MIL specification parts, the following shall be provided as a baseline:

- a. Stacosystems.
- b. Irvine, CA.
- c. Cage code (12522).
- d. Date code (YYWW).
- e. Switch schematic.
- f. Pushbutton schematic.
- g. MIL SPEC Part number.

Refer to Staco drawing 73112 for additional information and custom marking specs.

Switch / indicator housings: Unless otherwise specified, switch and indicator housings shall be marked as specified above with the switch or indicator part number marked on the housing.

Pushbuttons: Unless otherwise specified, pushbuttons shall be marked as follows:

- a. Incandescent configuration - date code (and slash number if applicable, and/or TAB number if specified).
- b. LED configurations - date code and rated voltage (and slash number if applicable, and/or TAB number if specified).
- c. All pushbuttons shall have the word TOP marked on the same side as the index post as an orientation aid when installing the pushbutton into the switch.
- d. High Brightness LED lighted pushbutton is identified by "H.B.".
- e. High Brightness LED lighted pushbuttons with dimming features are marked as H.B.D.

Permanency of marking: Pushbutton Switches are marked in accordance to MIL-STD-22885 and MIL-STD-202, method 215.

4.9.2 User Instructions and Quality

Each over pack containing switches or indicators shall contain a copy of Panel Mounting Instructions (Staco Systems document 88101, sheet 4 only). Each over pack containing Pushbutton Types 8, 9 or 0 (pushbuttons with user replaceable legends) shall contain a copy of the text and figures from the Legend Replacement Procedure, Staco Systems document 88105.

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.

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.

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		NONE		SHEET 60 OF 76

Inspection of product for delivery shall consist of Group A inspections per MIL-PRF-22885 and the applicable slash sheet.

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 ORDER INFORMATION.

This section contains the information necessary to order the standard Series 100 pushbutton switch configurations and its features described in this specification.

PART NUMBER MODEL

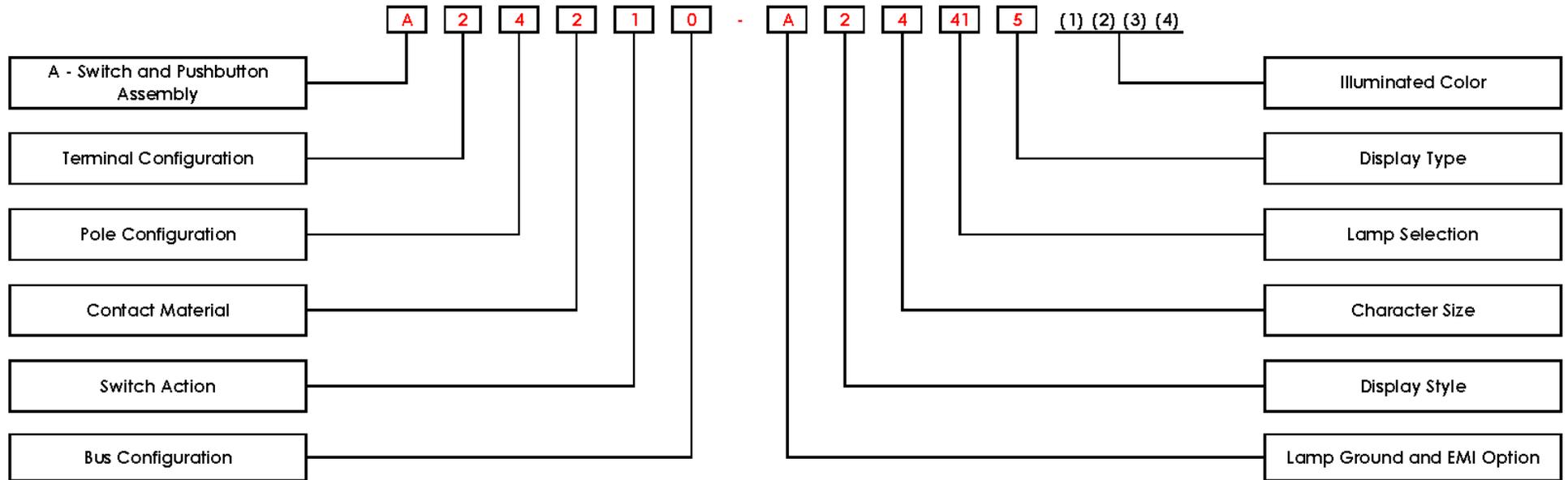


Figure 49: Part Number Model

WATERTIGHT OR SOLVENT RESISTANT SEAL: When ordering a model A 'coded' or model C 'coded' with watertight or solvent resistant seal, it's required to the add /005 (for watertight seal), or /006 (for solvent resistant), at the end of the final assembly part number.

Example: A24210-A244152255/005 (for model A 'coded') or C24210/005 (for Model C 'coded')

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Table L: Switches/Indicator Configuration Table

'CODED' MODEL	TERMINAL CONFIGURATON	POLE CONFIGURATION	CONTACT MATERIAL	SWITCH ACTION	BUS CONFIGURATION
X	X	X	X	X	X
A 1/	1 – CRIMP	0 – INDICATOR	0 - INDICATOR	0 – INDICATOR	0 – STANDARD
C 2/.	2 – SOLDER	1 – SINGLE POLE	1 - GOLD	1 – MOMENTARY	1 – SINGLE BUS
	3 – PCB	2 – DOUBLE POLE	2 - SILVER	2 - ALTERNATE	2 – HORIZONTAL BUS
		4 – FOUR POLE			3 – VERTICAL BUS
					4 – BOTTOM BUS
					5 – TOP BUS

NOTES:

- 1/. A – Switch and pushbutton Assembly.
- 2/. C – Switch//Indicator (without pushbutton)

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Table XXIV: Incandescent Pushbutton Configuration Table

LAMP GROUND AND EMI OPTION	DISPLAY STYLE	CHARACTER DEFINITION	LAMP SELECTION & SEAL	DISPLAY TYPE						COLOR		
X	X	X	XX	X						XXXX		
1 - Single Common, Non- EMI	1 - Full	0 - NONE	00 - Fiberboard, seal	CODE	FILTER	NON-ILLUMINATED		ILUMINATED		CODE	STD	NVIS
						LEGEND	BACKGROUND	LEGEND	BACKGROUND			
2 - Vert split, Non- EMI	2- 2-Way horiz split	1 - 0.072 inch	01 - 3071 (5VDC), seal	1	STD	Black	Translucent color	Black	Color	0	White	---
3 - Horiz split, Non- EMI	3 - 2-Way vert split	2 - 0.087 inch	02 - 718 (5VDC), seal			Hidden black	Black	Black	Visible in color			
4 - Single common, EMI/RFI	4 - 3-Way horiz top	3 - 0.100 inch	04 - 3335 (28VDC), seal	2	STD	Hidden	Black	Visible in color	Black	2	Green	Green B
5 - Vert split, EMI/RFI	5 - 4-Way	4 - 0.125 inch	05 - 3042 (6VDC), seal	3	STD	Translucent white	Black	Visible in color	Black	3	Aviation yellow	Yellow B
6 - Horiz split, EMI/RFI	6 - 3-Way vert left	5 - 0.145 inch	06 - 1099 (12VDC), seal	4	STD	Black	Translucent white	Black	Color	4	Lunar white	---
	7 - 3-Way horiz bottom		07 - 3229 (14VDC), seal			Hidden	Black	Visible in color	Black			
	8 - 3-Way vert right		08 - 6839 (28VDC), seal	6	STD	Hidden	Black	Visible in color	Black	5	Lemon yellow	Yellow A
			09 - Dummy plug, seal	7	NVIS	Hidden	Black	Visible in color	Black	6	Blue	Green A
			10 - Fiberboard, seal	8	STD	Hidden black	Black	Black	Visible in color	7	Aviation green	
			11 - 3071 (5VDC), seal	9	STD	Black	Translucent white	Black	Color			
			12 - 718 (5VDC), seal	0	STD	Hidden	Black	Visible in color	Black			
			14 - 3335 (28VDC), seal									
			15 - 3042 (6VDC), seal									
			16 - 1099 (12VDC), seal									
			17 - 3229 (14VDC), seal									
			18 - 6839 (28VDC), seal									
			19 - Dummy plug, seal									

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Table XXV: High Brightness LED Pushbutton Configuration Table

LAMP GROUND AND EMI OPTION	DISPLAY STYLE	CHARACTER DEFINITION	LAMP SELECTION & SEAL	DISPLAY TYPE						COLOR		
X	X	X	XX	X						XXXX		
A - HB LED, common ground, EMI/RFI, Sourcing	1 - Full	0 - NONE	31 - Sourcing, seal, full or 2-way, 5 VDC	CODE	FILTER	NON-ILLUMINATED		ILLUMINATED		CODE	STD	NVIS
B - HB LED, common ground, EMI/RFI, Sinking	2 - 2-Way horiz split	1 - 0.072 inch	32 - Sourcing, seal, full or 2-way, 28 VDC			LEGEND	BACKGROUND	LEGEND	BACKGROUND			
C - HB LED, split ground, EMI/RFI, Sourcing	3 - 2-Way vert split	2 - 0.087 inch	33 - Sourcing, seal, 3-way, 5 VDC	1	STD	Black	Translucent color	Black	Color	0	White	Blue
D - HB LED, split ground, EMI/RFI, Sinking	4 - 3-Way horiz top	3 - 0.100 inch	34 - Sourcing, seal, 3-way, 28 VDC	2	---	---	---	---	---	1	Red	Red
E - HB LED/voltage dimming, common ground, EMI/RFI, Sourcing	5 - 4-Way	4 - 0.125 inch	35 - Sourcing, seal, 4-way, 5 VDC	3	---	---	---	---	---	2	Green	Green B
F - HB LED/voltage dimming, common ground, EMI/RFI, Sinking	6 - 3-Way vert left	5 - 0.145 inch	36 - Sourcing, seal, 4-way, 28 VDC	4	STD	Translucent white	Black	Visible in color	Black	3	Aviation Yellow	Yellow B
G - HB LED/voltage dimming, split ground, EMI/RFI, Sourcing	7 - 3-Way horiz bottom		41 - Sourcing, seal, full or 2-way, 5 VDC	5	STD	Black	Translucent white	Black	Color	4	---	White
H - HB LED/voltage dimming, split ground, EMI/RFI, Sinking	8 - 3-Way vert right		42 - Sourcing, seal, full or 2-way, 28 VDC	6	STD	Hidden	Black	Visible in color	Black	5	Lemon Yellow	Yellow A
			43 - Sourcing, seal, 3-way, 5 VDC	7	NVIS	Hidden	Black	Visible in color	Black	6	Blue	Green A
			44 - Sourcing, seal, 3-way, 28 VDC	8	---	---	---	---	---	7	---	---
			45 - Sourcing, seal, 4-way, 5 VDC	9	---	---	---	---	---	8	---	---
			46 - Sourcing, seal, 4-way, 28 VDC	0	STD	Hidden	Black	Visible in color	Black			
			51 - Sinking, seal, full or 2-way, 5 VDC									
			52 - Sinking, seal, full or 2-way, 28 VDC									
			53 - Sinking, seal, 3-way, 5 VDC									
			54 - Sinking, seal, 3-way, 28 VDC									
			55 - Sinking, seal, 4-way, 5 VDC									
			56 - Sinking, seal, 4-way, 28 VDC									
			61 - Sinking, seal, full or 2-way, 5 VDC									
			62 - Sinking, seal, full or 2-way, 28 VDC									
			63 - Sinking, seal, 3-way, 5 VDC									
			64 - Sinking, seal, 3-way, 28 VDC									
			65 - Sinking, seal, 4-way, 5 VDC									
			66 - Sinking, seal, 4-way, 28 VDC									

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5.1 Accessories and Part Number

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.

5.1.1 Panel Seals (15097)

Series 100 switch/indicators may be ordered as sealed units with the panel seal installed on the switch/indicator housing. (Refer to [Figure 5: S100 exploded view \(solder termination version shown\)](#), [Figure 6: S100 exploded view \(PCB termination version shown\)](#) or [Figure 7: S100 exploded view \(Crimp termination version shown\)](#)) The panel seal also may be ordered separately, packaged as 10 in a plastic envelope, for replacement parts or for field upgrade of the switch/indicator. To order panel seals specify Part Number 15097.

NOTE: In order to attain drip-proof sealing for the unit, a pushbutton seal is required in addition to the panel seal. This must be factory installed and a fine coating of a special lubricant applied to the throat of the switch housing.

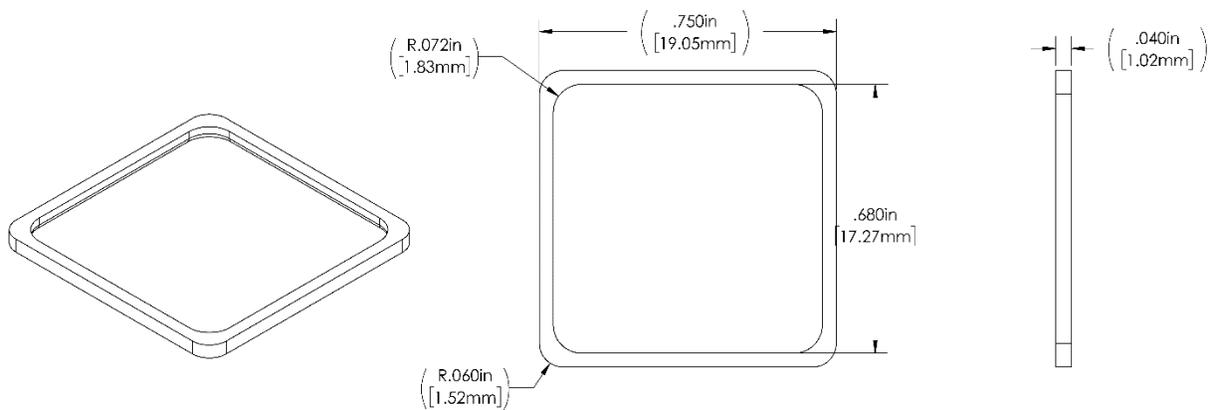


Figure 51: Panel Seal

5.1.2 Solvent Resistant Seals (/006)

Applicable installations requiring resistance to most petroleum-based fuels, solvents, oils and greases (as well as being splash-proof and watertight) the /006 version of the basic Watertight seal may be specified. The same restrictions apply, and the same numbering system is used, except the /005 is replaced with a /006. Available in Display Types 1 through 7. Type 6 is dead-front, but SLR contrast ratios do not apply.

5.1.3 Pushbutton Guard, General Purpose (15089)

Transparent cover must be lifted to allow actuation of the switch. It prevents any accidental operation of the switch. Spring loaded pushbutton guard cover remains closed until manually lifted; returns to closed position when released. Guard simply slips over the switch housing assembly at time of installation. (Refer to [Figure 32: Switch guards \(P/N 15089 & 156103\) type II, V](#) for dimensions.) Minimum center to center spacing is .871" (22.1 mm). To order, specify Part Number 15089.

Other variations include 15089-1 which has a red translucent cover, and the 15250-TAB which may be secured with a safety wire through .060" holes at bottom of corner guard.

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15089

15089-1

15089-2

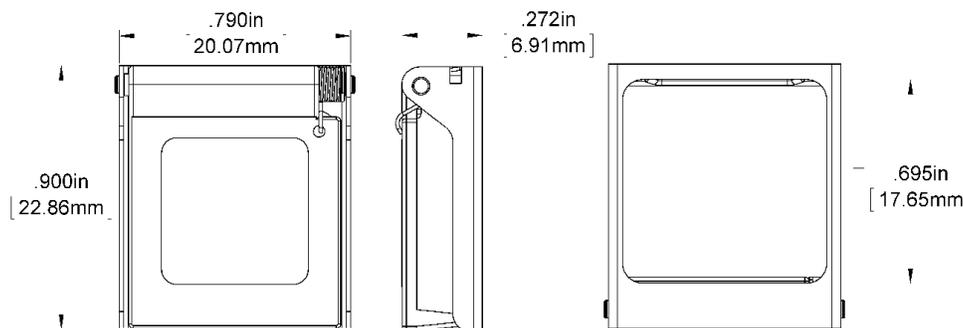


Figure 52: Standard Pushbutton Guard for Drip-proof Sealed Assemblies

5.1.4 Pushbutton Guard, Watertight Seal (15204/TAB)

This pushbutton guard is used with watertight/splash-proof seal applications. Transparent cover is lifted to allow access to pushbutton for switch actuation; will stay in open position until manually returned to its closed position. (Refer to [Figure 53: Pushbutton Guard for Watertight Sealed Assembly](#) for dimensions.) Center to center spacing for adjacent covers is 1.40" (35.6 mm).

To order specify Part Number 15204/005 for use with basic Watertight Seals. Applications requiring Solvent Resistant Seals should order Part Number 15204/006.

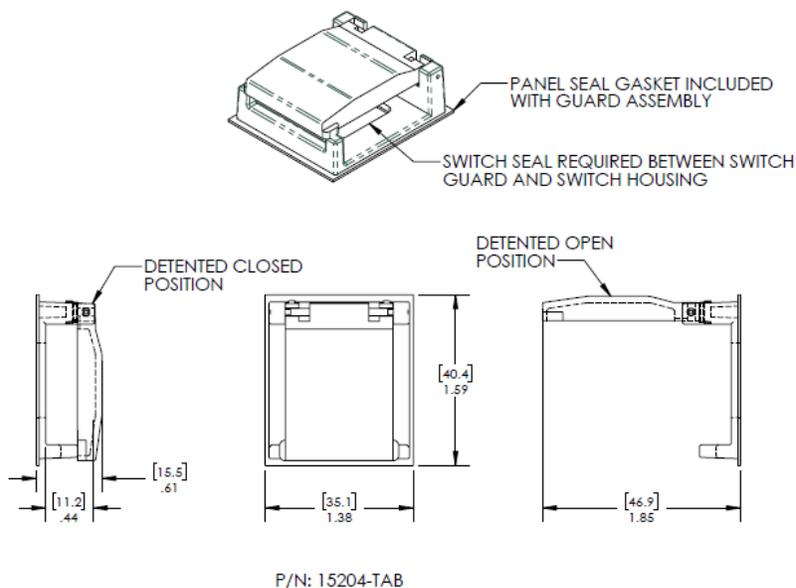


Figure 53: Pushbutton Guard for Watertight Sealed Assembly

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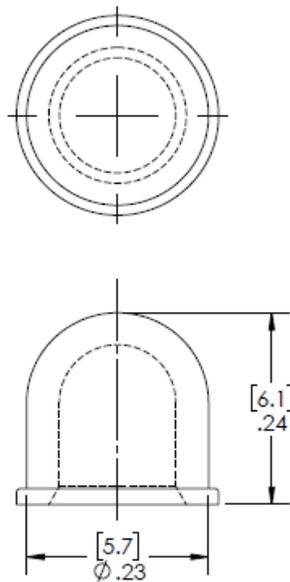
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5.1.5 Color Filter Caps (15194-TAB)

The following is intended for use in Series 100 Pushbuttons with incandescent T-1 Flange Based Lamps. These color filter caps allow changing of pushbutton cell area colors without the use of tools. It applies to legend types 2, 3, 4, 5, 8 and 9. (Refer to [Figure 54: Color Filter Caps](#) for size and shape.) These color filter caps are available in kits containing 25 pieces of a given color. To order, use part number code as follows:

Table XXVI: Color Filter Caps

PART NUMBER	COLOR
15194-0	Clear (Transparent) White
15194-1	Red
15194-2	Green
15194-3	Aviation Yellow
15194-4	Lunar White
15194-5	Lemon Yellow
15194-6	Blue
15194-7	Aviation Green



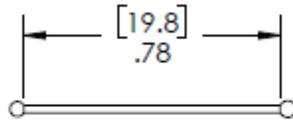
P/N: 15194-TAB

Figure 54: Color Filter Caps

5.1.6 Pushbutton Retainer Tie (15093)

When a Series 100 switch and pushbutton assemblies are ordered as "retained" configurations, these parts are included in the assembly. (Refer to Figures 2 and 3. As a separate part, it is shown in [Figure 55: Pushbutton Retainer Tie](#).) Their purpose is to secure the pushbutton to the switch during re-lamping to avoid possible mix-ups. Replacement of retainer ties for incandescent-based pushbuttons may be accomplished in the field. However, field replacement of retainer ties in LED-based pushbuttons is not recommended. Additional parts may be ordered by specifying Part Number 15093.

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P/N: 15093

Figure 55: Pushbutton Retainer Tie

5.1.7 Dummy Lamp (15091)

The dummy lamp is designed as a substitute for the T-1 flange based incandescent lamp. When less than four lamps are used, the dummy lamp is required to prevent a short circuit condition and to maintain a uniform actuation force. (Refer to [Figure 56: Dummy Lamp](#)) To order, specify Part Number 15091.

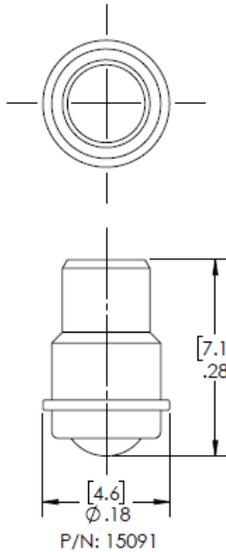


Figure 56: Dummy Lamp

5.1.8 Pushbutton Extraction Tool (15193)

Facilitates the removal of display pushbuttons, particularly when installed in multi-station matrix assemblies. (Refer to [Figure 57: Pushbutton Extraction Tool](#)) To order, specify Part Number 15193.

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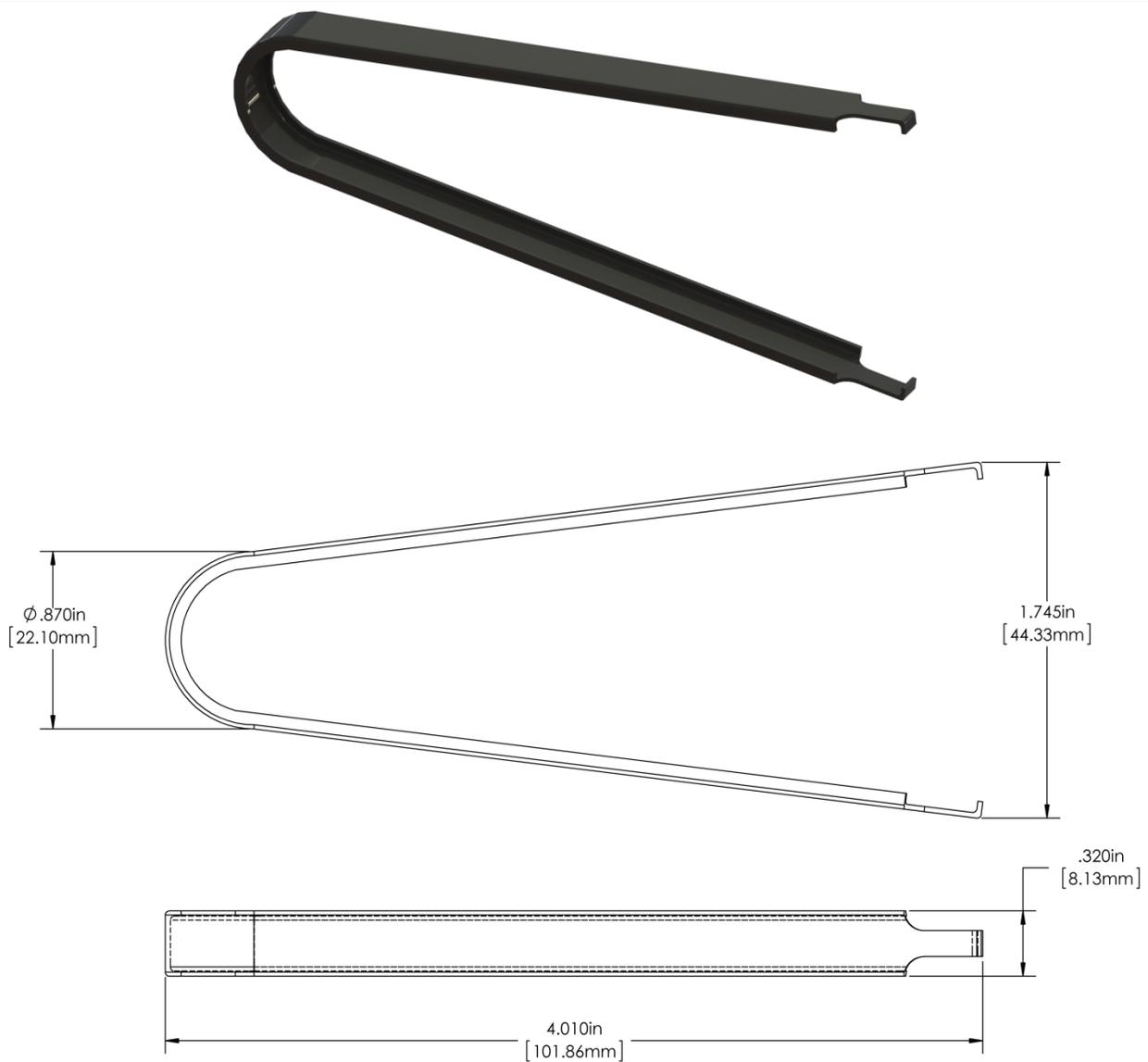


Figure 57: Pushbutton Extraction Tool

5.1.9 Crimp Pin Wire Termination Receptacles – Individual Mount (15197 and 15273)

The Series 100 Switch/Indicator with Display Pushbutton are supplied with crimp pin wire termination receptacles installed. (Refer to [Figure 21: Crimp termination](#)). Additional receptacles may be ordered separately as replacement parts or for use with Model 98 coded /010 switches without receptacles included.

5.1.10 Socket Contact Wire Termination Crimp Pin (15276)

Addition crimp pin wire termination can be ordered separately as replacement parts for use with crimp pin termination (Refer to [Figure 22: Crimp pin](#)). Crimp pins are ordered separately, in the quantity desired.

5.1.11 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 22: Crimp pin](#). The following [Table LVIII: Crimp Pin and Positioner P/N's](#) shows Staco Systems part number and the corresponding military standard part number.

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Table LVIII: 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. (Refer [Figure 59: Crimping Pin Tools and Positioner](#)) Each part number must be ordered separately.

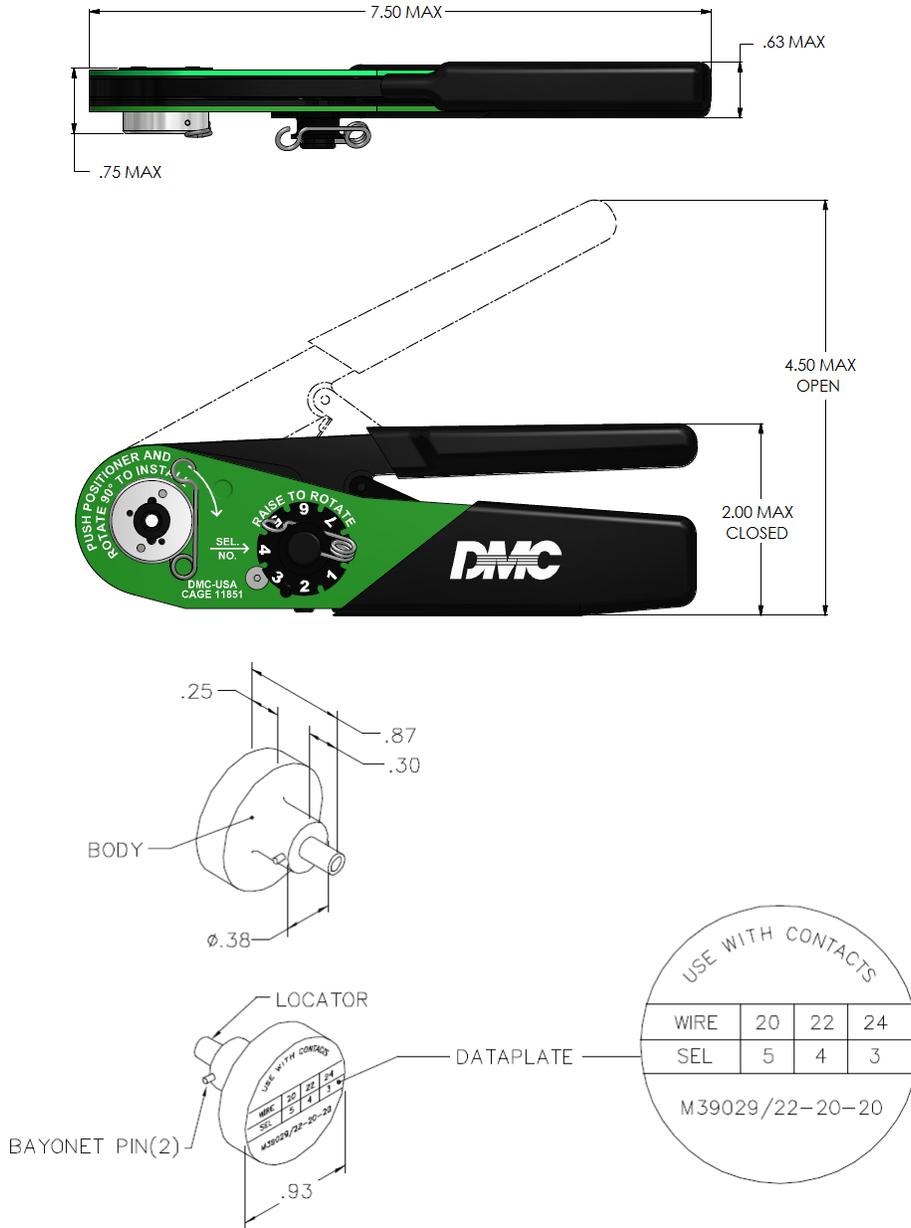


Figure 59: Crimping Pin Tools and Positioner

5.1.12 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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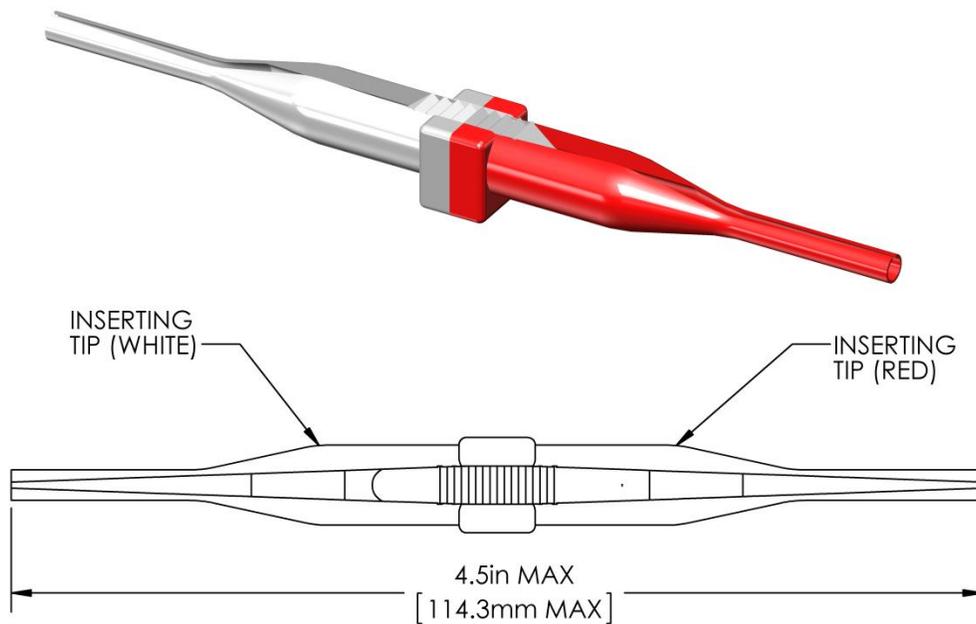


Figure 56: Wire Connector Insertion and Removal Tool

5.1.13 Insulator Plug (15177)

Unused terminal openings in termination receptacles of Models 98 and 99 individual mount switches or Model 95 and 97 Matrix Housing can be closed off by inserting standard MS27488- A20 plastic insulator plugs. (Refer [Figure 60: Insulator Plug](#)) The insulator plugs can be used with MIL-C-39029/16-168 and MIL-C-39029/22-192 receptacles. To order, specify Part Number 15177.

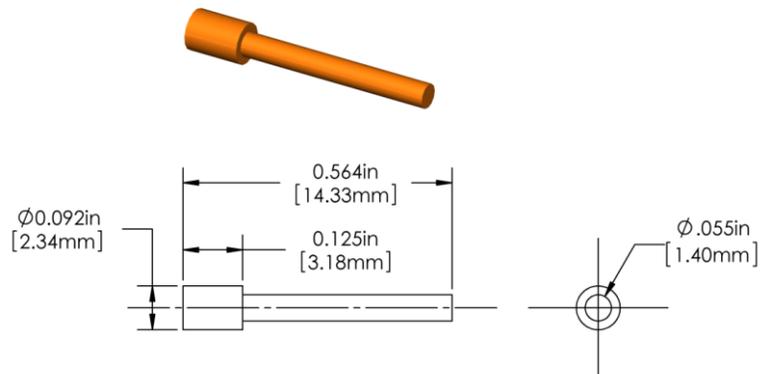


Figure 60: Insulator Plug

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5.1.14 Dress Bezel Mounting Cleat Assembly (15098)

The mounting cleat assemblies, required for installing Models 96 or 97 Series 90 Matrix Housings, are supplied as standard parts with the front mounting dress bezel housing. The quantity will depend on the size of the housing. (Refer to the Matrix Frame Assembly SCD, Series 94 through 97 Coded.) Additional cleat assemblies may be ordered, if desired, for applications of severe vibration or shock. They are packaged 5 to a plastic envelope. To order, specify Part Number 15098.

5.1.15 Light Source Assemblies (15290-TAB thru 15331-TAB)

The following is intended for use in Series 100 Pushbuttons with High Brightness LED. These light source assemblies allow the user to replace the pushbutton light source assemblies without the use of tools. Refer to the following figure for size and shape.

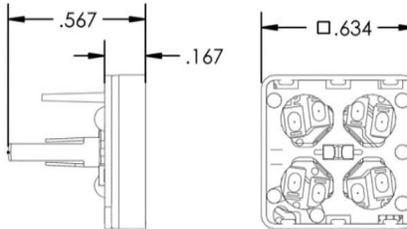


Figure 61: Light Source Assemblies

To order, use the following part number

Table XXVII: 5 Volt Light Source Assembly Part Numbers

Display Style		Part Number			
		Common Circuit		Split Circuit	
Code	Description	Sourcing	Sinking	Sourcing	Sinking
1	Full Screen				
2	Horizontal Split Screen	15306-001	15307-001	15306-002	15307-002
3	Vertical Split Screen	15308-001	15309-001	15308-002	15309-002
4	3 Way Split Screen (Horizontal Top Half)	15310-001	15311-001	15310-002	15311-002
5	4 Way Split Screen	15304-001	15305-001	15304-002	15305-002
6	3 Way Split Screen (Vertical Left Half)	15314-001	15315-001	15314-002	15315-002
7	3 Way Split Screen (Horizontal Bottom Half)	15312-001	15313-001	15312-002	15313-002
8	3 Way Split Screen (Vertical Right Half)	15316-001	15317-001	15316-002	15317-002

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Table XXVIII: 28 Volt Light Source Assembly Part Numbers

Display Style		Part Number			
		Common Circuit		Split Circuit	
Code	Description	Sourcing	Sinking	Sourcing	Sinking
1	Full Screen				
2	Horizontal Split Screen	15292-001	15293-001	15292-002	15293-002
3	Vertical Split Screen	15294-001	15295-001	15294-002	15295-002
4	3 Way Split Screen (Horizontal Top Half)	15296-001	15297-001	15296-002	15297-002
5	4 Way Split Screen	15290-001	15291-001	15290-002	15291-002
6	3 Way Split Screen (Vertical Left Half)	15300-001	15301-001	15300-002	15301-002
7	3 Way Split Screen (Horizontal Bottom Half)	15298-001	15299-001	15298-002	15299-002
8	3 Way Split Screen (Vertical Right Half)	15302-001	15303-001	15302-002	15303-002

Table XXIX: 28 Volt with Voltage Dimming Light Source Assembly Part Numbers

Display Style		Part Number			
		Common Circuit		Split Circuit	
Code	Description	Sourcing	Sinking	Sourcing	Sinking
1	Full Screen				
2	Horizontal Split Screen	15320-001	15321-001	15320-002	15321-002
3	Vertical Split Screen	15322-001	15323-001	15322-002	15323-002
4	3 Way Split Screen (Horizontal Top Half)	15324-001	15325-001	15324-002	15325-002
5	4 Way Split Screen	15318-001	15319-001	15318-002	15319-002
6	3 Way Split Screen (Vertical Left Half)	15328-001	15329-001	15328-002	15329-002
7	3 Way Split Screen (Horizontal Bottom Half)	15326-001	15327-001	15326-002	15327-002
8	3 Way Split Screen (Vertical Right Half)	15330-001	15331-001	15330-002	15331-002

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6.0 TECHNICAL BULLETINS.

Technical Bulletin Number	Description
TB-206	Pushbutton switch assembly - mounting procedure
TB-207	Receptacle assembly installation procedure
TB-208	Crimp pin contact terminated wiring system installation procedure
TB-209	Wire crimping procedure
TB-210	Crimp contact installation & removal procedures
TB-211	Cleaning instructions
TB 167	Pushbutton and Incandescent lamp removal procedure.
TB 12 A 29A	Legend replacement procedure

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