

INCH-POUND

MIL-PRF-22885/108D  
11 December 2001  
SUPERSEDING  
MIL-PRF-22885/108C  
1 March 2001

PERFORMANCE SPECIFICATION SHEET

SWITCHES, PUSHBUTTON, ILLUMINATED, 4-LAMP REPLACEABLE INCANDESCENT OR NON-REPLACEABLE LIGHT EMITTING DIODE (LED), 0.750 SQUARE, SPDT, DPDT, 4PDT SILVER CONTACTS - 2 CIRCUIT (5 AMPERES) OR SPDT (7.5 AMPERES); GOLD CONTACTS - LOW LEVEL TO 1 AMPERE, SUNLIGHT READABLE DISPLAY (DRIPPROOF, WATERTIGHT, SPLASHPROOF, EMI/RFI SHIELDING, HIGH IMPACT SHOCK RESISTANT, COMMON TERMINATION SYSTEM, NIGHT VISION GOGGLE COMPATIBLE)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the push buttons described herein shall consist of this specification and MIL-PRF-22885.

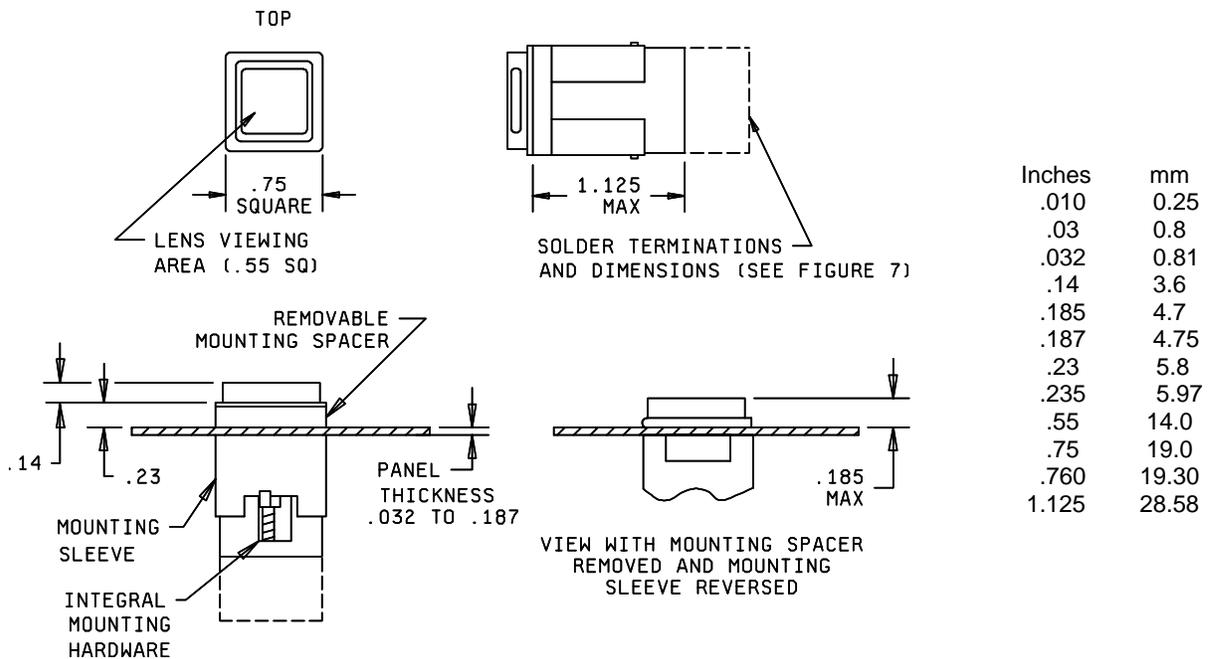
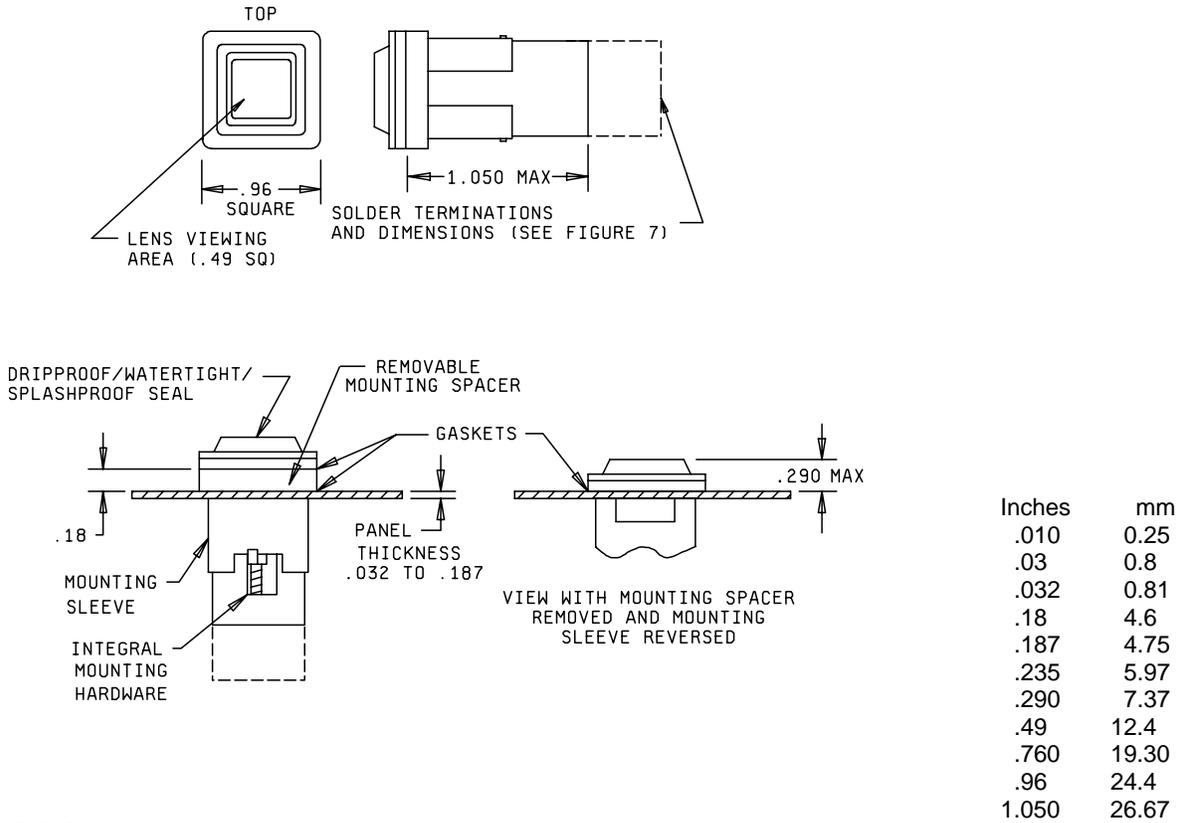


FIGURE 1. Switch - type I, 2 pole (enclosure design 1, unsealed with solder terminals).

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are  $\pm 0.010$  for three place decimals and  $\pm 0.03$  for two place decimals.
4. The mounting sleeve shall not exceed .760 square and shall be reversible so as to be usable with or without the mounting spacer. In either case, the switch shall accommodate mounting to panels from .032 to .187 thick.
5. A mounting spacer is supplied with each switch unit for SAE-AS7788 panel requirements and places the mounting flange flush with the top of a .235 thick edge lighted panel.
6. Spacer is to be used only for edge lighted panels, discard otherwise.
7. Pushbutton cap shall be designed to prevent incorrect insertion into switch housing.
8. Pushbutton cap shall be held captive to switch body by retaining element to prevent accidental interchange, but shall allow replacement of the lamps.
9. Exact shape of switch is optional, provided dimensions specified are not exceeded.
10. Terminals and basic switch identification shall be permanently marked as shown on figures 7 and 9.

FIGURE 1. Switch - type I, 2 pole (enclosure design 1, unsealed with solder terminals - Continued.



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are  $\pm 0.010$  for three place decimals and  $\pm 0.03$  for two place decimals.
4. The mounting sleeve shall not exceed .760 square and shall be reversible so as to be usable with or without the mounting spacer. In either case, the switch shall accommodate mounting to panels from .032 to .187 thick.
5. A mounting spacer is supplied with each switch unit for SAE-AS7788 panel requirements and places the mounting flange flush with the top of a .235 thick edgelighted panel.
6. Spacer is to be used only for edgelighted panels, discard otherwise.
7. Pushbutton cap shall be designed to prevent incorrect insertion into switch housing.
8. Pushbutton cap shall be held captive to switch body by retaining element to prevent accidental interchange, but shall allow replacement of the lamps.
9. Exact shape of switch is optional, provided dimensions specified are not exceeded.
10. Terminals and basic switch identification shall be permanently marked as shown on figures 7 and 9.

FIGURE 2. Switch - type II, 2 pole (enclosure design 2, 3, and 4; dripproof, watertight, and splashproof with solder terminals).

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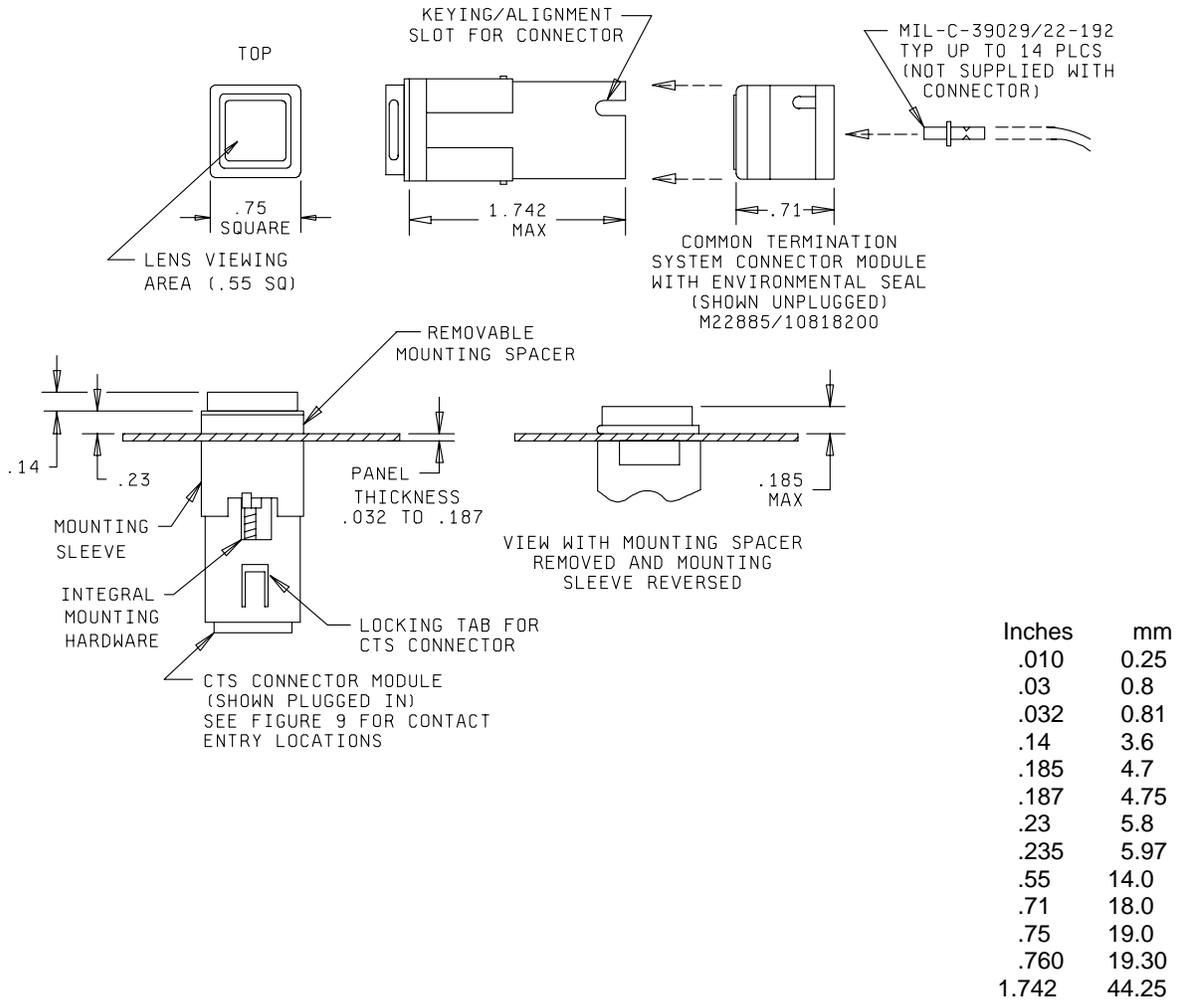


FIGURE 3. Switch - type III (enclosure design 1; unsealed with 2 pole common terminal system).

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are  $\pm 0.010$  for three place decimals and  $\pm 0.03$  for two place decimals.
4. The mounting sleeve shall not exceed .760 square and shall be reversible so as to be usable with or without the mounting spacer. In either case, the switch shall accommodate mounting to panels from .032 to .187 thick.
5. A mounting spacer is supplied with each switch unit for SAE-AS7788 panel requirements and places the mounting flange flush with the top of a .235 thick edgelifhted panel.
6. Spacer is to be used only for edgelifhted panels, discard otherwise.
7. Pushbutton cap shall be designed to prevent incorrect insertion into switch housing.
8. Pushbutton cap shall be held captive to switch body by retaining element to prevent accidental interchange, but shall allow replacement of the lamps.
9. The Common Termination System (CTS) connector shall be designed and constructed to meet the performance requirements of this document. These items, M22885/10818200 for 2 pole switches and M22885/108C8240 for 4 pole switches, shall be acquired from a source listed on QPL-22885.
10. The CTS connector shall be removable from the switch housing to allow the housing to be mounted separately. The connector may be wired during harnessing operations, allowing bench testing without the need of the switch housing.
11. The CTS connector shall be considered as a connector plug that may be separated from the switch housing for the convenience of installation.
12. The CTS connector shall be removable from the switch body by use of a M22885/108T8234 CTS module extraction tool (see figure 10). This item shall be acquired from a source listed on QPL-22885.
13. The CTS connector shall be capable of receiving MIL-C-39029/22-192 socket contacts crimped to a 20, 22, or 24 gauge wire.
14. The CTS connector shall be capable of having the socket contacts inserted or removed using an M81969/14-10 contact insertion/removal tool.
15. Exact shape of switch is optional provided dimensions specified are not exceeded.
16. Terminals and basic switch identification shall be permanently marked as shown on figures 7 and 9.

FIGURE 3. Switch - type III (enclosure design 1, unsealed with 2 pole common termination system) - Continued.

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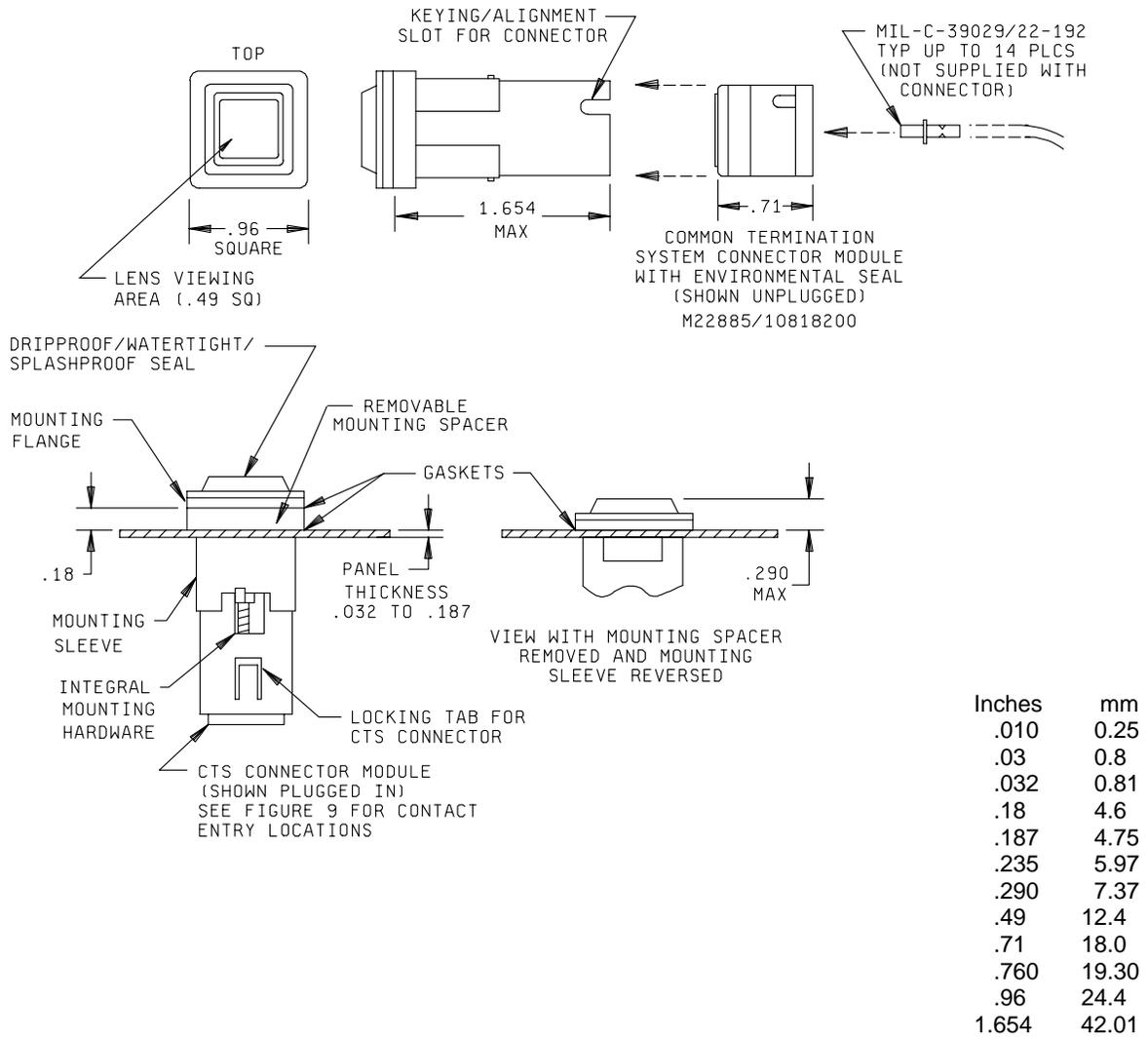


FIGURE 4. Switch - type IV (enclosure design 2, 3, and 4; dripproof, watertight, and splashproof with 2 pole common termination system).

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are  $\pm 0.010$  for three place decimals and  $\pm 0.03$  for two place decimals.
4. The mounting sleeve shall not exceed .760 square and shall be reversible so as to be usable with or without the mounting spacer. In either case, the switch shall accommodate mounting to panels from .032 to .187 thick.
5. A mounting spacer is supplied with each switch unit for SAE-AS7788 panel requirements and places the mounting flange flush with the top of a .235 thick edgelifghted panel.
6. Spacer is to be used only for edgelifghted panels, discard otherwise.
7. Pushbutton cap shall be designed to prevent incorrect insertion into switch housing.
8. Pushbutton cap shall be held captive to switch body by retaining element to prevent accidental interchange, but shall allow replacement of the lamps.
9. The Common Termination System (CTS) connector shall be designed and constructed to meet the performance requirements of this document. These items, M22885/10818200 for 2 pole switches and M22885/108C8240 for 4 pole switches, shall be acquired from a source listed on QPL-22885.
10. The CTS connector shall be removable from the switch housing to allow the housing to be mounted separately. The connector may be wired during harnessing operations, allowing bench testing without the need of the switch housing.
11. The CTS connector shall be considered as a connector plug that may be separated from the switch housing for the convenience of installation.
12. The CTS connector shall be removable from the switch body by use of a M22885/108T8234 CTS module extraction tool (see figure 10). This item shall be acquired from a source listed on QPL-22885.
13. The CTS connector shall be capable of receiving MIL-C-39029/22-192 socket contacts crimped to a 20, 22, or 24 gauge wire.
14. The CTS connector shall be capable of having the socket contacts inserted or removed using an M81969/14-10 contact insertion/removal tool.
15. Exact shape of switch is optional provided dimensions specified are not exceeded.
16. Terminals and basic switch identification shall be permanently marked as shown on figures 7 and 9.

FIGURE 4. Switch - type IV (enclosure design 2, 3, and 4; dripproof, watertight, and splashproof with 2 pole common termination system) - Continued.

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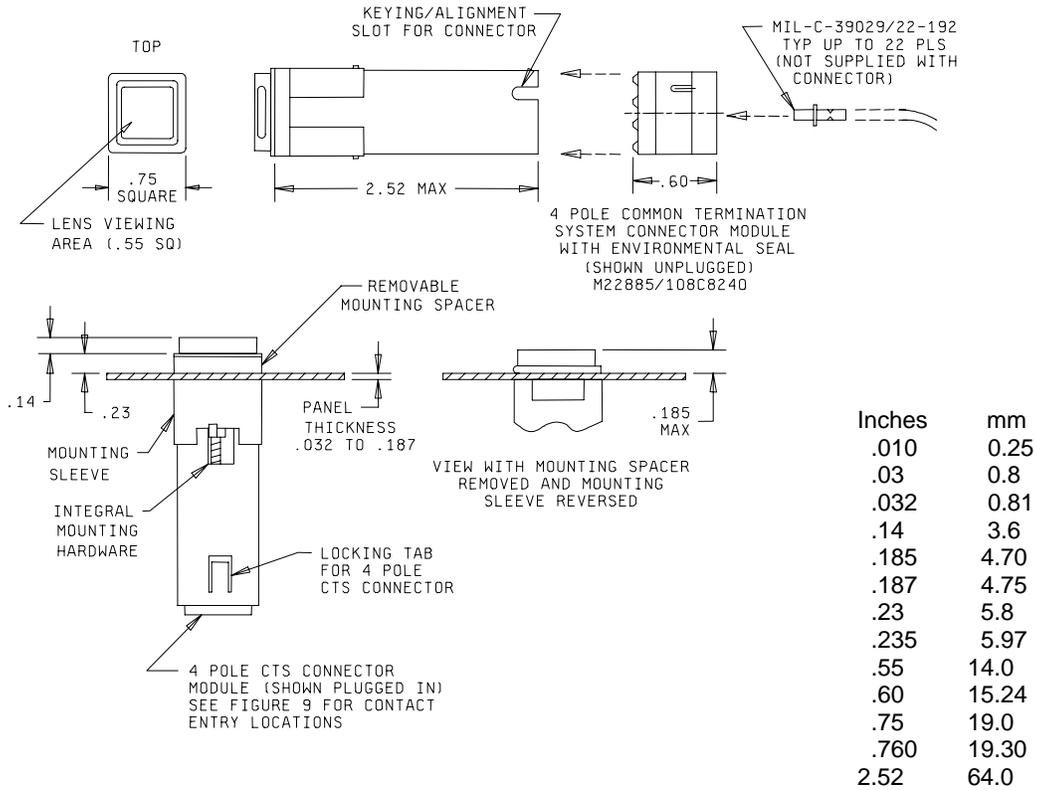


FIGURE 5. Switch - type V (enclosure design 1: unsealed with 4 pole common termination system).

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are  $\pm 0.010$  for three place decimals and  $\pm 0.03$  for two place decimals.
4. The mounting sleeve shall not exceed .760 square and shall be reversible so as to be usable with or without the mounting spacer. In either case, the switch shall accommodate mounting to panels from .032 to .187 thick.
5. A mounting spacer is supplied with each switch unit for SAE-AS7788 panel requirements and places the mounting flange flush with the top of a .235 thick edgelighted panel.
6. Spacer is to be used only for edgelighted panels, discard otherwise.
7. Pushbutton cap shall be designed to prevent incorrect insertion into switch housing.
8. Pushbutton cap shall be held captive to switch body by retaining element to prevent accidental interchange, but shall allow replacement of the lamps.
9. The Common Termination System (CTS) connector shall be designed and constructed to meet the performance requirements of this document. These items, M22885/10818200 for 2 pole switches and M22885/108C8240 for 4 pole switches, shall be acquired from a source listed on QPL-22885.
10. The CTS connector shall be removable from the switch housing to allow the housing to be mounted separately. The connector may be wired during harnessing operations, allowing bench testing without the need of the switch housing.
11. The CTS connector shall be considered as a connector plug that may be separated from the switch housing for the convenience of installation.
12. The CTS connector shall be removable from the switch body by use of a M22885/108T8234 CTS module extraction tool (see figure 10). This item shall be acquired from a source listed on QPL-22885.
13. The CTS connector shall be capable of receiving MIL-C-39029/22-192 socket contacts crimped to a 20, 22, or 24 gauge wire.
14. The CTS connector shall be capable of having the socket contacts inserted or removed using an M81969/14-10 contact insertion/removal tool.
15. Exact shape of switch is optional provided dimensions specified are not exceeded.
16. Terminals and basic switch identification shall be permanently marked as shown on figures 7 and 9.

FIGURE 5. Switch - type V (enclosure design 1: unsealed with 4 pole common termination system) - Continued.

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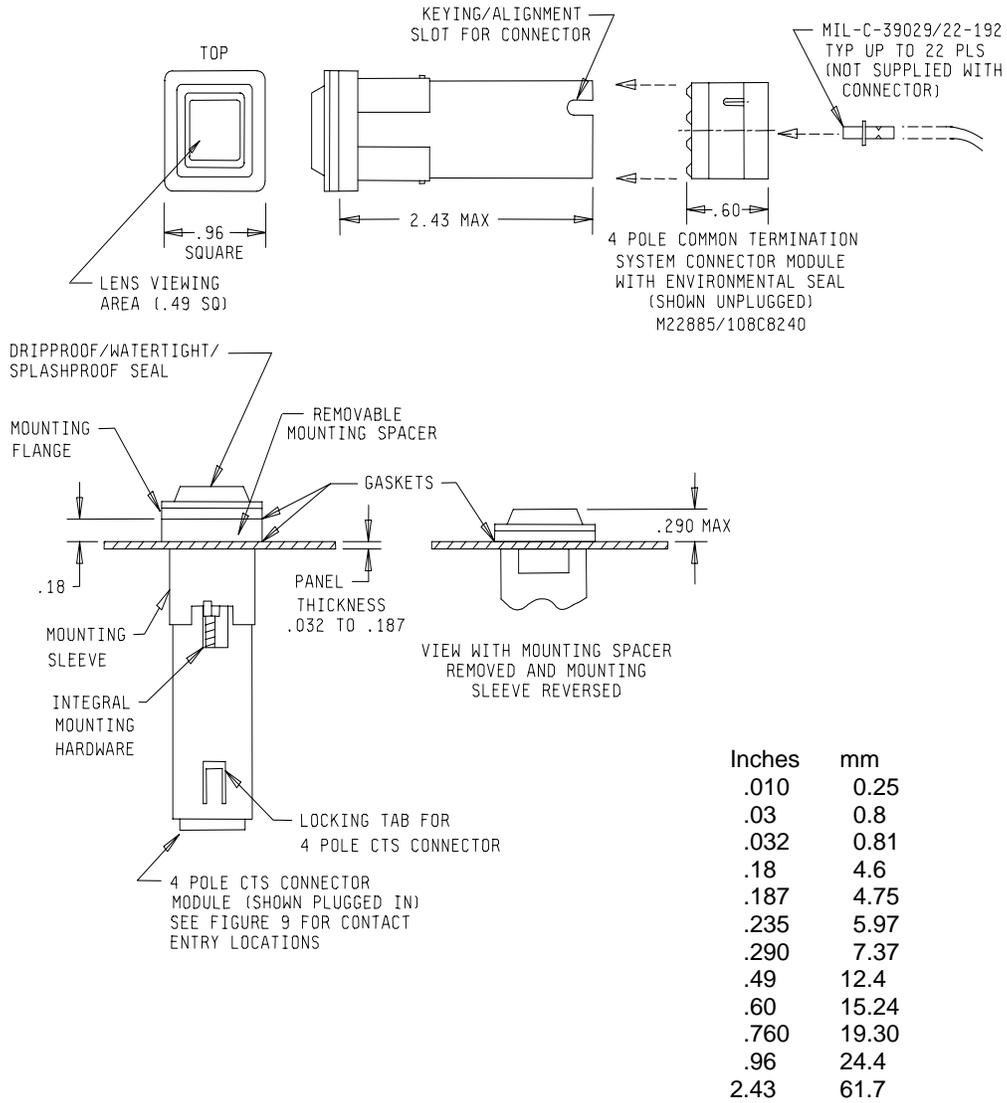


FIGURE 6. Switch- type VI (enclosure design 2, 3, and 4: dripproof, watertight, and splashproof with 4 pole common termination system).

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are  $\pm 0.010$  for three place decimals and  $\pm 0.03$  for two place decimals.
4. The mounting sleeve shall not exceed .760 square and shall be reversible so as to be usable with or without the mounting spacer. In either case, the switch shall accommodate mounting to panels from .032 to .187 thick.
5. A mounting spacer is supplied with each switch unit for SAE-AS7788 panel requirements and places the mounting flange flush with the top of a .235 thick edgelifghted panel.
6. Spacer is to be used only for edgelifghted panels, discard otherwise.
7. Pushbutton cap shall be designed to prevent incorrect insertion into switch housing.
8. Pushbutton cap shall be held captive to switch body by retaining element to prevent accidental interchange, but shall allow replacement of the lamps.
9. The Common Termination System (CTS) connector shall be designed and constructed to meet the performance requirements of this document. These items, M22885/10818200 for 2 pole switches and M22885/108C8240 for 4 pole switches, shall be acquired from a source listed on QPL-22885.
10. The CTS connector shall be removable from the switch housing to allow the housing to be mounted separately. The connector may be wired during harnessing operations, allowing bench testing without the need of the switch housing.
11. The CTS connector shall be considered as a connector plug that may be separated from the switch housing for the convenience of installation.
12. The CTS connector shall be removable from the switch body by use of a M22885/108T8234 CTS module extraction tool (see figure 10). This item shall be acquired from a source listed on QPL-22885.
13. The CTS connector shall be capable of receiving MIL-C-39029/22-192 socket contacts crimped to a 20, 22, or 24 gauge wire.
14. The CTS connector shall be capable of having the socket contacts inserted or removed using an M81969/14-10 contact insertion/removal tool.
15. Exact shape of switch is optional provided dimensions specified are not exceeded.
16. Terminals and basic switch identification shall be permanently marked as shown on figures 7 and 9.

FIGURE 6. Switch - type VI (enclosure design 2, 3, and 4; dripproof, watertight, and splashproof with 4 pole common termination system) - Continued.

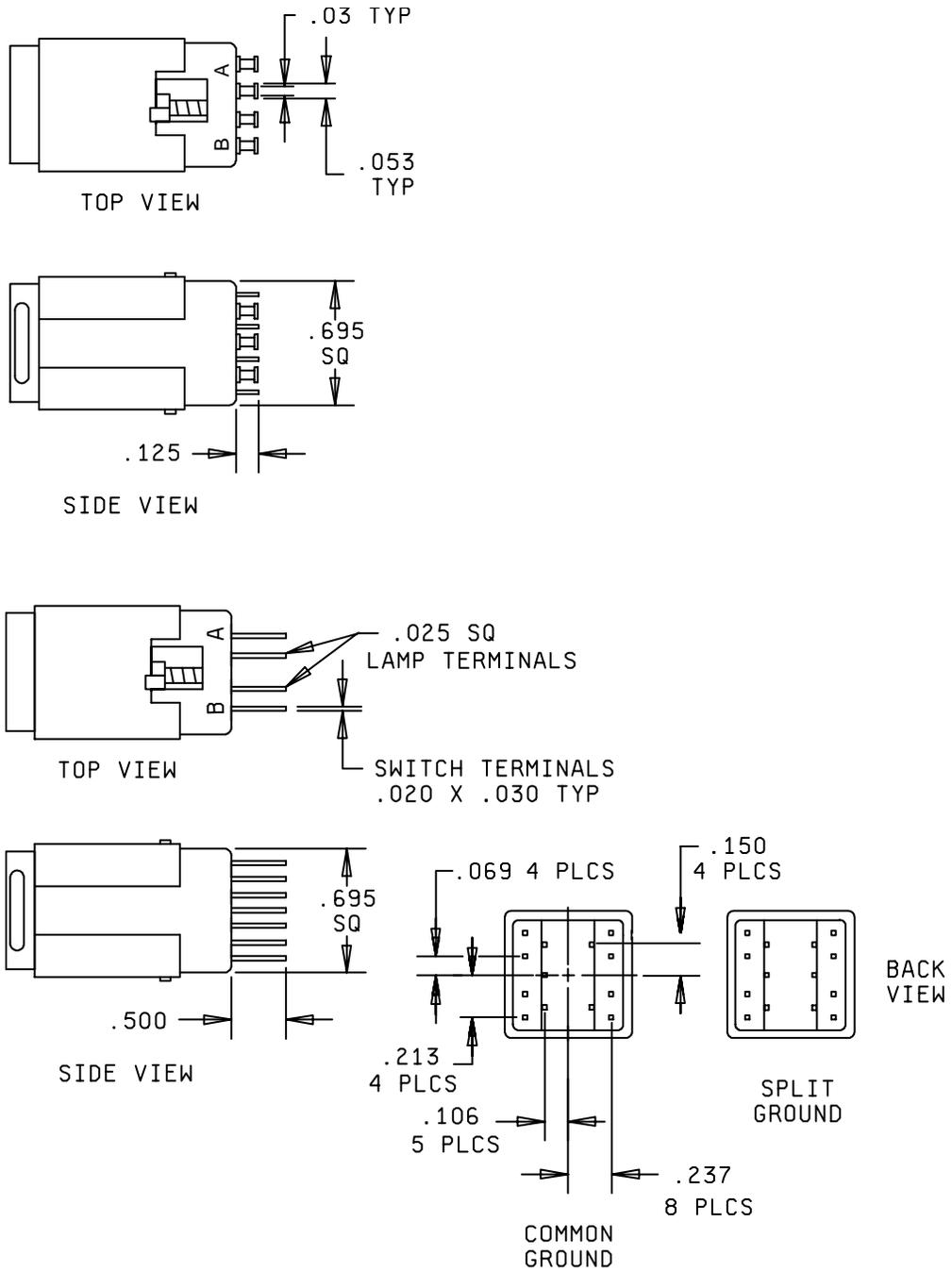
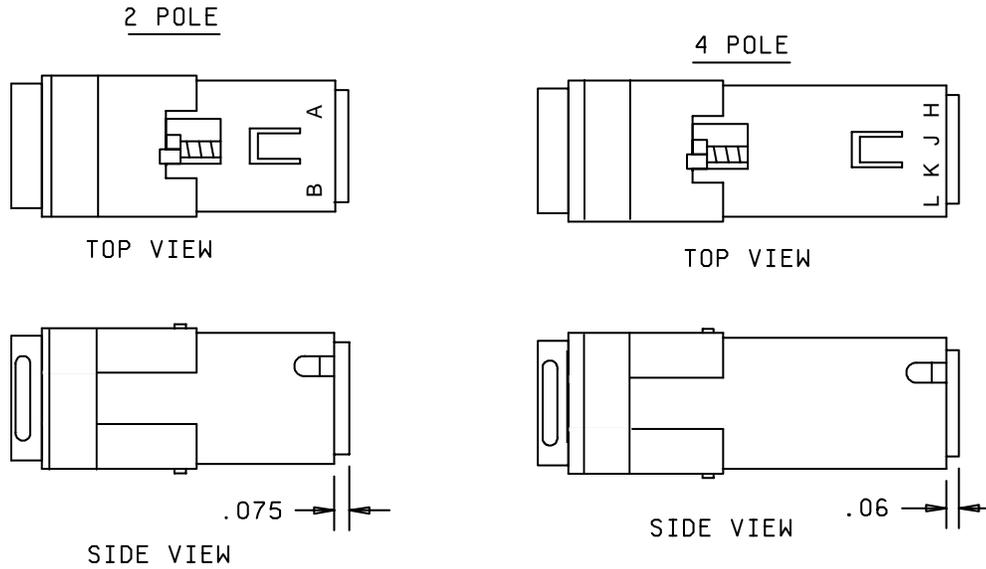


FIGURE 7. Switch and lamp terminations - dimensions and center location.

COMMON TERMINATION SYSTEM



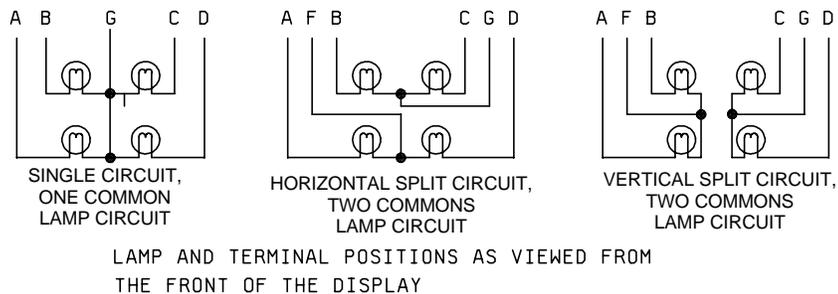
Inches	mm	Inches	mm
.020	0.51	.106	2.69
.025	0.64	.125	3.18
.03	0.8	.150	3.81
.053	1.35	.213	5.41
.06	1.5	.237	6.02
.069	1.75	.500	12.70
.073	1.85	.695	17.65

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are  $\pm 0.010$  (0.25 mm) for three place decimals and  $\pm 0.03$  for two place decimals.

FIGURE 7. Switch and lamp terminations - dimensions and center location - Continued.

INCANDESCENT LAMP CIRCUIT SCHEMATIC



SWITCH CIRCUIT SCHEMATIC

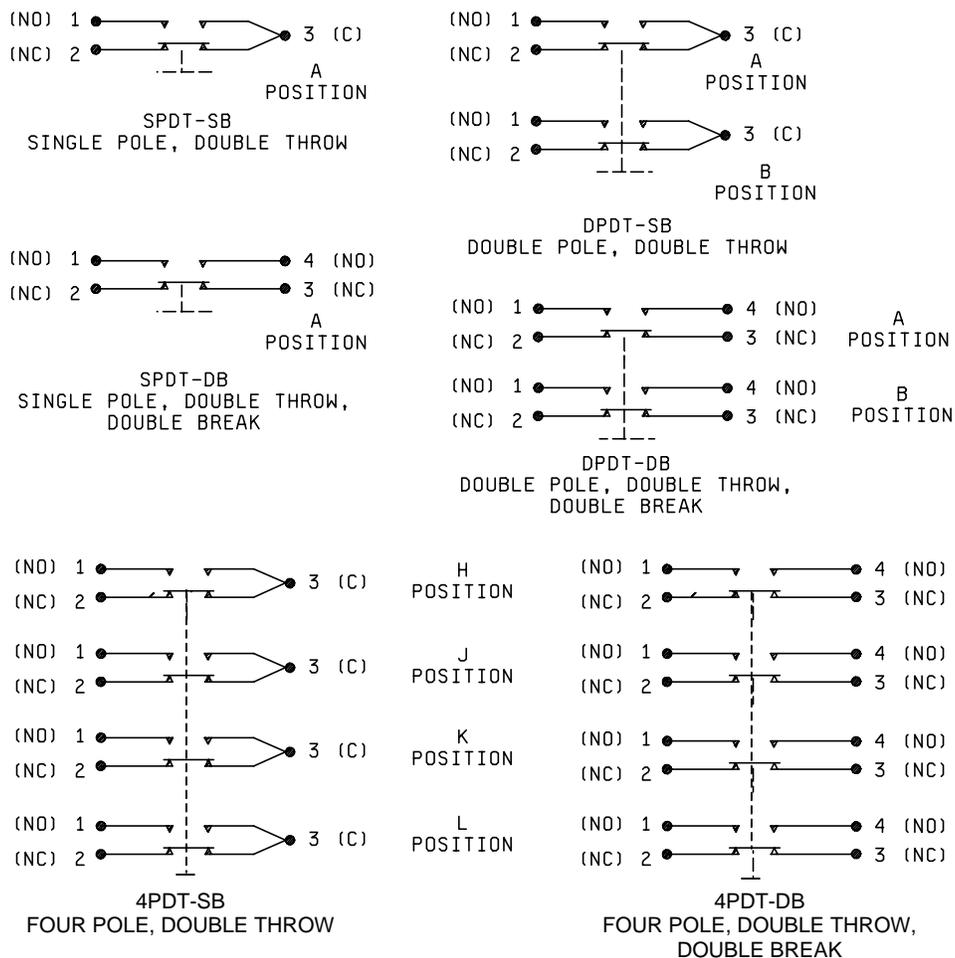
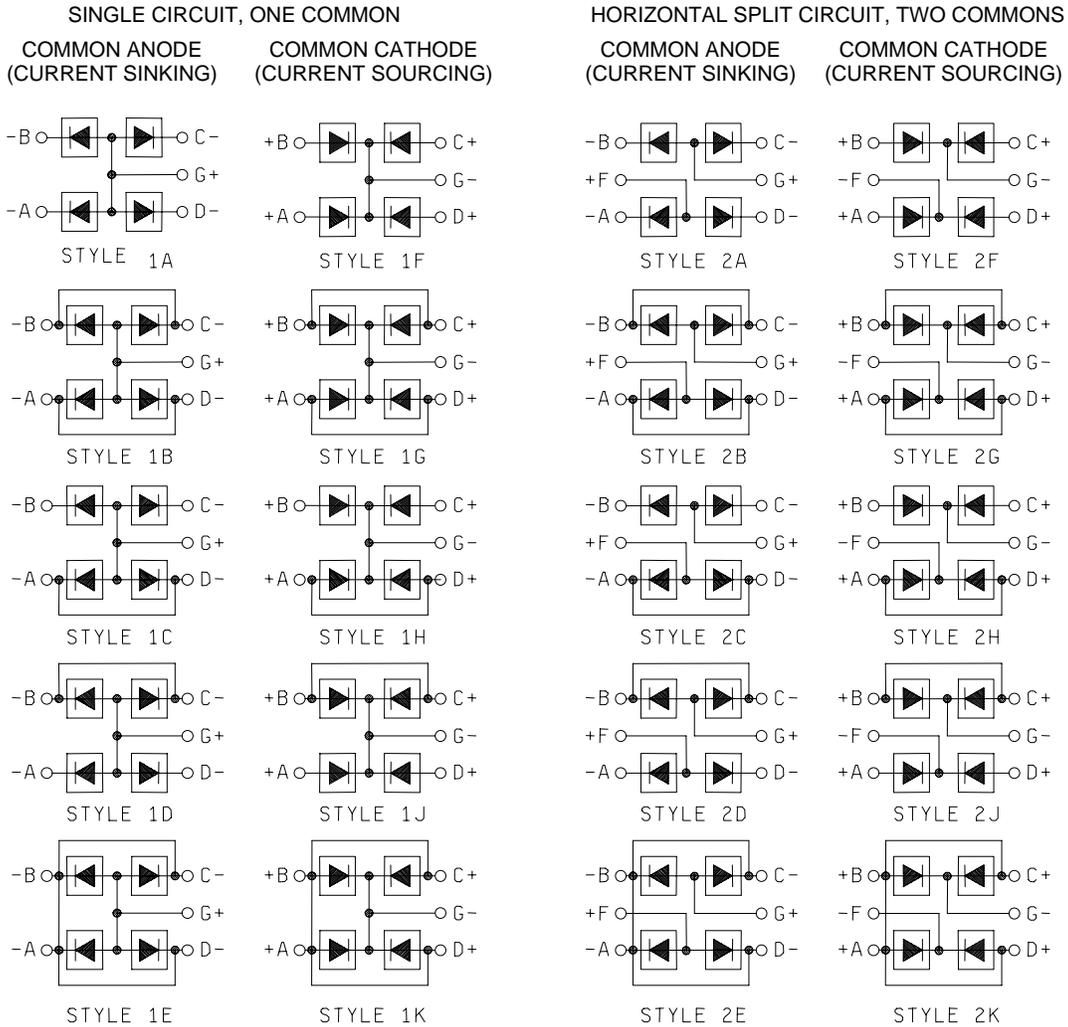


FIGURE 8. Lamp and switch circuit configurations, schematics, and recommended panel cutouts.

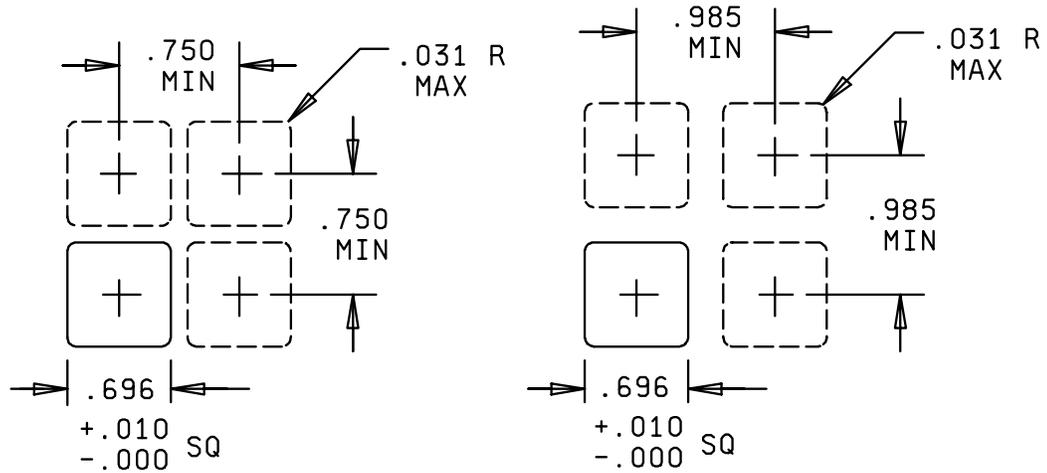
LED CIRCUIT SCHEMATIC BLOCK DIAGRAMS AND POLARITY



The symbol  represents an entire quadrant's electronic circuit including 4 LEDs and the driver, dimming and protection circuitry necessary for operation. Quadrant positions and terminal positions as viewed from the front of the display

FIGURE 8. Lamp and switch circuit configurations, schematics, and recommended panel cutouts - Continued.

RECOMMENDED PANEL CUTOUTS



TYPE I, III, AND V SWITCHES

TYPE II, IV, AND VI SWITCHES

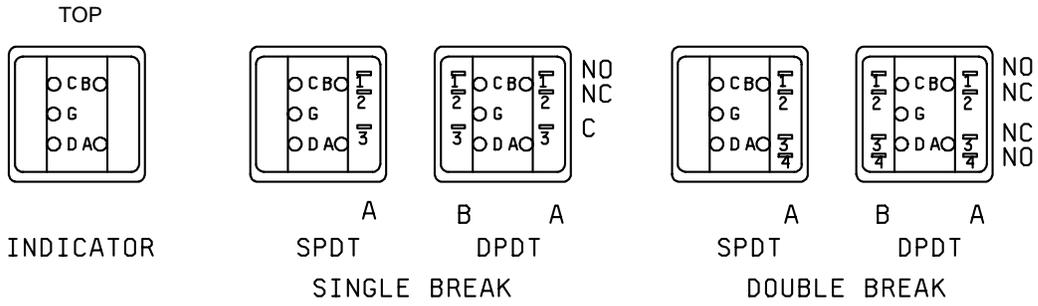
Inches	mm
.010	0.25
.031	0.79
.696	17.68
.750	19.05
.985	25.02

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 8. Lamp and switch circuit configurations, schematics, and recommended panel cutouts - Continued.

COMMON GROUND, SOLDER TERMINATIONS TYPE I AND II



SPLIT GROUND, SOLDER TERMINATIONS TYPE I AND II

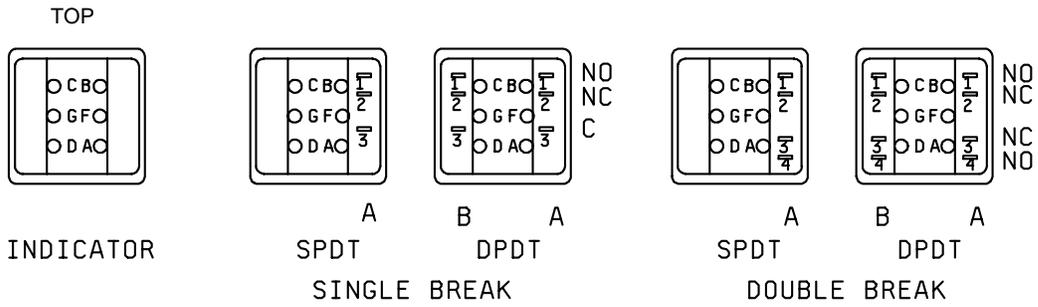
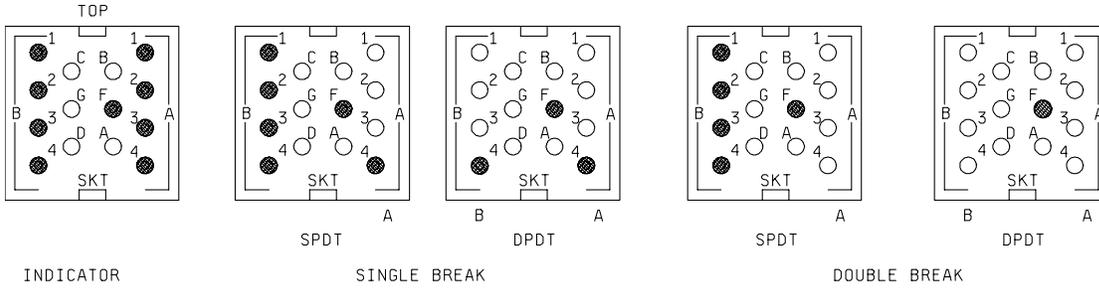


FIGURE 9. Switch poles and lamp terminal arrangements and identification.

COMMON GROUND, CTS TYPE III AND IV



SPLIT GROUND, CTS TYPE III AND IV

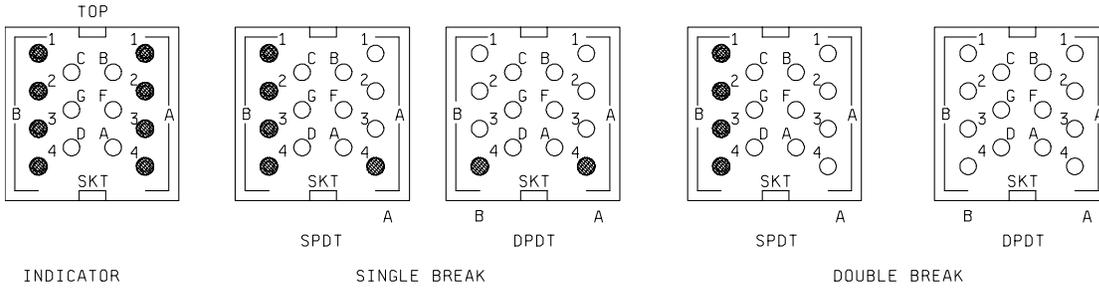
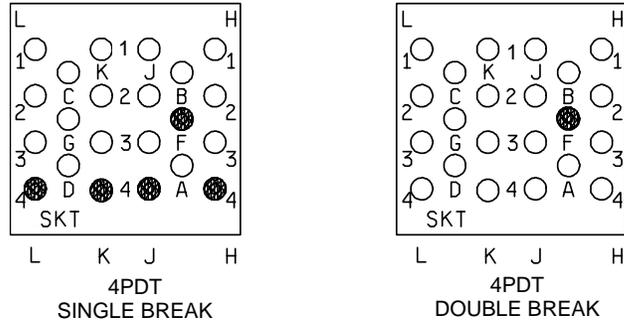
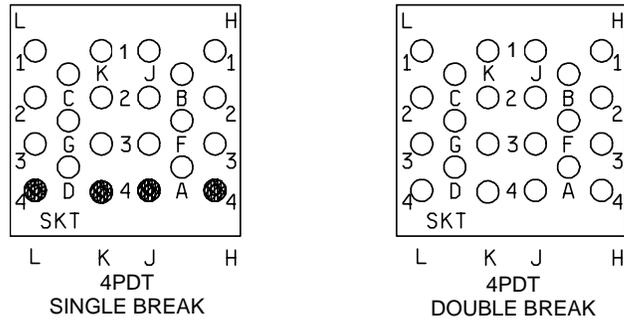


FIGURE 9. Switch poles and lamp terminal arrangements and identification - Continued.

COMMON GROUND, 4 POLE CTS  
TYPE V AND VI



SPLIT GROUND, 4 POLE CTS  
TYPE V AND VI



NOTES:

1. All 2 pole common termination system (CTS) switches have identical switch and lamp terminal arrangement identification. All 4 pole CTS switches have identical switch and lamp terminal arrangement identification.
2. To make the various CTS combinations, an MS27488-20 sealing plug is placed in the locations not to be used. In the above identifications, blackened circles indicate where the sealing plugs shall be located to form the described variation.
3. "SKT" identifies the socket side.
4. A and B or H, J, K, and L identify each switch.
5. C, B, G, F, D, and A identify the lamp circuit terminations.
6. 1, 2, 3, and 4 identify the switch contact termination.

FIGURE 9. Switch poles and lamp terminal arrangements and identification - Continued.

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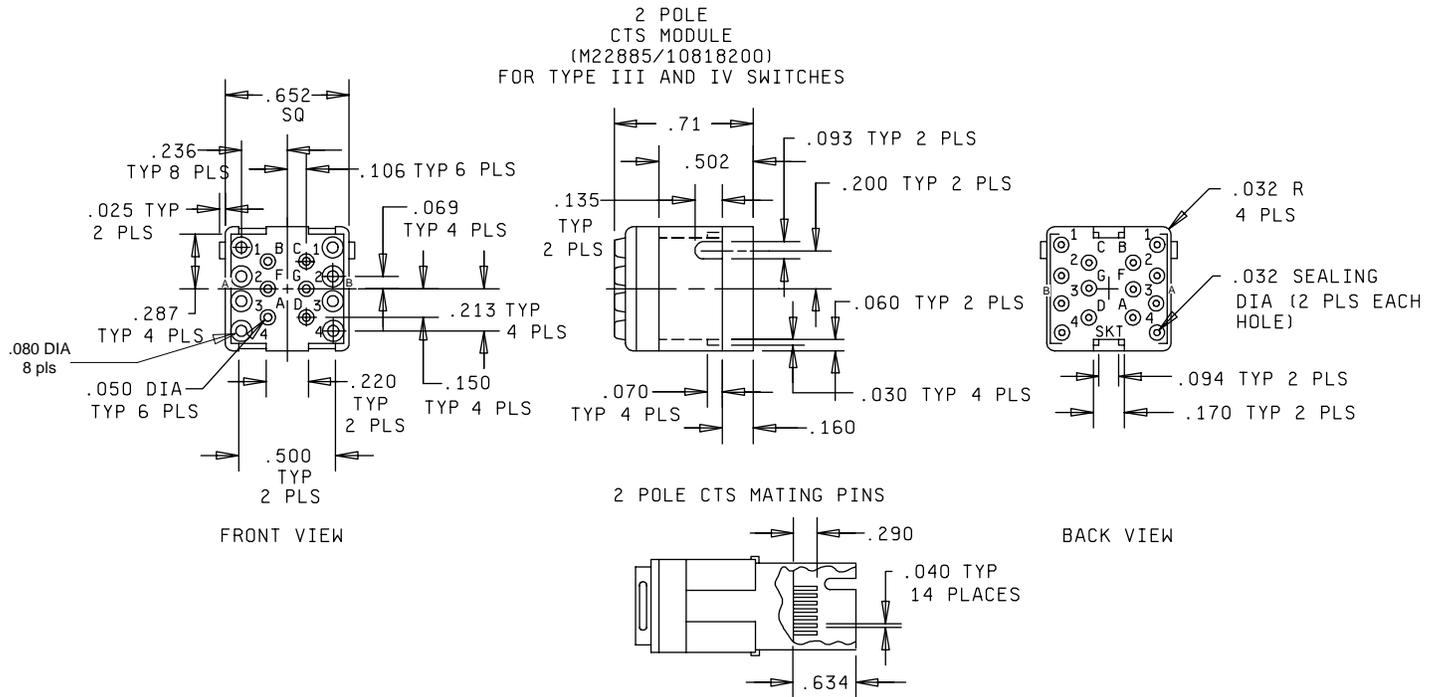


FIGURE 10. CTS modules and extraction tools.

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4 POLE CTS MODULE - (M22885/108C8240)

FOR TYPE V AND VI SWITCHES

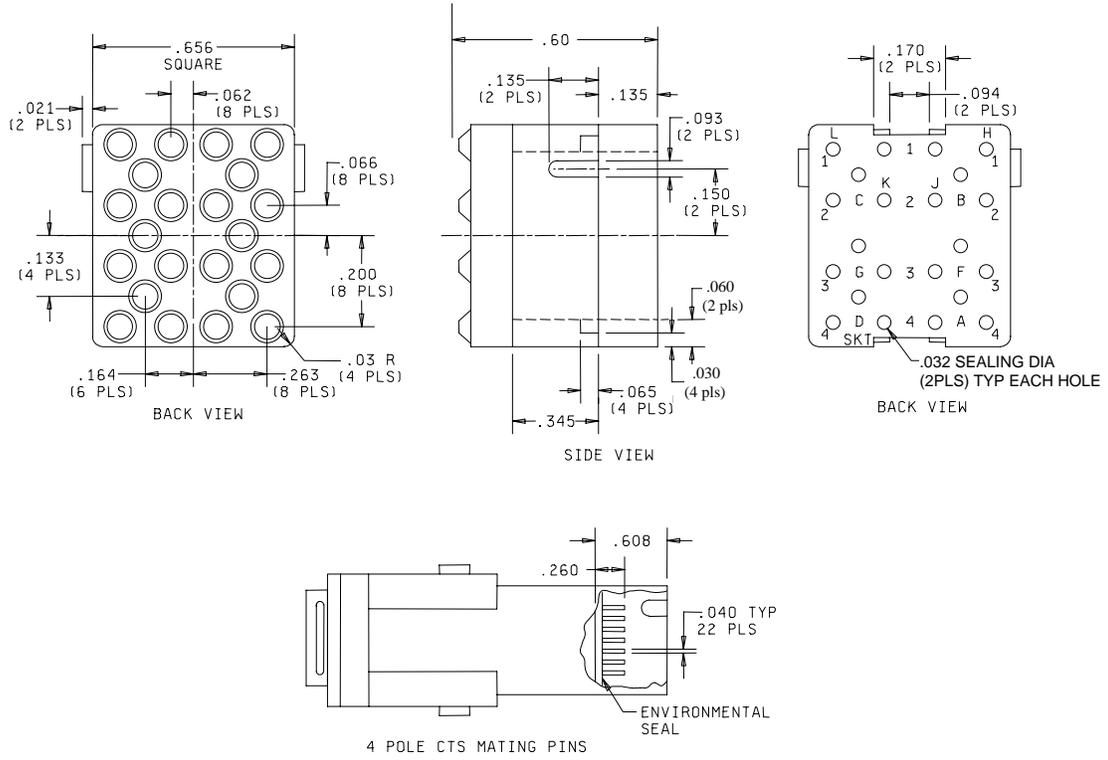


FIGURE 10. CTS modules and extraction tools - Continued.

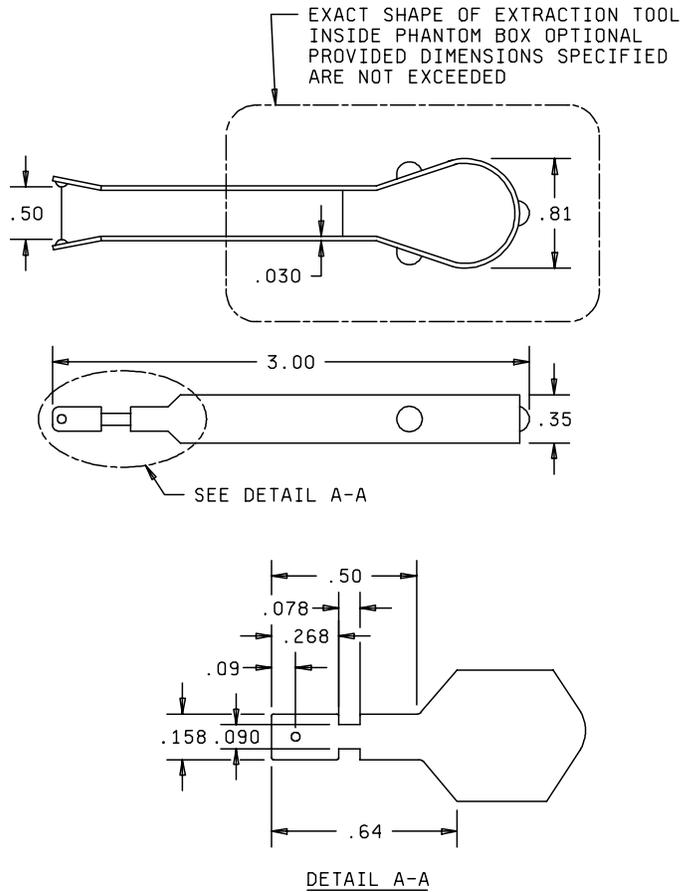
Inches	mm	inches	mm	Inches	mm	Inches	mm
.010	0.25	.080	2.03	.220	5.59	.608	15.44
.021	0.53	.090	2.29	.236	5.99	.634	16.10
.025	0.64	.093	2.36	.260	6.60	.640	16.26
.030	0.76	.094	2.39	.263	6.68	.652	16.56
.032	0.81	.100	2.54	.268	6.81	.656	16.66
.038	0.97	.106	2.69	.287	7.29	.71	18.03
.040	1.02	.133	3.38	.290	7.37	.75	19.0
.050	1.27	.135	3.43	.345	8.76	.81	20.6
.060	1.52	.138	3.51	.35	8.9	2.42	61.47
.062	1.58	.150	3.81	.426	10.82	3.00	76.2
.065	1.65	.158	4.01	.46	11.7		
.066	1.68	.160	4.06	.472	11.99		
.069	1.75	.164	4.17	.500	12.70		
.070	1.78	.170	4.32	.502	12.75		
.078	1.98	.213	5.41	.60	15.2		

FIGURE 10. CTS modules and extraction tools - Continued.

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CTS MODULE EXTRACTION TOOL  
(M22885/108T8234)

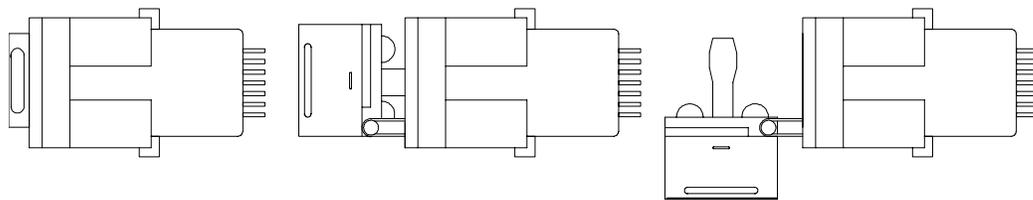
PART NUMBER M22885/10818208 HAS BEEN CANCELED  
AND REPLACED WITH M22885/108T8234



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Above dimensions are shown for information only.

FIGURE 10. CTS modules and extraction tools - Continued.



NOTES:

1. Retaining element shall be permanently attached to switch housing.
2. Retaining element shall allow pushbutton cap to be pulled fully out of switch housing and dropped down 90 degrees to facilitate lamp replacement. (Pushbutton cap must still be retained.)
3. Pushbutton cap shall be removable from the retaining element to allow caps to be changed if necessary.

FIGURE 11. Pushbutton cap retaining element.

REQUIREMENTS:

Design and construction: See figures 1 through 11.

Complete switch shall consist of:

One switch body, including a reversible mounting sleeve, a panel mounting spacer, and an integral cap retaining element. Type II, IV and VI switch bodies also include a splashproof mounting flange. When specified, type III, IV, V, and VI switch bodies also include an environmentally sealed plug-on connector, common termination system (CTS,) designed in accordance with the Terminal Junction System (TJS) of MIL-T-81714.

One lens module pushbutton cap: Includes legend module configuration, lamp circuit type, night vision goggle compatibility when specified, EMI/RFI shielding efficiency when specified, and an integral dripproof, watertight, and splashproof seal when specified.

Four lamps: T-1 flange base not included, order separately.

Optional LED lens module pushbutton cap: When specified, the legend module configuration includes non-replaceable LED lamps, LED circuit assembly with LED driver, dimming and electrical protection circuitry, night vision goggle compatibility when specified, EMI/RFI shielding efficiency when specified, and an integral dripproof, watertight and splashproof seal when specified.

Material:

Housing:

Type I and type II: Aluminum alloy, anodized black.

Type III, type IV, type V and type VI: Corrosion-resistant steel.

Mounting sleeve: Corrosion resistant steel or aluminum alloy. Aluminum alloy is surface treated in accordance with MIL-STD-171.

Panel mounting spacer: Corrosion resistant steel, black, or thermoplastic, black for type I, type III, and type V. Thermoplastic, black, for type II, type IV, and type VI.

Front lens material: High temperature heat-resistant thermoplastic.

Enclosure design:

Symbol 1 (unsealed) for type I, type III, and type V.

Symbol 2 (dripproof) for type II, type IV, and type VI.

Symbol 3 (watertight) for type II, type IV, and type VI.

Symbol 4 (splashproof) for type II, type IV, and type VI.

Temperature characteristic: 1 (-55°C to +85°C for type I, type III, and type V), (-48°C to +85°C for type II, type IV, and type VI), (-40°C to +71°C for the optional LED lens module pushbutton cap.).

Vibration grade: 3 (10 to 2,000 Hz).

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Operating characteristics:

Actuation force: 2 to 5 pounds.

Actuation travel: 0.150 ±0.030 inch, except 0.100 ±0.030 inch for high impact shock units.

Lens module extraction force: 2 to 5 pounds, except 2 to 8 pounds for high impact shock units.

Strength of actuator: 25 pounds.

Sand and dust: Applicable to type II, type IV, and type VI.

Shock: 75 g (MIL-STD-202, method 213, test condition B).

High impact shock: MIL-STD-202, method 207, when specified. Applicable to indicator and momentary action type II, type IV, and type VI only.

Weight:

Connector (CTS): 6 grams maximum.

4 pole connector (CTS): 6 grams maximum.

Type I (solder terminations): 19 grams maximum.

Type II (solder terminations): 21 grams maximum.

Type III (CTS): 26 grams maximum.

Type IV (CTS): 28 grams maximum.

Type V (4 pole CTS): 38 grams maximum.

Type VI (4 pole CTS): 41 grams maximum.

Seal:

Watertight test: When specified, test in accordance with MIL-PRF-22885 and MIL-STD-108. There shall be no leakage of water through the panel and pushbutton seals as determined by visual examination and the dielectric withstanding voltage test.

Splashproof test: When specified, test in accordance with MIL-PRF-22885 and MIL-STD-108. There shall be no leakage of water through the panel and pushbutton seals as determined by visual examination and the dielectric withstanding voltage test.

Mechanical endurance: 100,000 cycles.

Unsealed switches: 10,000 cycles of operation at -55°C ±2°C (-40°C ±2°C for switches with LED lens modules), 20,000 cycles of operation at +85°C ±2°C (+71°C ±2°C for switches with LED lens modules), and 70,000 cycles of operation at room temperature.

Sealed switches: 10,000 cycles of operation at -46°C ±2°C (-40°C ±2°C for switches with LED lens modules), 20,000 cycles of operation at +85°C ±2°C (+71°C ±2°C for switches with LED lens modules), and 70,000 cycles of operation at room temperature. Cycling rate shall not exceed 18 cycles per minute during low temperature portion of the mechanical endurance test.

Electrical endurance: 50,000 cycles.

Intermediate current: Applicable, 50,000 cycles.

Low level life: Applicable to gold-plated contacts, 50,000 cycles.

Electrical ratings: See table I.

Color and luminance: See table II and table III for display type S. See table IV and table V for display type N.

Sunlight readability (display type S):

Requirements: All legends shall be capable of being read in direct sunlight and at any glare-producing, specularly reflective angles up to 15 degrees  $\pm$  2 degrees to the normal of the display viewing surface. The average luminance contrast ratio of each lighted legend character to background shall be 0.6 minimum (0.4 minimum for incandescent blue, incandescent NVIS green A and NVIS red). The average luminance contrast ratio of each unlighted legend character to background shall have an absolute value equal to or less than 0.1. The average luminance contrast ratio for each color shall not be less than the values listed in tables VI and VII for the respective glare-producing angle.

Test method: The test procedure for measuring the average luminance contrast ratios for sunlight readability shall be the specular reflectance test in accordance with MIL-PRF-22885.

Color contrast: In addition to luminance contrast, color contrast is an important factor in sunlight readability. The effects of both luminance contrast and color contrast can be combined into a single value called the index of discrimination (ID). The index of discrimination value for all legend characters shall be greater than 1.0 for those legends to be considered as sunlight readable. The minimum value for the index of discrimination are also listed in table VI and table VII. The index of discrimination is determined by using the same specular reflectance test setup shown in MIL-PRF-22885, and using the following formulas for calculation:

$$C_L = \frac{\log_{10} \left( \frac{L_1 + L_2}{L_b} \right)}{0.15} \quad \text{Formula I}$$

$$C_C = \frac{\sqrt{(u_1 - u_b)^2 + (v_1 - v_b)^2}}{0.027} \quad \text{Formula II}$$

$$ID = \sqrt{C_L^2 + C_C^2} \quad \text{Formula III}$$

Where:

ID = Index of discrimination.

$C_L$  = Luminance contrast.

$C_C$  = Chrominance contrast.

$L_1$  = Average character luminance of energized legend.

$L_2$  = Average reflected character luminance of nonenergized legend.

$L_b$  = Average reflected background luminance.

$u_1, v_1$  = Average 1960 UCS color coordinates of the reflected and emitted light from the illuminated legend.

$u_b, v_b$  = Average 1960 UCS color coordinates of the reflected background light.

The illuminated chromaticity limits and minimum average luminance for sunlight readable displays are listed in table II and table III.

Display type N:

Requirements: All legends shall be visible white with an opaque black background. The legend characters shall always be visible in any light ambience except in darkened conditions. In darkened conditions, the legend characters shall illuminate in color with an average luminance of 0.5 to 3.0 foot-lamberts when energized at full rated voltage. See table IV and table V for specific colors and luminance.

Test method: The test procedure for measuring the average luminance and color of the illuminated visible white legend characters shall be in accordance with MIL-PRF-22885.

Display type D:

Requirements: All legends shall be visible white with an opaque black background. The legend characters shall illuminate in color with an average display luminance in excess of 100 foot-lamberts when energized at full rated voltage. See Table II for specific colors.

Test method: The test procedure for measuring the average luminance and color of the illuminated visible white legend characters shall be in accordance with MIL-PRF-22885.

Display type A:

Requirements: All legends shall be visible white on an obscure black background. The legend background shall illuminate in color with an average display luminance in excess of 200 foot-lamberts when energized at full rated voltage. See Table II and Table III for specific colors. Contrast requirements do not apply.

Test method: The test procedure for measuring the average luminance and color of the illuminated display background shall be in accordance with MIL-PRF-22885.

Display type B:

Requirements: All legends shall be opaque black on an obscure black background. The legend characters shall remain black and the legend background shall illuminate in color with an average display luminance in excess of 200 foot-lamberts when energized at full rated voltage. See Table II and Table III for specific colors. Contrast requirements do not apply.

Test method: The test procedure for measuring the average luminance and color of the illuminated display background shall be in accordance with MIL-PRF-22885.

Display type W:

Requirements: All legends shall be opaque black on a visible white background. The legend characters shall remain black and the legend background shall illuminate in color with an average display luminance in excess of 100 foot-lamberts when energized at full rated voltage. The color of the illuminated background is as specified in Table II. This option is only available in pushbutton style H from Table VIII. Contrast requirements do not apply.

Test method: The test procedure for measuring the average luminance and color of the illuminated display background shall be in accordance with MIL-PRF-22885.

Night vision imaging system (NVIS) compatibility:

NVIS Green A: Shall meet all MIL-STD-3009, as previously defined in MIL-L-85762, requirements for illuminated controls for type I, class A and type II, class B equipment.

NVIS Green B: Shall meet all MIL-STD-3009, as previously defined in MIL-L-85762, requirements for illuminated controls for type I, class A and type II, class B equipment.

NVIS Blue: Shall meet all MIL-STD-3009, as previously defined in MIL-L-85762, NVIS radiance requirements for illuminated controls and advisory lights for type I, Class A, type I, Class B equipment. The color shall meet the requirements as specified herein.

NVIS Yellow Class A: Shall meet all MIL-STD-3009, as previously defined in MIL-L-85762, requirements for caution signals for type I, class A and type II, class B equipment.

NVIS Yellow Class B: Shall meet all MIL-STD-3009, as previously defined in MIL-L-85762, requirements for caution signals for type I, class B and type II, class B equipment.

NVIS Red: Shall meet all MIL-STD-3009, as previously defined in MIL-L-85762, requirements for warning signals for type I, Class B and type II, class B equipment.

Test methods: The test procedure for measuring luminance, chromaticity and spectral radiance shall be in accordance with MIL-STD-3009, as previously defined in MIL-L-85762, for illuminated controls (for NVIS green A and NVIS green B), illuminated controls and advisory lights (for NVIS blue), caution signals (for NVIS yellow) and warning signals (for NVIS red).

The night vision goggle compatible feature, when specified, is in addition to the sunlight readable feature and all minimum sunlight readable requirements shall be maintained on all type S displays along with the unique requirements for night vision goggle compatibility. When night vision goggle compatibility is specified for type N displays (visible legend), all the requirements for color and NVIS radiance in accordance with MIL-STD-3009, as previously defined in MIL-L-85762, shall be satisfied when display is operated at the specified luminance level (see table V).

Lens module pushbutton caps containing NVIS compatible displays are marked with NVIS Type ( ), Class ( ), in accordance with MIL-STD-3009, as previously defined in MIL-L-85762.

EMI/RFI shielding:

Requirement: When specified, the EMI/RFI shielding attenuation shall be not less than 60 dB over the frequency range from 100 to 1,000 MHz.

Test method: Switches shall be tested to determine the shielding effectiveness in accordance with MIL-S-22885, for shielding efficiency.

Measurements are to be performed at the following frequencies:

<u>Frequency</u>	<u>Minimum attenuation</u>
100 MHz	60 dB
200 MHz	60 dB
400 MHz	60 dB
600 MHz	60 dB
800 MHz	60 dB
1,000 MHz	60 dB

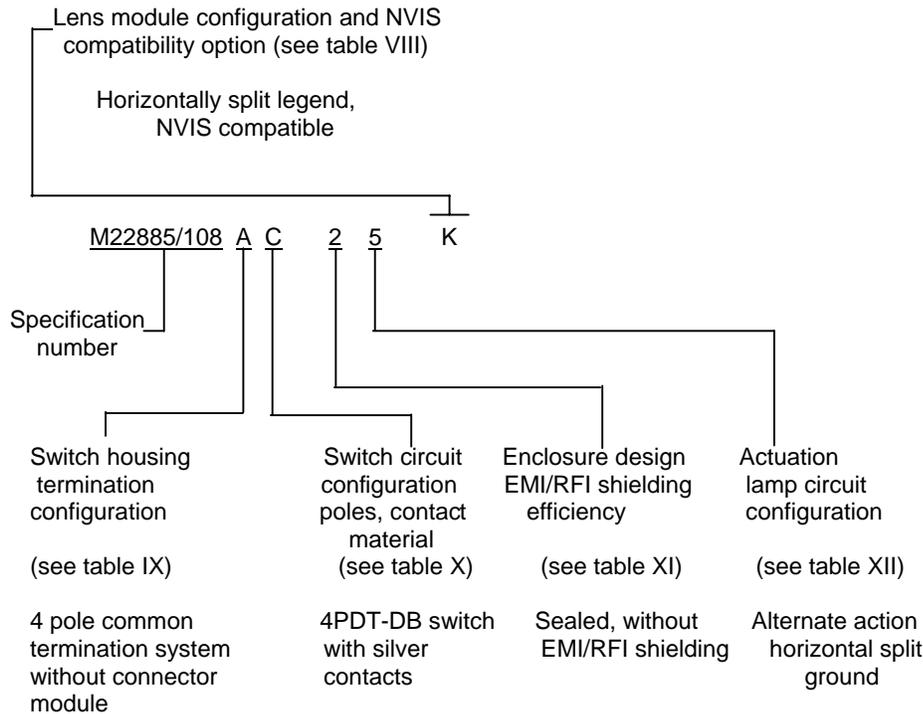
Electrical environment requirements:

Requirements: The LED illuminated display and related circuitry shall not be adversely affected when subjected to the following electrical environmental conditions specified in RTCA/DO-160D

- Magnetic Effect: Section 15, equipment Class A.
- Power Input: Section 16, Category Z.
- Voltage Spike: Section 17, Category A.
- Audio Frequency Conducted Susceptibility: Section 18, Category Z.
- Induced Signal Susceptibility: Section 19, Category C and Z.
- Radio Frequency Susceptibility: Section 20, Category R.
- Emission of Radio Frequency Energy: Section 21, Category M.
- Lightning Induced Transient Susceptibility: Section 22, Category A3XX.
- Electrostatic Discharge (ESD): Section 25, Category A.

Test method: The test procedures shall be in accordance with the test methods described in RTCA/DO-160D Sections 15 through 22 and Section 25 for compliance with the equipment categories as listed above under requirements.

Part or Identifying Numbers (PIN): PIN's are assigned as follows:



PIN's generated do not include display type (N, S, D, A, B or W), segment color (see table XIV), legends, incandescent lamp type or optional LED illumination. When lamps are to be included with the switch, equipment manufacturers may add an additional suffix number from table XIII to the military PIN for reference only. When the optional LED illuminated lens module pushbutton cap is selected equipment manufactures may add an additional suffix form the "designation codes" in Table XV to the military PIN for reference only. Acquisition documents shall be prepared in accordance with ordering data in section 6 of MIL-S-22885 for category II switches.

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Lamp types usable in the lens modules: Table XIII is shown for information only.

Lens module legend positions: Table XIV is shown for information only.

Optional LED illuminated lens module: Table XV is shown for information only. The bottom of each LED lens module pushbutton cap shall be marked with the appropriate circuit diagram from Table XVI showing whether it is a single common circuit or a horizontal split circuit and also showing the voltage, circuit polarity and any internal quadrant interconnections.

Qualification inspection: All applicants for qualification approval shall demonstrate that each of their items conform to all the requirements specified in the applicable documents singularly and in combination with all other previously qualified items, regardless of manufacturer. Table XVII is based on the use of MIL-PRF-8805 category I or category II basic switches listed on QPL-8805.

Group submission: See table XVII.

Group A inspection: See table XVIII.

Group B inspection: See table XIX.

TABLE I. Electrical ratings.

Contact material	Load	Sea level			50,000 feet	
		28 V dc		115 V ac, 60 Hz	28 V dc	
		NO or NC (amperes max)	2 circuit (amperes max)	NO or NC (amperes max)	NO or NC (amperes max)	2 circuit (amperes max)
Silver (gold finish)	Resistive	7.5	5.0	7.5	4.0	3.0
	Inductive	4.0	2.0	4.0	2.5	1.0
	Motor	4.0	---	---	---	---
	Lamp	1.0	---	---	---	---
Gold plated	Resistive	1.0	---	---	1.0	---
	Inductive	0.5	---	---	0.5	---
Low level life applicable: 30 millivolts maximum or peak ac at 10 milliamperes maximum.						

TABLE II. Illuminated chromaticity limits and luminance for sunlight readable displays (type S).

Color	Color code	Lens module illumination source	x <u>1/</u> <u>3/</u>	y <u>1/</u> <u>3/</u>	Minimum average character luminance with or without EMI/RFI shielding
Red	R	Incandescent or LED	.695 .710 .655 .660	.285 SL <u>2/</u> .325 SL <u>2/</u>	150 foot-lamberts
Green	G	Incandescent or LED	.300 .300 .380 .380	SL <u>2/</u> .600 .600 SL <u>2/</u>	200 foot-lamberts
Yellow	Y	Incandescent or LED	.562 .570 .596 .605	.415 SL <u>2/</u> .382 SL <u>2/</u>	300 foot-lamberts
Blue <u>4/</u>	B	Incandescent only	.230 .230 .320 .320	.420 .350 .350 .420	150 foot-lamberts
White	W	Incandescent only	.400 .460 .400 .460	.420 .420 .380 .380	250 foot-lamberts
LED Blue	T	LED Only	.100 .180 .180 .100	.145 .145 .250 .250	200 foot-lamberts
White Illuminant B 4870°K	A	LED Only	.330 .350 .400 .400 .380 .330	.330 .330 .380 .420 .420 .370	350 foot-lamberts

1/ Chromaticity is expressed as x and y on the CIE chromaticity diagram.

Values shown are corners of the limiting envelope.

2/ SL - spectrum locus (where intersected by other coordinate pair).

3/ Chromaticity limits and luminance levels apply when the displays are energized at full rated voltage.

4/ Blue Incandescent is not available as a display type D or display type W.

TABLE III. Illuminated chromaticity limits and luminance for NVIS night vision goggle compatible, sunlight readable displays (type S).

Color	Color code	Lens Module illumination source	u' <u>1/</u>	v' <u>1/</u>	r <u>1/</u>	Foot-lamberts <u>3/</u>	Minimum average character luminance with or without EMI/RFI shielding at full rated voltage <u>4/</u>
NVIS Green A	P	Incandescent only	.088	.543	.037	0.1	200 foot-lamberts
NVIS Green A	H	LED only	.088	.543	.037	0.1	200 foot-lamberts
NVIS Green B <u>2/</u>	J	Incandescent or LED	.131	.623	.057	0.1	200 foot-lamberts
NVIS Blue	E	LED Only	.082	.390	.037	0.1	200 foot-lamberts
NVIS Yellow Class A <u>2/</u>	K	Incandescent or LED	.274	.622	.083	15.0	200 foot-lamberts
NVIS Yellow Class B <u>2/</u>	U	LED	.274	.622	.083	15.0	200 foot-lamberts
NVIS Red <u>2/</u>	S	Incandescent or LED	.450	.550	.060	15.0	200 foot-lamberts

1/ Chromaticity is expressed as u' and v' coordinates of the 1976 UCS diagram. The values shown describe a circle whose center is at u', v', and of radius r.

2/ The area enclosed by the described circle intersecting the spectral locus is the envelope limiting the acceptable color space.

3/ Chromaticity limits must be met when the display voltage is set to produce 0.1 foot-lamberts for NVIS green A, NVIS green B and NVIS blue and 15 foot-lamberts for NVIS yellow Class A, NVIS yellow Class B and NVIS red.

4/ Minimum luminance values apply when the displays are energized at full rated voltage.

TABLE IV. Illuminated chromaticity limits and luminance for visible legend displays (type N).

Color	Color code	Lens module illumination source	x <u>1/</u>	y <u>1/</u>	Character luminance with or without EMI/RFI shielding
Blue/white	V	Incandescent Only	.400 .460 .400 .460	.420 .420 .380 .380	0.5 to 3.0 foot-lamberts
Red	N	Incandescent or LED	.695 .710 .655 .660	.285 SL <u>2/</u> .325 SL <u>2/</u>	0.5 to 3.0 foot-lamberts
White Illuminant B 4780° K	D	LED only	.330 .350 .400 .400 .380 .330	.330 .330 .380 .420 .420 .370	0.5 to 3.0 foot-lamberts

1/ Chromaticity is expressed as x and y on the CIE chromaticity diagram. Values shown are corners of the limiting envelope.

2/ SL - spectrum locus (where intersected by other coordinate pair).

TABLE V. Illuminated chromaticity limits and luminance for NVIS night vision goggle compatible, visible legend displays (type N).

Color	Color code	Lens module illumination source	$u'$ <sup>1/</sup>	$v'$ <sup>1/</sup>	$r$ <sup>1/</sup>	Character luminance with or without EMI/RFI shielding
NVIS Green A	M	Incandescent Only	.088	.543	.037	0.5 to 3.0 foot-lamberts
NVIS Green A	F	LED only	.088	.543	.037	0.5 to 3.0 foot-lamberts
NVIS Green B <sup>2/</sup>	L	Incandescent or LED	.131	.623	.057	0.5 to 3.0 foot-lamberts

<sup>1/</sup> Chromaticity is expressed as  $u'$  and  $v'$  coordinates of the 1976 UCS diagram. The values shown describe a circle whose center is at  $u'$ ,  $v'$ , and of radius  $r$ .

<sup>2/</sup> The area enclosed by the described circle intersecting the spectral locus is the envelope limiting the acceptable color space.

TABLE VI. Minimum contrast ratios <sup>1/</sup> and minimum indexes of discrimination <sup>2/</sup> for sunlight readable displays (type S) with or without EMI/RFI shielding.

Color <sup>3/</sup>	Color code	Lens Module illumination source	Condition 1 ( $\phi_1 = \phi_2 = 15^\circ$ )		Condition 2 ( $\phi_1 = \phi_2 = 30^\circ$ )	
			Contrast ratio	Index of discrimination	Contrast ratio	Index of discrimination
Red	R	Incandescent or LED	0.6	2.0	0.3	1.4
Green	G	Incandescent or LED	0.6	1.6	0.3	1.2
Yellow	Y	Incandescent or LED	0.6	1.6	0.4	1.2
Blue	B	Incandescent only	0.4	1.2	0.2	1.1
White	W	Incandescent only	0.6	1.2	0.2	1.1
LED Blue	T	LED only	0.6	1.6	0.3	1.2
White illuminant B 4780° K	A	LED only	0.6	1.4	0.4	1.2

<sup>1/</sup> Minimum average contrast of each legend character.

<sup>2/</sup> The index of discrimination takes into account both the luminance contrast and the chrominance contrast.

<sup>3/</sup> Application note: In addition to luminance contrast, color contrast is an important factor in readability. Colors in table are listed in order of general preference. Red has the best color contrast during sunlight conditions; blue and white have the poorest color contrast, except LED blue which has good contrast in sunlight conditions.

TABLE VII. Minimum contrast ratios 1/ and minimum indexes of discrimination 2/ for NVIS night vision goggle compatible sunlight readable displays (type S) with or without EMI/RFI shielding.

Color 3/	Color code	Lens module illumination source	Condition 1 ( $\phi_1 = \phi_2 = 15^\circ$ ) 4/	
			Contrast ratio	Index of discrimination
NViS Green A	P	Incandescent only	0.4	1.2
NViS Green A	H	LED only	0.6	1.4
NViS Green B	J	Incandescent or LED	0.6	1.6
NViS Blue	E	LED only	0.6	1.6
NViS Yellow Class A	K	Incandescent or LED	0.6	1.4
NViS Yellow Class B	U	LED only	0.6	1.6
NViS Red	S	Incandescent or LED	0.4	1.1

- 1/ Minimum average contrast of each legend character.
- 2/ The index of discrimination takes into account both the luminance contrast and the chrominance contrast.
- 3/ Application note: In addition to luminance contrast, color contrast is an important factor in sunlight readability. Colors in table are listed in order of general preference for sunlight readability.
- 4/ Condition 2 is not applicable to NVIS compatible colors.

TABLE VIII. Lens module configurations.

		Configurations							
									
Standard lighting designations		B	C	D	E	F	G	J	H
NVIS compatible designations		K	L	M	N	P	Q	R	S

TABLE IX. Switch housing termination configuration.

Termination type	Designation
Turret terminals	1
Wire wrap/PCB terminals	3
CTS (SPDT, DPDT, and indicator light)	
Without connector module <u>1/</u>	4
With connector module <u>2/</u>	5
CTS (4PDT only)	
Without connector module <u>1/</u>	A
With connector module <u>2/</u>	B

- 1/ The common termination system designation 4 or A is for the CTS switch housing excluding the connector module. The connector module is provided separately so wiring and harnessing can be accomplished independent of the switch housing.
- 2/ The common termination system designation 5 or B is for the CTS switch housing including the connector module. The connector module is provided plugged into the switch housing (sealing plugs are in their appropriate positions).

TABLE X. Switch circuit configuration, poles and contact material.

Switch poles <u>1/</u> and circuit configuration	Contact material	
	Silver with gold finish	Gold plated
SPDT-SB	1	5
DPDT-SB	2	6
SPDT-DB	3	7
DPDT-DB	4	8
4PDT-SB	A	F
4PDT-DB	C	H
Indicator light	O	O

- 1/ SPDT - Single pole, double throw.  
 SB - Single break.  
 DPDT - Double pole, double throw.  
 DB - Double break.  
 4PDT - Four pole, double throw.

TABLE XI. Enclosure design and EMI/RFI shielding efficiency.

Enclosure design	Without EMI/RFI shielding	With EMI/RFI shielding
1-unsealed	1	4
2-Dripproof 3-Watertight 4-Splashproof	2	5
High impact shock resistant <u>1/</u> 2-Dripproof 3-Watertight 4-Splashproof	3	6

1/ Not available in alternate action.

TABLE XII. Lamp circuit configuration and actuation.

Lamp circuit or LED circuit configuration	Actuation		
	Momentary	Alternate	Indicator
Single circuit, one common	1	4	7
Horizontal split circuit two commons	2	5	8
Vertical split circuit two commons <u>1/</u>	3	6	9

1/ Not available in optional LED illuminated lens module.

TABLE XIII. Incandescent lamp types usable in the lens modules. 1/

Lamp type	MS number	Voltage	Current	MSCP	Life hours
1	---	5	.060	.15	6,500
2	MS-24515	5	.115	.15	40,000
6	MS-3338	28	.024	.15	16,000

1/ Lamps with a mean spherical candle power of .15 minimum must be used to obtain the sunlight readability specified. Replacement lamps must be aged and selected to meet this requirement.

TABLE XIV. Lens module legend positions. <sup>1/</sup>

Display Type Lighting	Legend Positions
Type S and Type N	
Type B	
Type A	
Type D	
Type W	

<sup>1/</sup> Segment characters are to be used to identify display type lighting, color and legend positions.

<sup>2/</sup> Legend positions are available for incandescent illuminated lens module only.

<sup>3/</sup> Type W display is available in lens module configuration H.

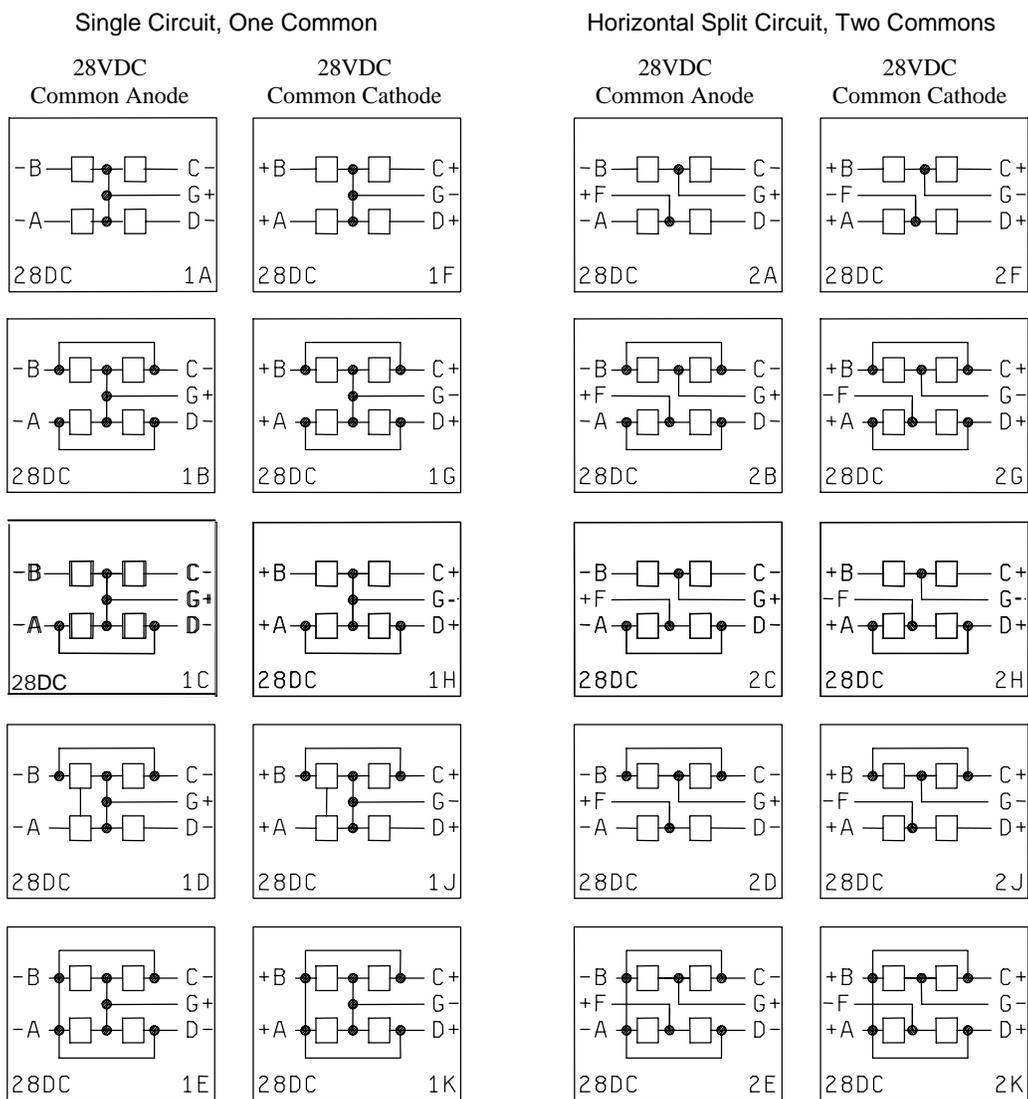
TABLE XV. LED voltage, circuit polarity and quadrant interconnection styles. <sup>1/</sup> <sup>2/</sup>

Quadrant Interconnections		Voltage, Circuit Polarity and Designation Code	
Block Diagram	Description	28 VDC Common Anode	28 VDC Common Cathode
	Four inputs, all four Quadrants independent	A	F
	Two inputs, top quadrants coupled and bottom quadrants coupled	B	G
	Three inputs, only bottom Two quadrants coupled	C	H
	Three inputs, only top two Quadrants coupled	D	J
	One input, all four quadrants connected	E	K

<sup>1/</sup> Display quadrant power inputs are labeled A, B, C and D as viewed from the front of the display.

<sup>2/</sup> The LED circuit is available with the quadrants A, B, C and D internally connected in various styles so one input wire can activate one or more quadrants thereby reducing the number of input wires necessary to illuminate the display.

TABLE XVI. LED lens module pushbutton cap circuit diagrams. 1/ 2/ 3/



- 1/ The appropriate circuit diagram must be marked in white lettering on the bottom of the LED lens module pushbutton cap.
- 2/ The circuit diagrams are as viewed from the front of the display.
- 3/ The two character identifiers 1A, 1B, etc. are for reference only.

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TABLE XVII. Qualification inspection, group submission.

Test sample	Inspection table X of MIL-PRF-22885		Additional testing	Extent of approval <u>1/</u>
	Group	Number of samples		
M22885/1081444E2 <u>2/</u>	I II III VI VII VIII	14 4 (from group I) <u>3/ 4/</u> 2 (from group I) 2 (from group I) <u>5/</u> 4 (from group I) <u>4/ 6/ 7/</u> 56 <u>8/</u>	Sunlight readable testing shall include determining the index of discrimination. NVIS color and NVIS radiance measurements shall be taken where applicable after sunlight readable testing.	All
M22885/1081844E2 <u>2/</u>	I VII	2 <u>9/</u> 2 (from group I) <u>4/ 10/</u>		
M22885/108BC61E2 <u>2/</u>	I II III V VI VII	12 4 (from group I) <u>4/ 11/ 12/</u> 2 (from group I) 2 (from group I) <u>4/ 12/</u> 2 (from group I) <u>13/</u> 2 (from group I) <u>4/ 14/</u>		
M22885/1081232E2 <u>2/</u>	I II	4 4 (from group I) <u>4/ 11/ 12/</u>		
2 samples - any wire wrap/pc terminal switch			Solderability Terminal strength	
2 samples – any LED lens module with two commons			Electrical environment test in accordance with the test methods described in RTCA/DO-160D Sections 15 through 22 and Section 25 for compliance with the equipment categories as listed in the electrical environment requirements section	

1/ Includes single break, silver contacts, gold contacts, and wire wrap termination when the basic switches are qualified to MIL-S-8805/101 category I or category II.

2/ Lens module configuration shall be "E" for non-NVIS legends and "N" for NVIS legends (3-way split) in accordance with table VIII.

Test legend:

FUELS	
23	45

3/ Shock method I.

4/ During tests requiring switch to be mounted, one-half of the sample units shall be mounted utilizing the mounting spacer. The remaining half shall be mounted with the mounting spacer removed.

5/ Inductive dc NO-NC only, sea level.

6/ Two units shall be subjected to the mechanical endurance test:

7/ Two units shall be tested for intermediate current.

8/ 56 lens modules, two for each of 28 different colors, including additional lens modules for those color codes made from either incandescent or LED illumination source shall be tested for color, luminance, and sunlight readability where applicable. A single separate switch body shall be provided so lens modules can be individually energized.

9/ Contact resistance measurement for gold contact switches which are to be subjected to low level life testing shall be made in accordance with MIL-PRF-22885, switch contact resistance paragraph, except the test current shall not exceed 10 milliamperes and the open-circuit test voltage shall not exceed 30 millivolts dc. Maximum contact resistance is 3 ohms.

10/ Two units shall be tested for low level life only.

11/ Shock method II.

12/ Sealing shall be verified by performing the watertight test and the splashproof test only.

13/ Resistive dc two circuit only, sea level.

14/ Intermediate current test not required.

TABLE XVIII. Group A inspection.

Inspection
Seal (when applicable) (external inspection only) Visual and mechanical examination Operating characteristics Dielectric withstanding voltage Contact resistance <u>1/</u> Sunlight readability <u>2/</u> NVIS compatibility <u>3/</u>

- 1/ Contact resistance measurements for gold contact switches shall be measured in accordance with switch contact resistance paragraph of MIL-PRF-22885, except the test current shall not exceed 10 milliamperes and the open-circuit test voltage shall not exceed 30 millivolts dc. Maximum contact resistance is 3 ohms.
- 2/ Test one switch per color and use these as visual standards. Visually inspect all switches in each lot against the appropriately colored standard switch. The switches used as visual standards shall be certified annually by performing the sunlight readability test.
- 3/ Test one switch each for NVIS green A , NVIS green B, NVIS blue, NVIS yellow and NVIS red in accordance with the requirements of MIL-STD-3009, as previously defined in MIL-L-85762. These units will serve as standards when viewed with an image intensifier. Visually inspect all NVIS compatible switches in each lot with an image intensifier against the appropriate standard switch. The switches used as visual standards shall be certified annually by performing the NVIS compatibility test.

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TABLE XIX Group B inspection.

Inspection <u>1/</u>	Test sample PIN's and sample numbers																<u>2/</u>
	M22885/ 1085445E2								M22885/ 1085861E2				M22885/ 1083444E2		MS22885/ 108BC41E2		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Visual and mechanical	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Solderability													X	X			
Shock I	X	X															
Shock II									X	X							
Moisture resistance	X	X							X	X							
Salt spray			X	X													
Overload cycling					X	X									X	X	
Electrical endurance- inductive dc															X	X	
Electrical endurance resistance dc					X	X											
Mechanical endurance							X	X									
Low level life										X	X						
Color																X	
Luminance																X	
Sunlight readability																X	
NVIS compatibility																X	
Dielectric withstanding voltage					X	X									X	X	
Operating characteristics	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Seal									X	X							
Marking visibility	X	X	X	X					X	X							

1/ All tests shall be performed as required by table XV.

2/ Two samples of each color.

Custodians:  
 Army - CR  
 Navy - EC  
 Air Force - 11  
 DLA - CC

Preparing activity:  
 DLA - CC

(Project 5930-1135)