

PERFORMANCE SPECIFICATION SHEET

SWITCH, PUSHBUTTON, ILLUMINATED,
4-LAMP 0.750 SQUARE, LOW LEVEL TO 7 AMPERES,
(DRIPPROOF, EMI/RFI SHIELDING, NIGHT VISION GOGGLE COMPATIBLE)

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

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

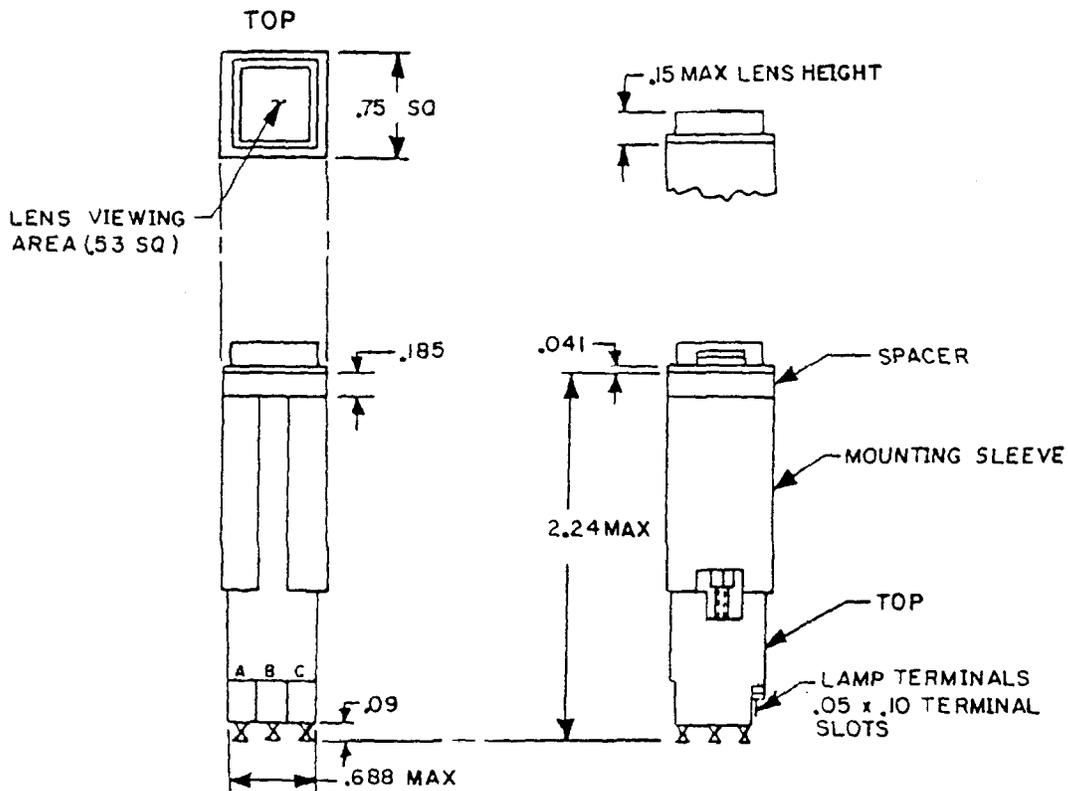


FIGURE 1. Switch, individual mounted (type I).

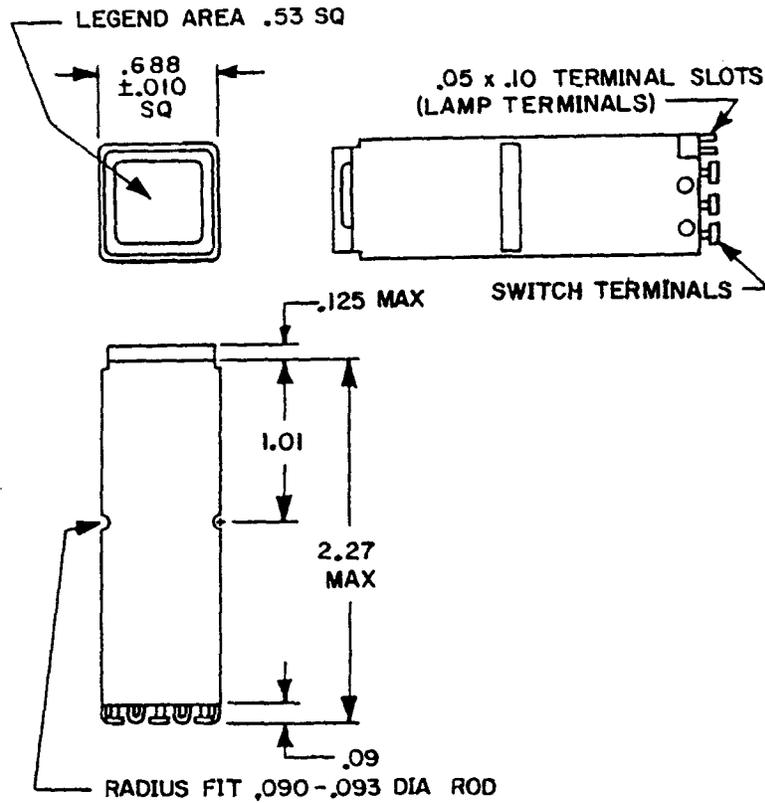
MIL-PRF-22885/90C

Inches	mm
.41`	1.04
.05	1.3
.09	2.3
.10	2.5
.15	3.8
.185	4.70
.53	13.5
.688	17.48
.75	19.0
2.24	56.9

NOTES:

1. Dimensions are inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are ± 0.010 (.25 mm) for three place decimals and ± 0.03 (0.8mm) for two place decimals.
4. Unit mounts in panels from .031 to .19 (0.79 to 4.8 mm) thick.
5. A spacer is supplied with each switch unit for MIL-P-7788 panel requirements. Spacer places switch mounting flange flush with top of overlay panel.
6. Spacer to be used only for edge-light panels, discard otherwise.
7. Mounting sleeve shall not exceed .760 (19.30 mm) square and shall be reversible to accommodate edge-light panel spacer requirements.
8. Pushbutton is designed to prevent incorrect insertion into switch housing.
9. Exact shape of switch optional provided dimensions specified are not exceeded.
10. Terminal dimensions are not applicable to printed circuit board termination.

FIGURE 1. Switch, individual mounted (type I) - Continued.

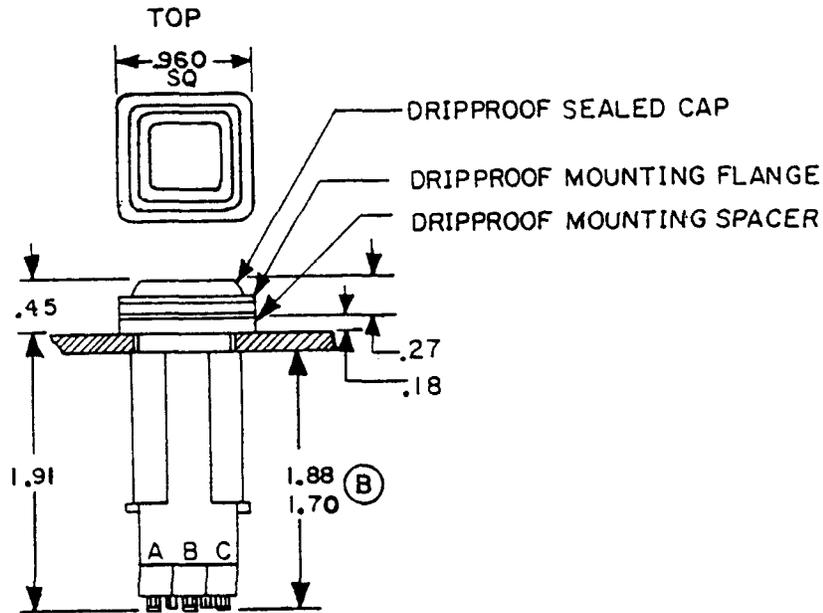


Inches	mm
.010	0.25
.05	1.3
.090	2.29
.093	2.36
.10	2.5
.125	3.18
.53	13.5
.688	17.48
1.01	25.7
2.27	57.7

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are ± 0.010 (0.25 mm) for three place decimals and ± 0.03 (0.8 mm) for two place decimals.
4. Pushbutton is designed to prevent incorrect insertion into switch housing.
5. Exact shape of switch optional provided dimensions specified are not exceeded.
6. Terminal dimensions are not applicable to printed circuit board terminations.

FIGURE 2. Switch, matrix mounted (type II).



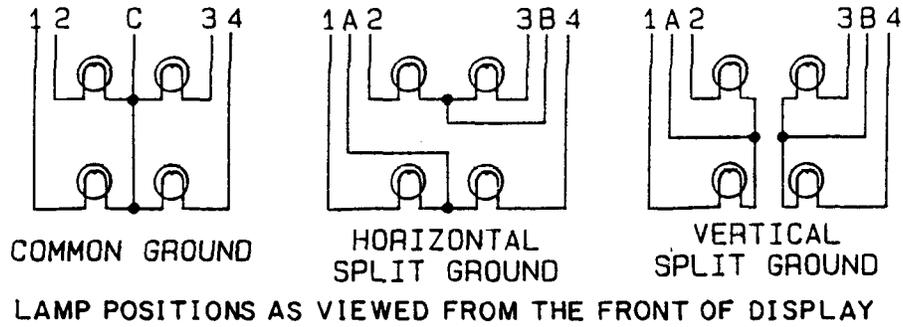
Inches	mm
.19	4.6
.27	6.9
.45	11.4
.960	24.38
1.72	43.7
1.88	47.8
1.91	48.5

NOTES:

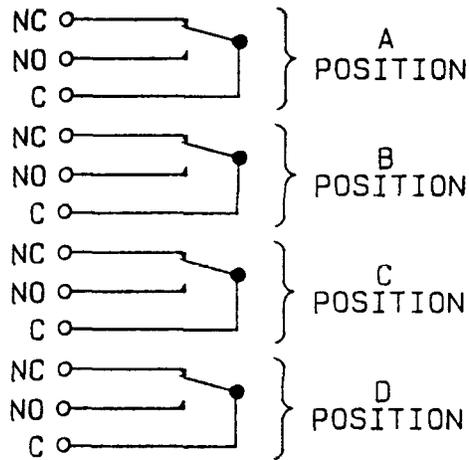
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerances are ± 0.010 (0.25 mm) for three place decimals and ± 0.03 (0.8 mm) for two place decimals.
4. Unit mounts in panels from .031 to .19 (0.79 to 4.8 mm) thick.
5. A spacer is supplied with each switch unit for MIL-P-7788 panel requirements.
6. Spacer to be used only for edge-light panels, discard otherwise.
7. Mounting sleeve shall not exceed .760 (19.30 mm) square and shall be reversible to accommodate edge-light panel spacer requirements.
8. Pushbutton is designed to prevent incorrect insertion into switch housing.
9. Exact shape of switch optional provided dimensions specified are not exceeded.
10. Terminal dimensions are not applicable to printed circuit board terminations.

FIGURE 3. Switch, dripproof sealed (type III).

LAMP CIRCUIT SCHEMATIC



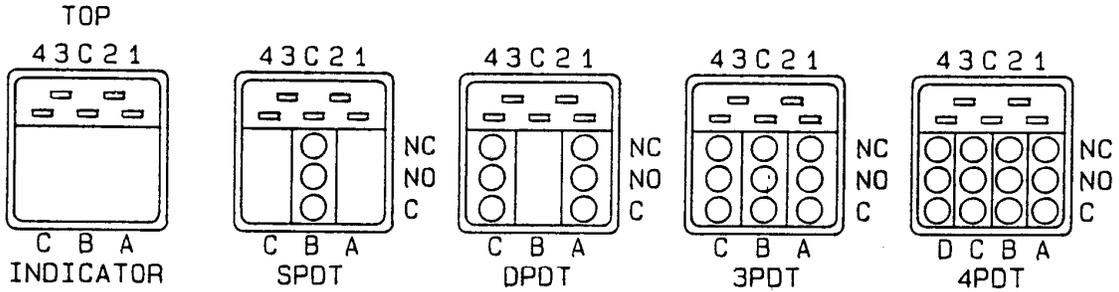
SWITCH CONTACT SCHEMATIC



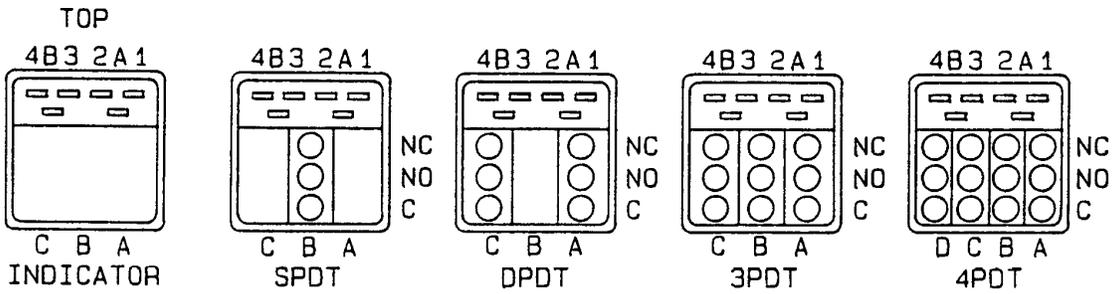
SWITCH POSITIONS 4PDT
(SHOWN FOR REFERENCE)

FIGURE 4. Switch and lamp circuit schematics and termination arrangements and identification.

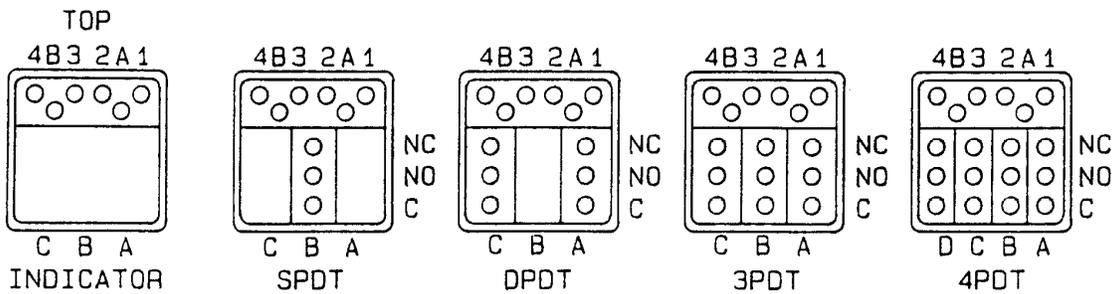
COMMON GROUND, SOLDER TERMINATIONS - REAR VIEWS



SPLIT GROUND, SOLDER TERMINATIONS - REAR VIEWS

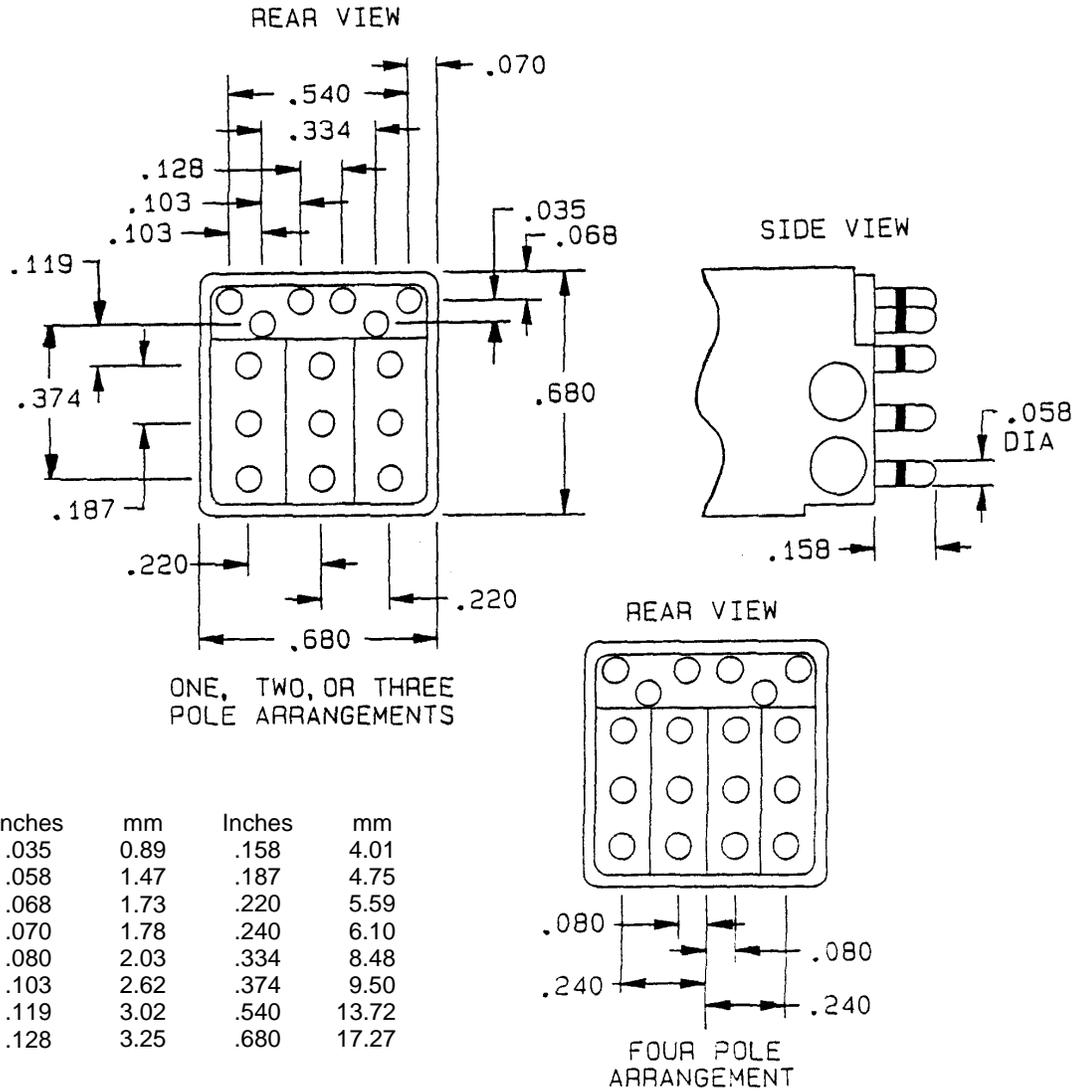


SPLIT GROUND, PC BOARD TERMINATIONS - REAR VIEWS



NOTE: Terminals and basic switch identification shall be permanently marked as shown.

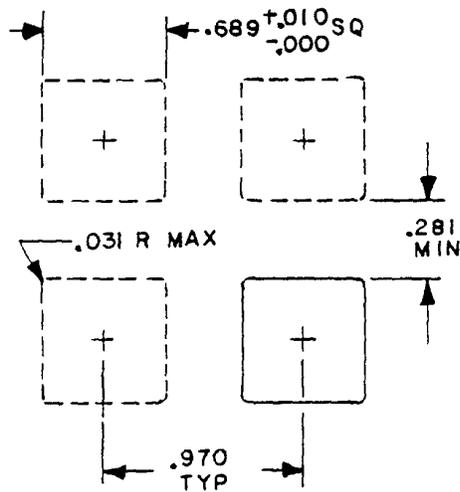
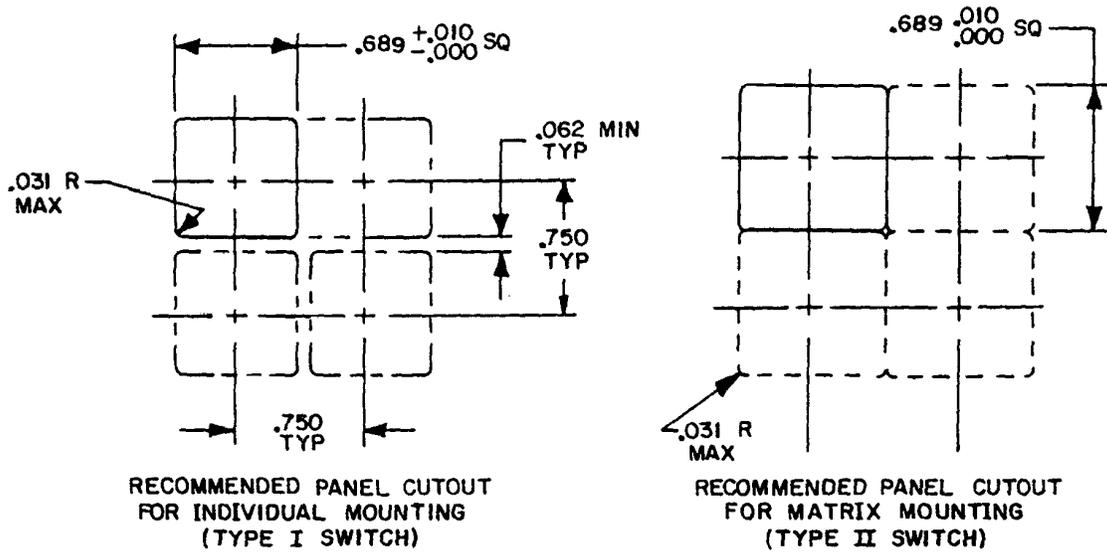
FIGURE 4. Switch and lamp circuit schematics and termination arrangements and identification - Continued.



NOTES:

1. Dimension are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is ± 0.010 (0.25 mm).
4. Terminal positions and dimensions for four pole arrangements are the same as for three pole arrangements except as specified.

FIGURE 5. Lamp and switch printed circuit pin terminal positions and dimensions.



Inches	mm
.010	0.25
.031	0.79
.062	1.57
.281	7.14
.689	17.50
.750	19.05
.970	24.64

NOTES:

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

FIGURE 6. Recommended panel cutouts.

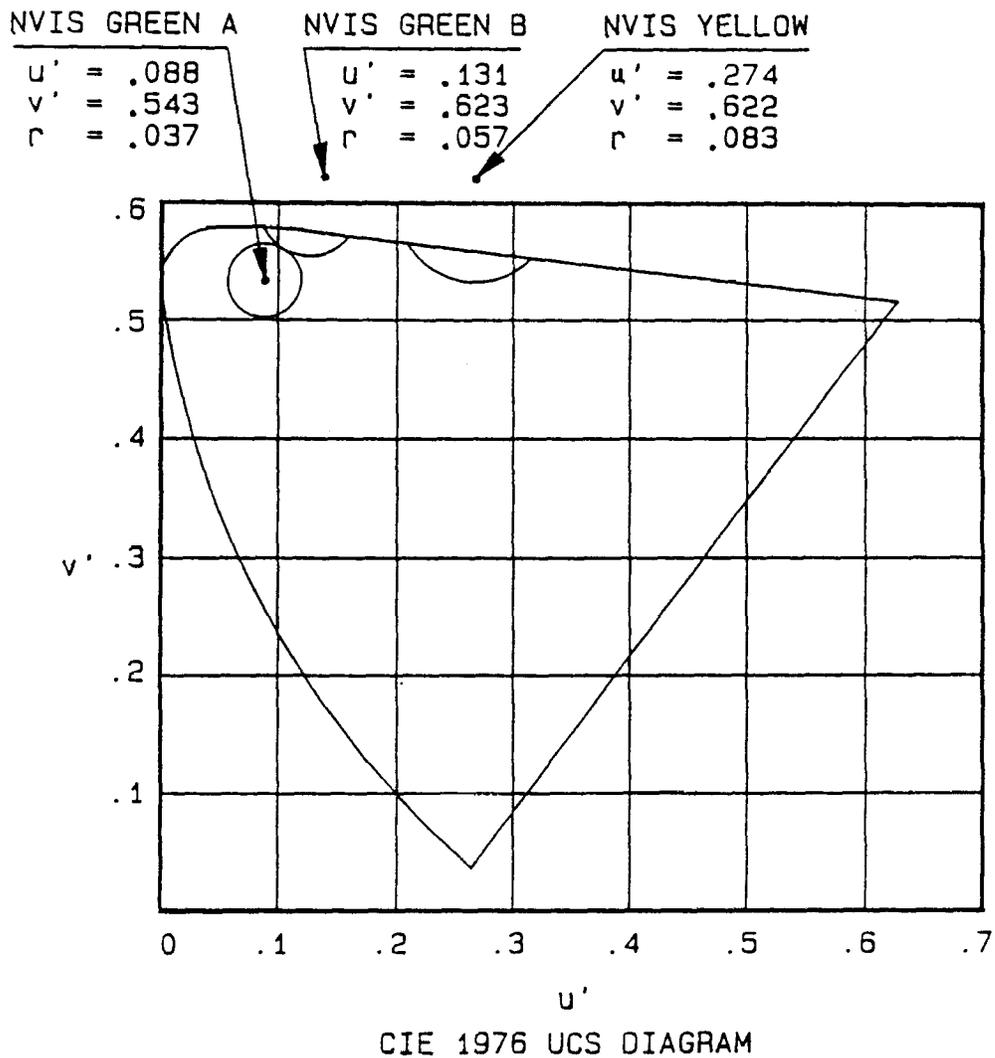


FIGURE 7. Color limits for NVIS night vision goggle compatible colors.

REQUIREMENTS:

Design and construction: See figures 1 through 6.

Complete switch shall consist of:

1 - Switch body: Includes category I or category II basic switches in accordance with MIL-S-8805/4 or/109. Type I bodies also include mounting sleeve and panel spacer. Type III bodies also include mounting sleeve, dripproof mounting flange and panel mounting spacer. EMI/RFI shielding is available when specified (see Part or Identifying Number (PIN)).

1 - Pushbutton: Includes display and lampholder. When specified, EMI/RFI shielding and night vision goggle compatibility are available (see PIN).

4 - Lamps: T-1 submidglet flanged base incandescent. Lamps are not supplied; order separately.

Enclosure design: 1 (unsealed) for types I and II.
2 (dripproof) for type III.

Temperature characteristic: 1 (-55°C to +85°C for types I and II).
2 (-46°C ±2°C to +85°C for type III).

Vibration grade: 2 (10-500 Hz).

Display type: S (sunlight readable, specularly reflective condition).
N (opaque background, visible legend).

Operating characteristics:

Actuation force: 2 to 5 pounds.

Actuation travel: .150 ±.031 inch.

Lens module extraction force: 2 to 5 pounds.

Moisture resistance: Following step 6 of the moisture resistance test, the insulation resistance measurement shall be not less than 5 megohms.

Dielectric withstanding voltage at reduced barometric pressure: Applicable.

Weight: 1.6 ounces maximum.

Contact resistance: Not applicable after electrical endurance, inductive load dc.

Electrical ratings: See table I.

Low level life: Applicable to gold contact switches, 25,000 cycles.

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Color and luminance: See tables II and III for display type S.
See tables IV and 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 $15^\circ \pm 2^\circ$ to the normal of the display viewing surface. The minimum average luminance contrast ratio of each lighted legend character to background shall be 0.6 minimum, except 0.4 minimum for blue and NVIS compatible colors. 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 minimum average shall have an absolute value equal to or less than 0.1. The minimum 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.

Visible legend (display type N):

Requirements: All legends shall be visible white with an opaque background. The legend characters shall always be visible in any light ambiance 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 tables IV and 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.

Night vision goggle (NVG) compatibility:

Requirements: The chrominance and luminance of the legend characters shall be compatible with NVIS (Night Vision Imaging System) goggles as specified in MIL-L-85762. The NVIS Green A color shall be within a circle where $u'_1 = .088$, $v'_1 = .543$ and the radius = .037 when the legend luminance is set at 0.1 foot-lamberts. The NVIS Green B color shall be within a circle where $u'_1 = .131$, $v'_1 = .623$ and the radius = .057 when the legend luminance is set at 0.1 foot-lamberts. The NVIS Yellow color shall be within a circle where $u'_1 = .274$, $v'_1 = .622$ and the radius = .083 when the legend luminance is set at 15.0 foot-lamberts. Formula 1 is solved for the radius r to confirm compliance for any of the three colors. See figure 7 for NVIS color limits.

The spectral radiance of the legend characters shall be compatible with NVIS goggles as specified in MIL-L-85762 where NVIS radiance (NR) is defined. The NVIS Green A spectral radiance output shall not exceed 1.7×10^{-10} NR for type I, class A and shall not exceed 1.6×10^{-10} NR for type II, class B goggles when the legend luminance is set at 0.1 foot-lamberts. The NVIS Green B spectral luminance shall not exceed 1.7×10^{-10} NR for type I, class A and shall not exceed 1.6×10^{-10} NR for type II, class B goggles when the legend luminance is set at 0.1 foot-lamberts. The NVIS Yellow spectral radiance output shall not exceed 1.5×10^{-7} NR nor be less than 5.0×10^{-8} NR for type I, class A goggles, and shall not exceed 1.4×10^{-7} NR for type II, class B goggles when the legend luminance is set at 15.0 foot lamberts.

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Test methods: The text procedure for measuring the NVIS Green A, NVIS Green B or the NVIS Yellow luminance and color shall be in accordance with MIL-L-85762. The test procedure for measuring the spectral radiance of the legend for either color shall be in accordance with MIL-L-85762.

$$(u' - u'_1)^2 + (v' - v'_1)^2 \leq r^2 \quad \text{Formula 1}$$

where:

- u', v' - - - - = 1976 UCS chromaticity coordinates of the test article.
- u'_1, v'_1 - - - = 1976 UCS chromaticity coordinates of the center point of the specified color area above.
- r - - - - - = radius of the allowable circular area on the 1976 UCS chromaticity diagram for the specified color.

When type S (sunlight readable) displays are required to be night vision goggle compatible, they shall meet the MIL-L-85762 minimum contrast requirement of 0.4 at rated voltage. Colors for type S (sunlight readable) night vision goggle compatible displays shall be NVIS Green B and NVIS Yellow (see table III). Colors for the type N (visible white) night vision goggle compatible displays shall be NVIS Green A and NVIS Green B (see table V).

TABLE I. Electrical ratings.

Contact material	Load	Sea level		50,000 feet
		28 V dc (amperes)	115 V ac, 60 Hz (amperes)	28 V dc (amperes)
Silver	Resistive	7	7	4
	Inductive	4	7	2.5
	Lamp	2.5	2	2.5
Gold	Resistive	1	---	1
	Inductive	0.5	---	0.5
Low level life applicable: 30 milli-volts maximum or peak ac at 10 milliamperes maximum.				

EMI shielding (when applicable):

Requirement: The EMI/RFI shielding attenuation shall be not less than 60 dB over the frequency range from 100 to 1000 MHz.

Test method: Switches shall be tested to determine the shielding effectiveness in accordance with MIL-PRF-22885.

Measurements are to be performed at the following frequencies:

Frequency	Minimum attenuation
100 MHz	60 dB
200 MHz	60 dB
400 MHz	60 dB
600 MHz	60 dB
800 MHz	60 dB
1000 MHz	60 dB

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

Color	Color code	X <u>1/</u>		Minimum average character luminance with or without EMI/RFI shielding
Red	R	.695	.285	150 foot-lamberts
		.710	SL <u>2/</u>	
		.655	.325	
		.660	SL <u>2/</u>	
Green	G	.300	SL <u>2/</u>	200 foot-lamberts
		.300	.600	
		.380	.600	
		.380	SL <u>2/</u>	
Yellow	Y	.562	.415	300 foot-lamberts
		.570	SL <u>2/</u>	
		.596	.382	
		.605	SL <u>2/</u>	
Blue	B	.230	.420	150 foot-lamberts
		.230	.350	
		.320	.350	
		.320	.420	
White	W	.400	.420	250 foot-lamberts
		.460	.420	
		.400	.380	
		.460	.380	

1/ The chromaticities of the colors are expressed as "X" and "Y" coordinates on the CIE chromaticity diagram and are within the limits bound by the coordinates listed for each color.

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

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

Color	Color code	u' <u>1/</u>	v' <u>1/</u>	r <u>1/</u>	Minimum average character luminance with or without EMI/RFI shielding
NVIS Green B	J	.131	.623	.057	200 foot-lamberts
NVIS Yellow	K	.274	.622	.083	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. the area enclosed by this circle intersecting the spectral locus is the envelope limiting the acceptable color space.

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

Color	Color code	x <u>1/</u>	y <u>1/</u>	Character luminance with or without EMI/RFI shielding
BLUE/ WHITE	V	.400 .460 .400 .460	.420 .420 .380 .380	0.5 to 3.0 foot-lamberts
RED	N	.695 .710 .655 .660	.285 SL <u>2/</u> .325 SL <u>2/</u>	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	u' ^{1/}	v' ^{1/}	r ^{1/}	Character luminance with or without EMI/RFI shielding
NVIS Green A	M	.088	.543	.037	0.5 to 3.0 foot-lamberts
NVIS Green B	L	.131	.623	.057	0.5 to 3.0 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 . The area enclosed by this circle intersecting the spectral locus is the envelope limiting the acceptable color space.

TABLE VI. Minimum contrast for sunlight readable displays (type S) with or without EMI/RFI shielding. ^{1/}

Color ^{2/}	Color code	Condition 1 ($\phi_1 = \phi_2 = 15^\circ\text{C}$)	Condition 2 ($\phi_1 = \phi_2 = 30^\circ\text{C}$)
		Contrast ratio	Contrast ratio
RED	R	0.6	0.2
GREEN	G	0.6	0.2
YELLOW	Y	0.6	0.3
BLUE	B	0.4	0.15
WHITE	W	0.6	0.15

^{1/} Minimum average contrast of each legend character.

^{2/} 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.

TABLE VIII. Switch type, lamp circuit, and termination codes.

Switch type	Lamp circuit	Termination	Code
TYPE I (Unsealed, individual mount)	Common ground	Solder	2
	Split ground	Solder	5
	Split ground	PCB pins	6
TYPE II (Unsealed, matrix mount)	Common ground	Solder	3
	Split ground	Solder	1
	Split ground	PCB pins	9
TYPE III (Sealed, individual mount)	Common ground	Solder	4
	Split ground	Solder	7
	Split ground	PCB pins	8

TABLE IX. Pushbutton action and EMI/RFI shielding efficiency codes.

Pushbutton action	Without EMI/RFI shielding	With EMI/RFI shielding
Momentary	1	4
Alternate	2	5
Indicator	3	6

TABLE X. Switch poles and contact material codes.

Switch poles	Contact material	
	Silver	Gold
SPDT	1	4
DPDT	2	5
3PDT	3	6
4PDT	P	R
Indicator	0	

TABLE XI. Lens module configuration codes.

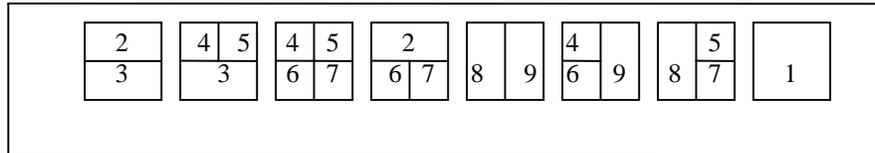
	Configurations							
								
Standard lighting designations	B	C	D	E	F	G	J	H
NVIS compatible designations	K	L	M	N	P	Q	R	S

TABLE XII. Lamp circuit and lens module style.

Lamp circuit	Without EMI/RFI option		With EMI/RFI option	
	Unsealed	Dripproof	Sealed	Dripproof
Common ground	1	2	L	M
Horizontal split ground	3	4	N	R
Vertical split ground	5	6	S	T

1/ Segment numbers are to be used to identify color and legend positions.

TABLE XIII. Lens module legend positions (for reference only). 1/



1/ Segment numbers are to be used to identify color and legend positions.

TABLE XIV. Lamp types usable in the lens modules (for reference only). 1/

Lamp type	MS number	Voltage	Current	MSCP	Life hours
1	---	5	.060	.15	6,500
2	---	5	.115	.15	40,000
3	---	12	.040	.15	16,000
4	---	14	.040	.15	16,000
5	---	18	.026	.15	10,000
6	MS-3338	28	0.24	.15	16,000

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

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TABLE XV. Part numbers for switch body only. (Inactive for new design).

M22885/90-(code letter shown below)							
Code letters			Circuit	Operation	Contract material	EMI shielding	
Type I	Type II	Type III					
A B C	G H J	N P Q	1PDT 2PDT 3PDT	Momentary Momentary Momentary	Silver Silver Silver	No No No	
D E F	K L M	R S T	1PDT 2PDT 3PDT	Alternate Alternate Alternate	Silver Silver Silver	No No No	
AA BA CA	GA HA JA	NA PA QA	1PDT 2PDT 3PDT	Momentary Momentary Momentary	Gold Gold Gold	No No No	
DA EA FA	KA LA MA	RA SA TA	1PDT 2PDT 3PDT	Alternate Alternate Alternate	Gold Gold Gold	No No No	
U	V	W	Indicator	---	---	No	
AB BB CB	GB HB JB	NB PB QB	1PDT 2PDT 3PDT	Momentary Momentary Momentary	Silver Silver Silver	Yes Yes Yes	
DB EB FB	KB LB MB	RB SB TB	1PDT 2PDT 3PDT	Alternate Alternate Alternate	Silver Silver Silver	Yes Yes Yes	
AC BC CC	GC HC JC	NC PC QC	1PDT 2PDT 3PDT	Momentary Momentary Momentary	Gold Gold Gold	Yes Yes Yes	
DC EC FC	KC LC MC	RC SC TC	1PDT 2PDT 3PDT	Alternate Alternate Alternate	Gold Gold Gold	Yes Yes Yes	
UB	VB	WB	Indicator	---	---	Yes	

1/ Part number codes are shown for switch body portion only. Lens modules, with required legends, dripproof seals, or EMI shielding shall be acquired separately from a source listed on the qualified products list. These parts are inactive for new design.

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Qualification inspection: See table XVI for group submission requirements.

TABLE XVI. Qualification inspection, group submission.

Test sample	Qualification inspection table of MIL-S-22885		Additional testing	Extent of approval <u>1/</u>
	Group	Number of samples		
M22885/90-75PER <u>2/</u>	I II III VI <u>2/</u> <u>4/</u> VII <u>5/</u> <u>6/</u> VIII <u>7/</u>	10 4 (from group I) 2 (from group I) 2 (from group I) 2 (from group I) 22 <u>7/</u>		Type III
M22885/90-213K1	I II VI <u>3/</u> <u>8/</u>	6 4 (from group I) 2 (from group I)		Type I <u>9/</u>
M22885/90-923B3			-2 samples- Visual and mechanical examination Solderability Terminal strength Shock Dielectric withstanding voltage Operating characteristics	Type II <u>9/</u>

- 1/ Includes gold and silver contact switches when the basic sensitive switches are qualified to MIL-S-8805/4 or /109, category I or category II.
- 2/ Part number M22885/90-75PNR is applicable for group VIII testing of NVIS compatible samples.
- 3/ Four T-1, 5 volt, 0.155 ampere or equivalent lamps shall be used in the lens module during group VI tests.
- 4/ Test inductive dc load only.
- 5/ Twenty five cycles of removal and reinstallation of the seal shall be made during the mechanical endurance test.
- 6/ Mechanical endurance with dripproof seal: 5000 cycles at -44°C to -48°C absolute minimum; 35,000 cycles at +25 ±2°C; 10,000 cycles at 85°C minimum. Cycling rate shall not exceed 18 cycles per minute.
- 7/ Twenty two lens modules only (with or without dripproof seal), two for each of eleven colors and display types shall be tested for color, luminance and sunlight readability where applicable. A single separate switch body shall be provided so that lens modules can be individually energized. NVIS color and NVIS radiance measurements shall be taken where applicable.
- 8/ Test resistive dc load only.
- 9/ When type III switches have been qualified.

Group A inspection: See table XVII.

TABLE XVII. Group A inspection.

Inspection
Seal (when applicable) <u>1/</u> Visual and mechanical examination Operating characteristic Dielectric withstanding voltage Contact resistance <u>2/</u> Sunlight readability <u>3/</u> NVIS compatibility <u>4/</u>

1/ External inspection only.

2/ Contact resistance measurements for gold contact switches shall be measured in accordance with switch contact resistance 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.

3/ 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.

4/ Test one switch each for NVIS green B and NVIS yellow in accordance with the requirements of 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.

Custodians:
 Army - CR
 Navy - EC
 Air Force - 85
 DLA - CC

Preparing activity:
 DLA - CC

Review activities:
 Army - AR, AV, MI
 Navy - AS, MC, OS, SH
 Air Force - 19, 99

(Project 5930-1689)