



MARINE POWER DISTRIBUTION

NAVY MOTOR CONTROLS & OPERATOR INTERFACES

OVER A CENTURY OF PROVIDING PROVEN
MOTOR CONTROL SOLUTIONS FOR
MARITIME APPLICATIONS

Exceptional Engineering, Proven Solutions.

Leonardo DRS combines exceptional engineering capability with a long history of successfully fielded products to deliver proven solutions. Our motor controllers, electronic motor operators and starters are the natural choice for critical applications specified for the U.S. Navy and other Maritime applications. MIL-STD naval specifications are only the start.

Leonardo DRS products are battle-tested and hardened, having proven themselves time and again, providing continuous, flawless operations in the harshest environments.

Leonardo DRS commands a 100+ year service record other providers can only envy: building and supporting motor controllers, starters and accessory products. Our products have been fielded on every U.S. Navy combatant since World War II.

Leonardo DRS products are also ever evolving as our company looks to future Navy needs, with innovative products.

Leonardo DRS delivers. As we develop innovations and improvements, we incorporate the very best ideas across product lines and through successive product iterations.

Leonardo DRS has the facilities to perform full qualification testing of our motor control products in our Wisconsin Facility.



PERFORMANCE



Our motor controller products are fielded on all U.S. surface and submarine vessels since World War II.

We provide a wide range of reliable motor control and variable speed drive offerings to our customers by leveraging our strong engineering capabilities, full understanding of applicable MIL-SPECS and experience gained from a history of successful products.

OUR CUSTOMER'S MANTRA IS OUR MANTRA – PRIDE, PURPOSE, PERFORMANCE.

PRIDE

Leonardo DRS has a rich history of providing robust equipment to the U.S. Navy and its international allies.

PURPOSE

Leonardo DRS' heritage of products reaches back to 1904, when it delivered its first motor controller products to the U.S. Navy. This heritage continues today into the U.S. Navy's new platforms.

PERFORMANCE

Leonardo DRS has demonstrated that it has the design capabilities and bench depth to meet the demanding needs of today's Navy. Leonardo DRS' extensive field service support and shipyard interaction has provided a unique perspective on product design.

Leonardo DRS Naval Power Systems

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PRIDE



PURPOSE



PERFORMANCE





CONTROLLERS & STARTERS

Controllers & Starters








STANDARD

TYPE 6922 AC/DC Manual Across-the-Line Starters

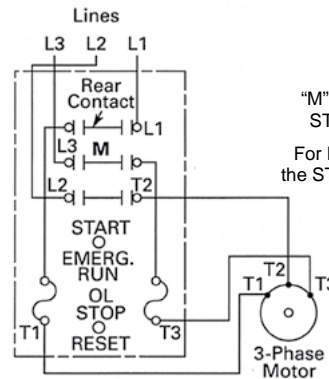


Starter in watertight enclosure

FEATURES

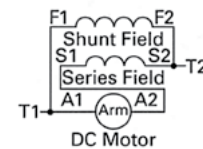
-  MIL-DTL-2212
-  50°C
-  DRIP-PROOF or WATERTIGHT
-  CONTINUOUS
-  MANUAL, LVR OPERATION
-  MOTOR STARTING
-  VOLTAGE RELEASE EFFECT
- THERMAL OVERLOAD PROTECTION
- AMBIENT COMPENSATION Change in rating does not exceed 5% for each 10°C change in ambient between 20°C and 70°C
- ADJUSTABLE 90 to 110%
- OVERLOAD HEATER COIL selection for 6922 on page 29.
- STARTERS do not include overload heater coils. Two required per controller.

TYPICAL WIRING DIAGRAM



To Reset Overload Mechanism, Press STOP-RESET Button After Heater Has Cooled

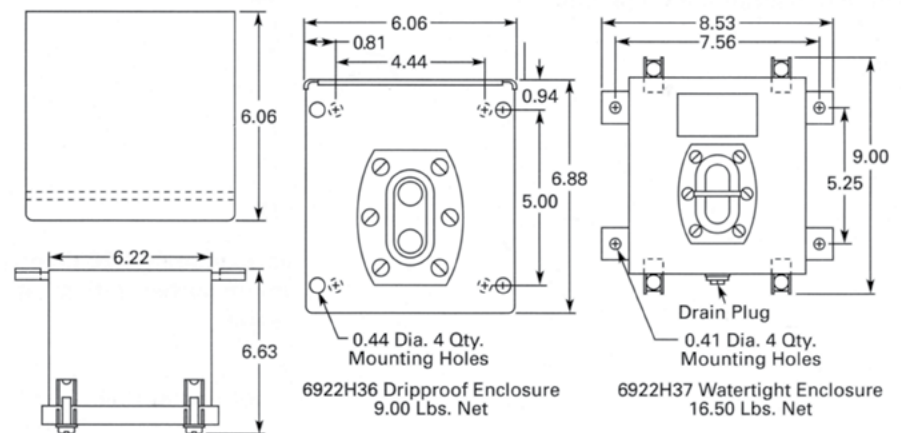
FRONT VIEW DIAGRAM



For Single-Phase or DC limit L3-T3 Connections (Only 1 Master Coil Used) Connect DC Motor as Shown

Max. HP	Starter			
	Drip-proof		Watertight	
440V 3-Phase	Catalog Number	lbs. Net	Catalog Number	lbs. Net
7.5	6922H36B	9.5	6922H37D	16.5

APPROXIMATE DIMENSIONS IN INCHES AND SHIPPING WEIGHTS

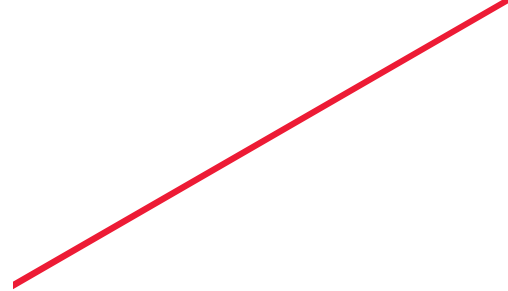


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TYPE 6922 AC or DC Manual Across-the-Line Starters

OVERLOAD HEATER COIL SELECTION FOR 6922

GENERAL

The 9104 Heater Coils listed at right are for use on Type 6922 Manual Starters.

AMBIENT COMPENSATION

Change in rating does not exceed 5% for each 10°C change in ambient between 20°C and 70°C.

HEATER SELECTION

For Navy standard motors rated 1.0 service factor, select a heater coil one or two sizes smaller.

Check that the motor operating current is below the ultimate tripping current of the heater coil, equal to approximately 1.2 times the minimum current listed in table.

Motor Amperes ❶		Catalog Number	Motor Amperes ❶		Catalog Number
Min.	Max.		Min.	Max.	
0.320	0.343	9104H3812	3.01	3.23	9104H3771
0.344	0.370	9104H3813	3.24	3.55	9104H3772
0.371	0.397	9104H3814	3.56	3.83	9104H3773
0.398	0.424	9104H3815	3.84	4.16	9104H3774
0.425	0.461	9104H3816	4.17	4.50	9104H3775
0.462	0.500	9104H3817	4.51	4.94	9104H3776
0.501	0.540	9104H3818	4.95	5.29	9104H3777
0.541	0.583	9104H3819	5.30	5.79	9104H3778
0.584	0.629	9104H3820	5.80	6.25	9104H3779
0.630	0.671	9104H3821	6.26	6.79	9104H3780
0.672	0.730	9104H3822	6.80	7.29	9104H3781
0.731	0.789	9104H3823	7.30	7.99	9104H3782
0.790	0.859	9104H3754	8.00	8.74	9104H3783
0.860	0.917	9104H3755	8.75	9.59	9104H3784
0.918	1.00	9104H3756	9.60	10.4	9104H3785
1.01	1.07	9104H3757	10.5	11.3	9104H3786
1.08	1.15	9104H3758	11.4	12.2	9104H3787
1.16	1.26	9104H3759	12.3	13.2	9104H3788
1.27	1.35	9104H3760	13.3	14.3	9104H3789
1.36	1.46	9104H3761	14.4	15.3	9104H3790
1.47	1.57	9104H3762	15.4	16.3	9104H3791
1.58	1.68	9104H3763	16.4	17.9	9104H3792
1.69	1.82	9104H3764	18.0	19.2	9104H3793
1.83	1.96	9104H3765	19.3	20.7	9104H3794
1.97	2.16	9104H3766	20.8	22.1	9104H3795
2.17	2.31	9104H3767	22.2	24.0	9104H3796
2.32	2.53	9104H3768	24.1	26.3	9104H3797
2.54	2.74	9104H3769	26.4	28.8	9104H3798
2.75	3.00	9104H3770			

❶ Based on starter in a maximum 50°C ambient.







Controllers & Starters

STANDARD (NON-ENGINEERED)

TYPE 6956 AC Magnetic Contactors– Enclosed



FEATURES

-  MIL-DTL-2212
-  CONTINUOUS
-  DRIP-PROOF
-  50°C
-  MAGNETIC, ACROSS-THE-LINE OPERATION
-  HEATER, LIGHTING, MAGNETIC, SOLENOID

HEATER LOADS (kW)

Size	115VAC	440VAC	
		Single-Phase	Three-Phase
1	3.1	11	20
2	5.1	19	34
3	10.3	39	68
4	15.5	58	100
5	31.0	118	205
5 SP	48.3	184	320

APPROXIMATE DIMENSIONS AND WEIGHTS

Size	Dimension in Inches			Weight lbs.
	Width	Height	Depth	
1	8.3	11.3	7.0	18
2	12.1	16.1	9.4	25
3	12.1	16.1	9.4	30
4	12.1	16.1	9.4	35

WHEN ORDERING SPECIFY

- Catalog or type number
- Specifications applying
- Voltage
- Horsepower rating
- Frequency
- Type of enclosure
- Full load motor current
- Local or remote master switch
- Scheme of operation (LVP or LVR)
- Non-automatic or automatic
- Application
- Type of motor with which starter will be used
- Any special contract requirements involving operation, construction, plans, packing, etc.

BASIC CONTROLLERS

APPROXIMATE DIMENSIONS AND WEIGHTS

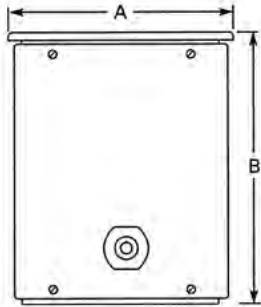
REMOTE CONTROL – 115VAC, 60Hz

Size	Max. Amps	Catalog Number
1	27	6956ED020365
2	45	6956ED02005255-01
3	90	6956ED02005255-02
4	135	6956ED02005255-03

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Controllers & Starters



Dripproof Enclosure Wraparound

APPROXIMATE DIMENSIONS AND WEIGHTS

Ref. Letter	Dimensions in Inches			Weight lbs.
	Width A	Height B	Depth C	
A	8.38	11.30	6.68	20
B	8.24	15.56	6.68	25
C	11.74	15.30	6.44	35
D	9.38	12.80	8.06	30
E	9.38	17.30	8.06	35
F	11.38	15.30	8.94	40
G	11.38	19.80	8.94	45
H	11.38	19.80	8.94	47
J	13.74	16.80	8.06	40

STANDARD (NON-ENGINEERED)

TYPE 6962H AC Motor Starters Single-Speed Non-Reversing

FEATURES

- MIL-DTL-2212
- 50°C
- DRIP-PROOF
- CONTINUOUS
- MOTOR STARTING, SINGLE SPEED, NON-REVERSING
- MAGNETIC, ACROSS-THE-LINE OPERATION
- THERMAL OVERLOAD PROTECTION HEATER COIL selection on page 29. Starters do not include overload heater coils. Two required per controller.

REMOTE CONTROL

WITH PROVISION FOR REMOTE START/STOP PUSHBUTTON (LVP) OR ON/OFF SELECTOR SWITCH (LVR)

Size	Remote START/STOP Pushbutton (LVP)			Remote ON/OFF Selector Switch (LVR)		Dim. Ref.
	Catalog Number			Catalog Number		
	Without Additional Features	With Provisions for		Without Additional Features	With Prov. for Remote Emergency Run	
		Remote Protective Device	Remote Emergency Run			

WITHOUT INDICATING LIGHT (1 PILOT CIRCUIT FUSE)

1	6962H154A2	6962H154A6	6962H154A3	6962H154A4	6962H154A5	B
2	6962H161A2	6962H161A4	6962H161A3	6962H161A7	6962H161A8	E
3	6962H170A2	6962H170A4	6962H170A3	6962H171A2	6962H171A3	G
4	6962H178A2	6962H178A4	6962H178A3	6962H179A2	6962H179A3	H

WITH PROVISION FOR INDICATING LIGHT (3 PILOT CIRCUIT FUSES)

1	6962H155A2	—	6962H155A3	6962H155A4	6962H155A5	B
2	6962H163A2	—	6962H163A3	6962H163A4	6962H163A5	E
3	6962H172A2	—	6962H172A3	6962H173A2	6962H173A3	G
4	6962H180A2	—	6962H180A3	6962H181A2	6962H181A3	H

LOCAL CONTROL

WITH START/STOP PUSHBUTTON (LVP) OR ON/OFF SELECTOR SWITCH (LVR) – 440V – 60 Hz

Size	START/STOP Pushbutton in Cover (LVP)								ON/OFF Selector Switch in Cover (LVR) with Local Emergency Run		START/STOP Pushbutton and MAN/AUTO Selector Switch in Cover (LVP) with Provisions for Remote 2-Wire Automatic Device	
	Without Additional Features		With Local Emergency Run		With Provisions for							
	Catalog Number	Dim. Ref.	Catalog Number	Dim. Ref.	Remote Pushbuttons (1 Pilot Fuse)		Remote Safety Switch (1 Pilot Fuse)		Catalog Number	Dim. Ref.	Catalog Number	Dim. Ref.

WITHOUT INDICATING LIGHT

1	6962H156A2	A	6962H157A2	A	6962H159A2	B	6962H159A3	B	6962H158A2	B	6962H160A2	C
2	6962H165A2	D	6962H166A2	D	6962H168A2	E	6962H168A3	E	6962H167A2	E	6962H169A2	J
3	6962H174A2	F	6962H175A2	F	6962H177A2	G	6962H177A3	G	6962H176A2	G	—	—
4	6962H182A2	H	6962H183A2	H	6962H185A2	H	6962H185A3	H	6962H184A2	H	—	—

Controllers & Starters









STANDARD AND ENGINEERED

AC Magnetic Starters— General Data



6962ED

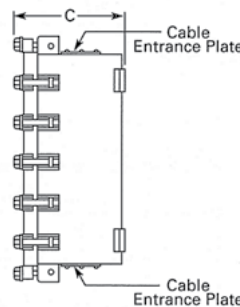
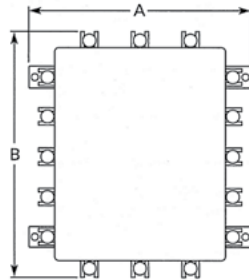
FEATURES

-  MIL-DTL-2212
-  50°C
-  DRIP-PROOF WATERTIGHT
-  CONTINUOUS
-  **OPTIONAL**
by separate emergency RUN button
-  MAGNETIC, ACROSS-THE-LINE OPERATION
-  TYPE 6962 Motor starting, non-reversing
TYPE 6963 Motor starting, reversing
TYPE 6966 Reduced voltage motor starting
TYPE 6967 Motor starting and speed selection
TYPE 6968 Motor starting, reversing two-speed
TYPE 6999 Custom
-  **OVERLOAD PROTECTION**
Thermal or Electronic

CONTROLLER SIZE RATINGS

Navy Starter Size	Main Contactor
	Enclosed Ampere Rating
0	18
1	27
2	45
3	90
4	135
5	270
5 SP	420
6	540

APPROXIMATE DIMENSIONS AND SHIPPING WEIGHTS – WATERTIGHT



Controller Size	Watertight Enclosure ①				Shipping Weight lbs.
	Dimensions in Inches				
	Width A	Height B	Depth C		

TYPE 6962 NON-REVERSING

0	9.5	19.0	7	34
1	9.5	19.0	7	35
2	13.5	19.0	9	52
3	Contact Factory			
4				
5				
5 SP				
6				

① Dimensions and weights shown are for the base controller only. The addition of optional features will affect the size and weight.

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Controllers & Starters

STANDARD (NON-ENGINEERED) TYPE 6967H Non-Reversing Two-Speed AC Motor Starters

LOCAL CONTROL – FAST/SLOW/STOP (440VAC)

Size	Maximum Horsepower	Catalog Number		
		Local FAST/SLOW/STOP Only	With Provisions for	
			Remote FAST/SLOW/STOP	Remote FAST/SLOW/STOP and MOTOR RUN Lights ❶ and Remote EM-START/EM-STOP
1	10	6967H21A2	–	–
2	25	6967H28A2	6967H26A2	6967H27A2

REMOTE CONTROL ONLY (440VAC)

Size	Maximum Horsepower	Catalog Number	
		With Provisions for	
		Remote FAST/SLOW/STOP	Remote FAST/SLOW/STOP and MOTOR RUN Lights ❶ and Remote EM-START/EM-STOP
1	10	6967H21A2	–
2	25	6967H28A2	6967H29A2

❶ Motor run light for each speed.

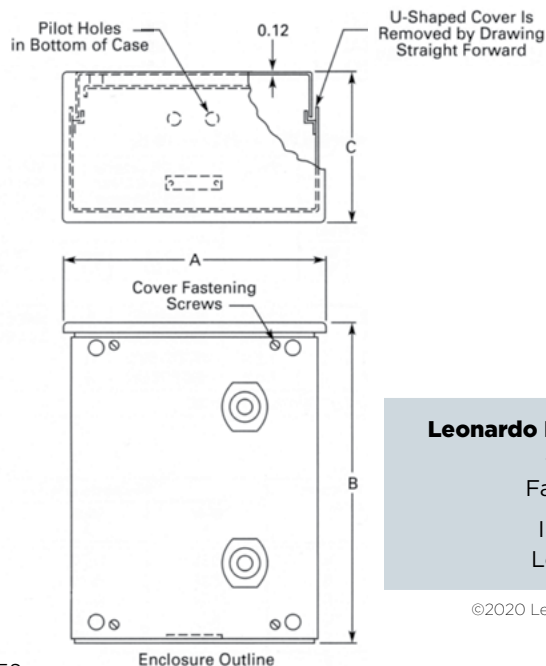
APPROXIMATE DIMENSIONS AND WEIGHTS

Size	Dimensions in Inches			Weight lbs.
	Width A	Height B	Depth C	
1	11.8	15.3	6.5	32
2	13.8	16.8	8.1	47

HORSEPOWER RATINGS – 60 Hz, STANDARD EFFICIENCY MOTOR

TYPES 6967, 6968 TWO SPEED ACROSS-THE-LINE

Navy Starter Size	Maximum Horsepower	
	440V, 3-Phase	
	Constant or Variable Torque	Constant Horsepower
1	10	7-1/2
2	25	20
3	50	40
4	100	75



FEATURES

- MIL-DTL-2212
- 50°C
- DRIP-PROOF
- CONTINUOUS
- MAGNETIC, ACROSS-THE-LINE OPERATION
- MOTOR STARTING, TWO-SPEED, TWO-WINDING
- THERMAL OVERLOAD PROTECTION
HEATER COIL selection on page 29.
Starters do not include overload heater coils.
Four required per controller.

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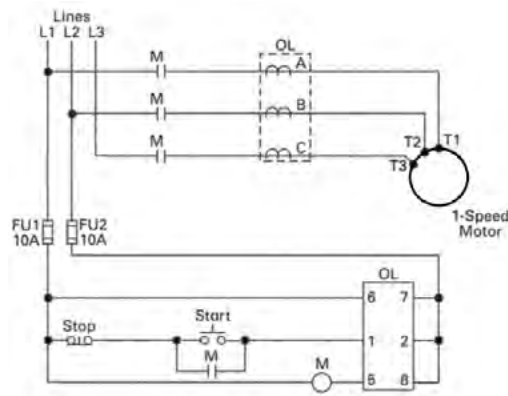
Controllers & Starters

ENGINEERED AC MAGNETIC STARTERS TYPE 6962 Non-Reversing Single-Speed

FEATURES

-  MIL-DTL-2212
-  50°C
-  DRIP-PROOF, WATERTIGHT, OTHER
-  CONTINUOUS
-  MAGNETIC, ACROSS-THE-LINE OPERATION
-  MOTOR STARTING, SINGLE SPEED
-  OVERLOAD PROTECTION
Thermal or Electronic

TYPICAL WIRING DIAGRAM

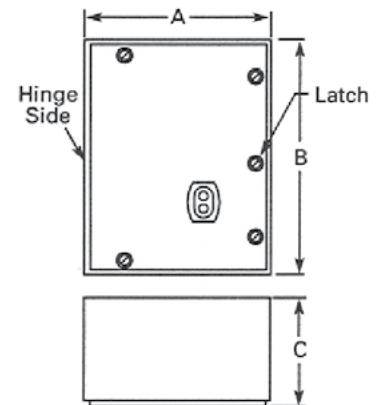


APPROXIMATE DIMENSIONS AND WEIGHTS

Controller Size	Drip-proof Enclosure ①			Shipping Weight lbs.
	Dimensions in Inches			
	Width A	Height B	Depth C	

TYPE 6962 NON-REVERSING

0	12.1	18.1	9.5	35
1	12.1	18.1	9.5	35
2	12.1	18.1	9.5	35
3	14.1	18.1	9.5	45
4	14.1	18.1	9.5	51
5	22.1	28.1	11.5	120
5 SP 6	Contact Factory			



MAXIMUM HORSEPOWER RATINGS

Navy Starter Size	Maximum Horsepower	
	115V, 1-Phase	440V, 3-Phase
0	—	5
1	2	10
2	3	25
3	7-1/2	50
4	—	100
5	—	200
5 SP	—	375
6	—	400

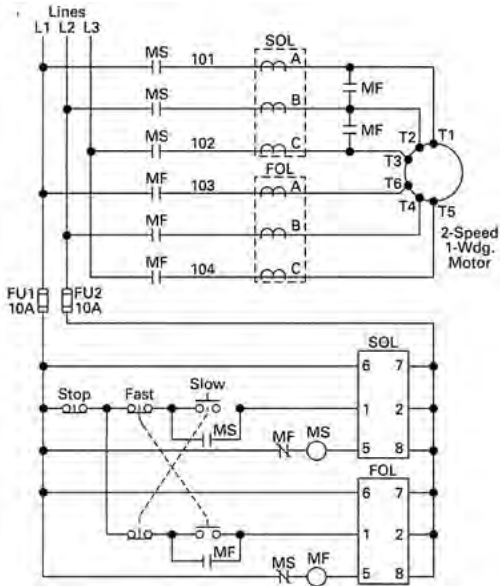
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Controllers & Starters

ENGINEERED AC MAGNETIC STARTERS TYPE 6967 Non-Reversing Two-Speed

TYPICAL WIRING DIAGRAM



FEATURES

-  MIL-DTL-2212
-  50°C
-  DRIP-PROOF, WATERTIGHT, OTHER
-  CONTINUOUS
-  MAGNETIC, ACROSS-THE-LINE OPERATION
-  MOTOR STARTING, TWO-SPEED
-  OVERLOAD PROTECTION Thermal or Electronic

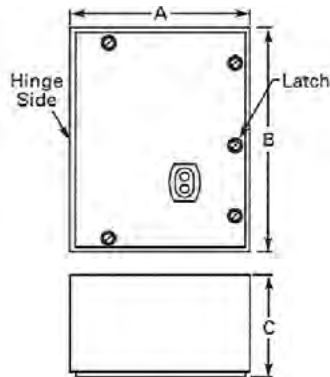
APPROXIMATE DIMENSIONS AND WEIGHTS

Size	Dimensions in Inches			Weight lbs.
	Width A	Height B	Depth C	

NON-REVERSING - DRIP-PROOF

1	14.1	18.13	9.38	45
2	16.1	20.13	9.38	55
3	18.1	22.13	9.38	73
4	18.1	22.13	9.38	85
5	Contact Factory			

Watertight weight, typically 50% greater than waterproof. Dimensions increase by approx. 5 inches in height and width.



MAXIMUM HORSEPOWER RATINGS

Size	Maximum Horsepower 440V, 3-Phase, 60 Hz	
	Constant or Variable Torque	Constant Horsepower
1	10	7-1/2
2	25	20
3	50	40
4	100	75
5	200	150

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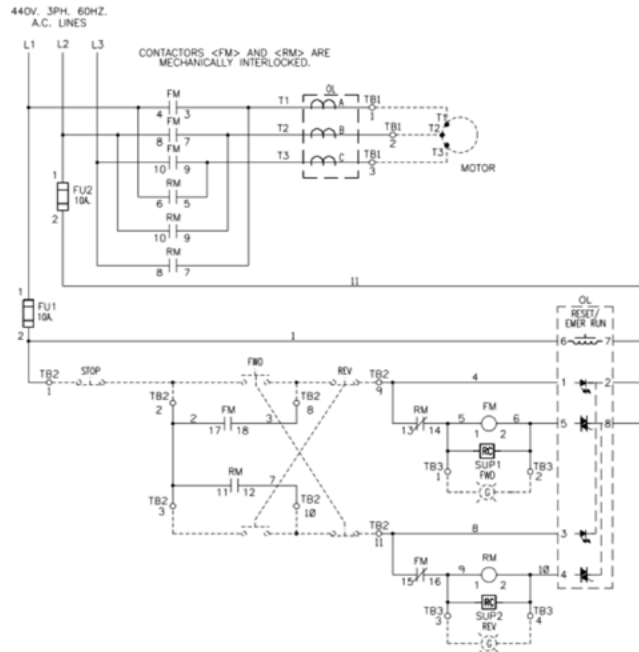
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Controllers & Starters

ENGINEERED AC MAGNETIC STARTERS

TYPE 6963 Reversing Single-Speed

TYPICAL WIRING DIAGRAM



FEATURES

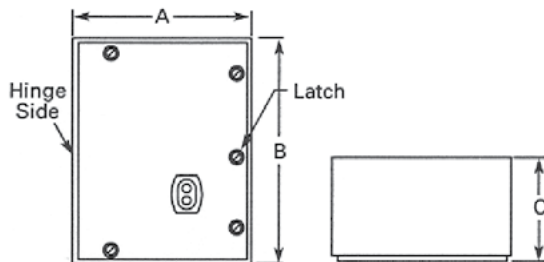
- MIL-DTL-2212
- 50°C
- DRIP-PROOF, WATERTIGHT, OTHER
- CONTINUOUS
- MAGNETIC, ACROSS-THE-LINE OPERATION
- MOTOR STARTING, SINGLE SPEED
- OVERLOAD PROTECTION
Thermal or Electronic

APPROXIMATE DIMENSIONS AND WEIGHTS

Controller Size	Drip-proof Enclosure ①			
	Dimensions in Inches			Shipping Weight lbs.
	Width A	Height B	Depth C	

TYPE 6963 REVERSING

1	14.1	18.0	9.5	35
2	16.1	20.0	9.5	47
3	18.1	22.1	9.5	65
4	18.1	22.1	9.5	75



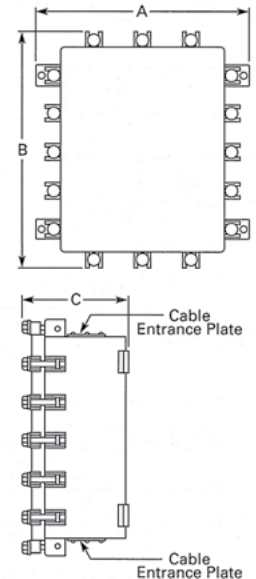
APPROXIMATE DIMENSIONS AND WEIGHTS – WATERTIGHT

Controller Size	Watertight Enclosure ①			
	Dimensions in Inches			Shipping Weight lbs.
	Width A	Height B	Depth C	

TYPE 6963 REVERSING

1	13.28	21.13	9	50
2	15.38	21.13	9	60
3	Contact Factory			
4				

① Dimensions and weights shown are for the base controller only. The addition of optional features will affect the size and weight.



MAXIMUM HORSEPOWER RATINGS

Navy Starter Size	Maximum Horsepower	
	115V, 1-Phase	440V, 3-Phase
0	—	5
1	2	10
2	3	25
3	7-1/2	50
4	—	100
5	—	200
5 SP	—	375
6	—	400

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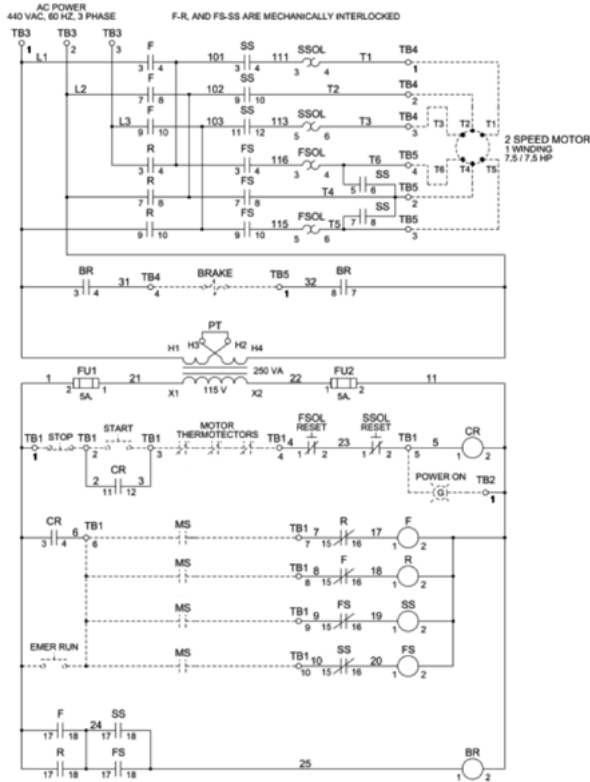
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Controllers & Starters

ENGINEERED AC MAGNETIC STARTERS TYPE 6968 Reversing Two-Speed

TYPICAL WIRING DIAGRAM



FEATURES

-  MIL-DTL-2212
-  50°C
-  DRIP-PROOF, WATERTIGHT, OTHER
-  CONTINUOUS
-  MAGNETIC, ACROSS-THE-LINE OPERATION
-  MOTOR STARTING, TWO-SPEED
-  OVERLOAD PROTECTION
Thermal or Electronic

APPROXIMATE DIMENSIONS AND WEIGHTS

Size	Dimensions in Inches			Weight lbs.
	Width A	Height B	Depth C	

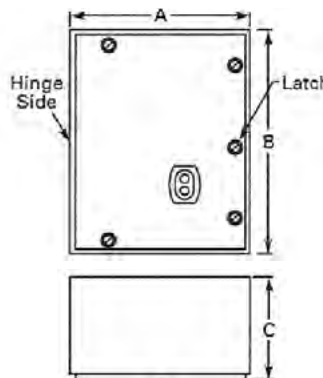
REVERSING - DRIP-PROOF

1	16	20	9	60
2	16	24	9	79
3	22	28	9	132
4	22	32	9	141
5	Contact Factory			

Watertight weight, typically 50% greater than waterproof.
Dimensions increase by approx. 5 inches in height and width.

MAXIMUM HORSEPOWER RATINGS

Size	Maximum Horsepower 440V, 3-Phase, 60 Hz	
	Constant or Variable Torque	Constant Horsepower
1	10	7-1/2
2	25	20
3	50	40
4	100	75
5	200	150



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Controllers & Starters

ENGINEERED AC MAGNETIC STARTERS

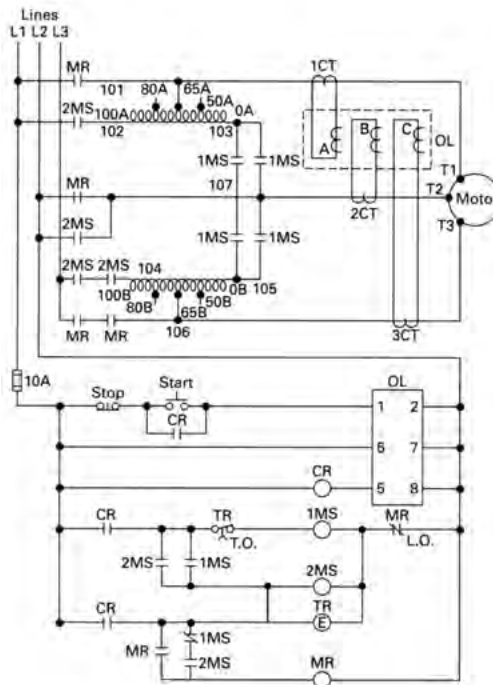
TYPE 6966

Engineered AC Magnetic Starters

FEATURES

-  MIL-DTL-2212
-  50°C
-  DRIP-PROOF
-  CONTINUOUS
-  MAGNETIC, REDUCED VOLTAGE AUTO-TRANSFORMER OPERATION
-  MOTOR STARTING
-  OVERLOAD PROTECTION
Thermal or Electronic

TYPICAL WIRING DIAGRAM



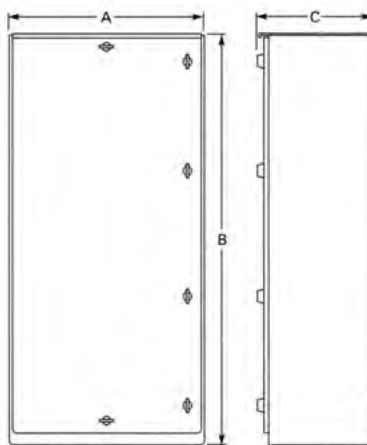
Contactors MR and 1MS are Mechanically Interlocked.
Relay CR Added to Get Active Control with N2000.
Size A OL Used Here.

HORSEPOWER RATINGS – 60 Hz, STANDARD EFFICIENCY MOTOR

TYPE 6966 REDUCED VOLTAGE
AUTOTRANSFORMER

Navy Starter Size	Maximum Horsepower	
	115VAC	440V
2	7-1/2	25
3	15	50
4	25	100
5	50	200
5 SP	—	375
6	—	400

APPROXIMATE DIMENSIONS AND WEIGHTS – TYPE 6966-1



Size	Dimensions in Inches			Weight lbs.
	Width A	Height B	Depth C	

DRIP-PROOF ENCLOSURE

1	20.1	42	14	190
2	20.1	42	14	200
3	20.1	42	14	300
4	26	60	24	700
5	32	84	28	1275
6	34	90	30	1700

Size 4, 5 and 6 Deck Mounted
(Bottom Open for Cable Entry)

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Controllers & Starters

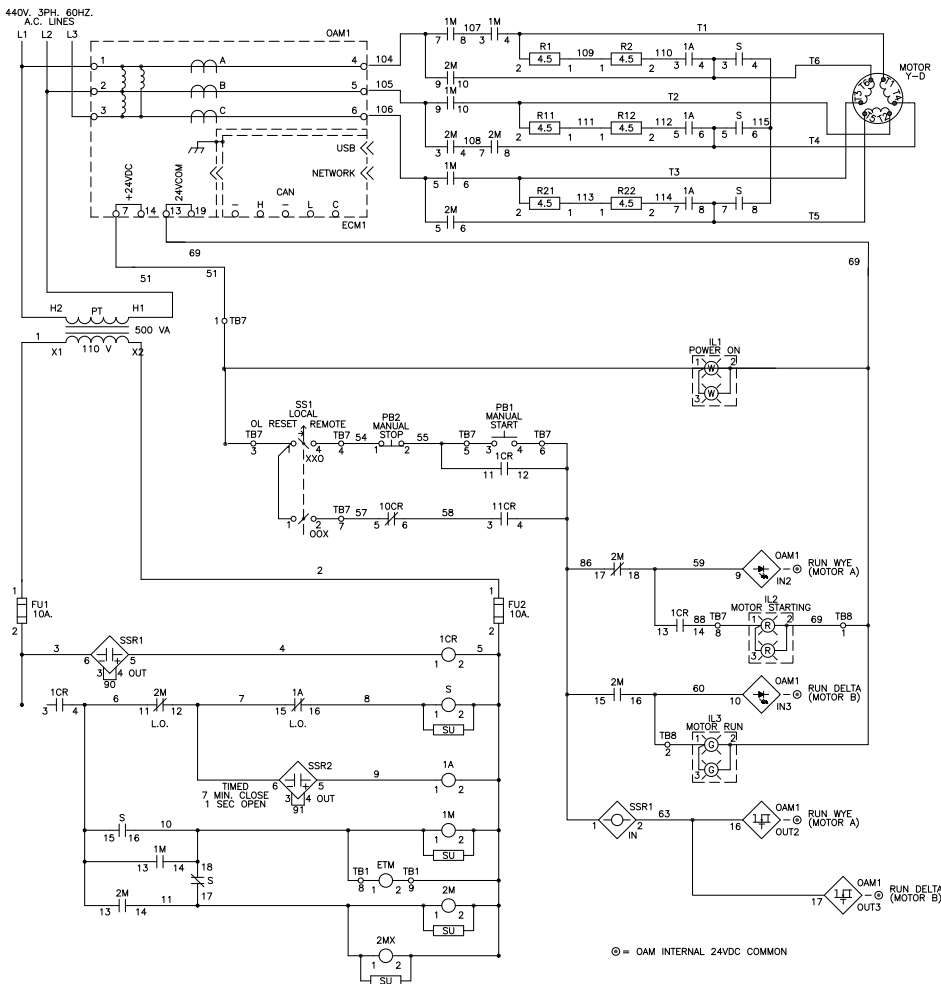
ENGINEERED AC MAGNETIC STARTERS TYPE 6999

Engineered AC Magnetic Starters and Controls

FEATURES

-  MIL-DTL-2212
-  50°C
-  DRIP-PROOF
-  CONTINUOUS
-  MAGNETIC, ACROSS-THE-LINE OR REDUCED VOLTAGE
-  MOTOR STARTING or CONTROL | WYE-DELTA | AUTOMATIC BUS TRANSFER
-  OVERLOAD PROTECTION
Thermal or Electronic

EXAMPLE DIAGRAM



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PRIDE




PURPOSE



PERFORMANCE





**CONTROLLER
& STARTER
COMPONENTS**

Navy Electronic Motor Operator (NEMO)

The Navy Electronic Motor Operator (NEMO), comprised of an Electronic Control Module (ECM), an Overload Application Module (OAM), and a Switch Module (SWM), answers the call for modern ship specifications requiring cost-effective and flexible control applications. NEMO products meet the latest MIL-DTL-2212 specification, contain required cyber security features, and are designed to withstand rugged maritime conditions for the life of the ship. Fielded on the latest U.S. Navy ships for motor control, HVAC control, and ABT control.

NEMO integrates control, motor protection, power monitoring, local and network operable I/O, and network communication qualified to MIL-DTL-2212. The LED display provides operating status, diagnostic and fault information. Two parameter sets allow one module to protect the fast and slow speed windings of a motor or to energize/de-energize two separate loads. All interfaces to the main power are galvanically isolated to ensure the integrity of the main bus, isolation to the network, and the safety of the operator.

FEATURES

- Selectable network communication
- Certified PROFIBUS wired or fiber optic
- RS-485
- Four character LED display for status
- Supplies operator safe 24 VDC I/O
- Pluggable control terminals
- Stud terminals for main power
- Galvanic isolation to power lines
- 5 inputs for control/monitoring
- 4 outputs for control/timing/alarm
- Local CAN network for I/O expansion - disabled when not in use
- Dual parameter sets allow two-speed, reverser control with one overload
- Field configurable control via mini USB port
- Configuration parameters shall only be changed from configuration port by authorized users
- Passwords must be changed from default
- Two user privilege levels: User and Admin
- Upgradable firmware - requires special tools and some disassembly
- MTBF - 188,000 Hrs at 40°C

POWER CHARACTERISTICS

Supply voltage	440 VAC
Optional	115 VAC
Supply frequency	60 Hz
Supply isolation (1 minute).....	2500 VAC
Current sensing.....	0.5 to 30 Arms
Optional	1.2 to 150 Arms

CONTROL CHARACTERISTICS

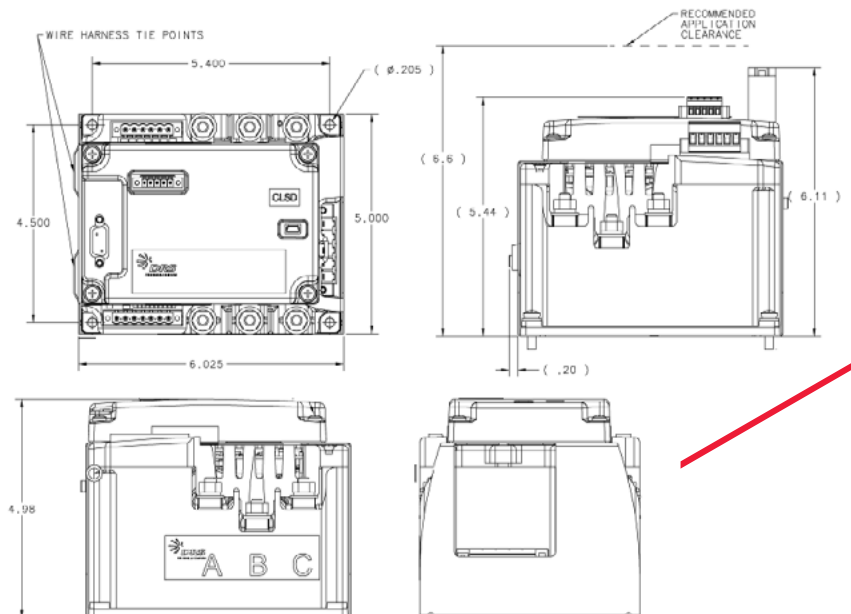
I/O power supply voltage	24 VDC
I/O power supply capacity.....	20 W
Input on state voltage	17 to 36 VDC
Input on state burden.....	17 mADC
Input isolation to chassis.....	500 VDC
Output voltage.....	36 VDC maximum
Output load current	100 mA maximum
Output leakage current	0.1 mA
Voltage drop	0.15 VDC Max
Output isolation to chassis.....	500 VDC

PHYSICAL CHARACTERISTICS

Four corner mounting holes.....	0.3 inch (0.8 cm) thick base
Weight.....	7.7 lbs. (3498 g)

RELATED DOCUMENTATION

NEMO operation manual.....	MC-007067/01
NEMO engineering configuration tool manual	MC-002410/23
Switch module application manual.....	MC-007055



Controller & Starter Components










NEMO is a product enhancement of our existing N2000 and N2001 products.

Navy Electronic Motor Operator (NEMO)

NAVY ELECTRONIC MOTOR OPERATOR (NEMO) APPLICATION MODELS

Application	Full Load Current (A)	Control Power Connection	Control Voltage	Assembly Part Number
Overload	0.5-30	Internal	440V	MC-009557-01
		External	440V	MC-009557-07
	115V		MC-009557-05	
	1.2-150	Internal	115V	MC-009557-04
		External	440V	MC-009557-08
	115V		MC-009557-06	
HVAC Control	0.5-30	Internal	440V	MC-009557-02
HVAC Monitoring	0.5-30	Internal	440V	MC-009557-03
Bus Transfer Switch	0.5-30	External	115	MC-009557-09
MC-009557-6	MC-009557-7	MC-009557-8	MC-009557-9	MC-009557-10

FEATURES

-  MIL-DTL-2212
-  -20 - 65°C
-  OPEN
-  95% NON-CONDENSING
-  ELECTRONIC Local/Automatic/Reset
-  AC MOTOR OVERLOAD, COMMUNICATION & CONTROL
-  PASSWORD REQUIRED TO CONFIGURE
Network Configuration Prohibited

NEMO APPLICATION MODULE (OAM)

Full Load Current (A)	Control Power Connection	Control Voltage	Part Number
0.5-30	Internal	440V	MC-001682-01
1.2-150			MC-001682-02
0.5-30	External	115V	MC-001682-03
1.2-150			MC-001682-04
0.5-30		440V	MC-001682-05
1.2-150			MC-001682-06

NEMO ELECTRONIC CONTROL MODULE (ECM)

Module Function	Protocol	Physical Communication	Part Number
Motor Overload	PROFIBUS	Wired Serial Bus	MC-001683-01
Motor Overload w/HVAC Control	PROFIBUS	Wired Serial Bus	MC-001683-02
Motor Overload w/HVAC Monitoring	PROFIBUS	Wired Serial Bus	MC-001683-03
Motor Overload	PROFIBUS	Fiber Optic	MC-001683-04
Automatic Bus Transfer	RS-485	Wired Serial Bus	MC-004520-01
Bus Transfer Switch	RS-485	Wired Serial Bus	MC-004520-02

SWITCH MODULE (SWM) - part number MC-001684-01, see page 47 for more details.

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Controller & Starter Components








TYPE 6957ED104 Navy Electronic Overload Relay- N2000



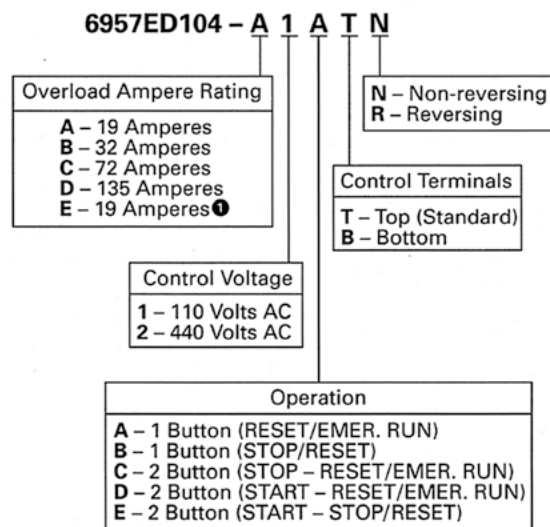
N2000

A more capable and upgraded product is the NEMO found on pages 22-23.

FEATURES

-  MIL-DTL-2212
-  0-65°C
-  OPEN
-  95% NON-CONDENSING
-  ELECTRONIC
Local-Automatic-Reset
-  AC MOTOR OVERLOAD
-  N2000HHP
REQUIRED TO CONFIGURE

CATALOG NUMBER FORMAT – N2000 OVERLOAD RELAY



① Used with external 500:5 current transformers for Size 5 and 5S applications.
 NOTE: This Size E device will not drive a Size 5 or 5S coil at 110 volts.
 Use only with 440 volt contactor coils.

Hand Held Programmer shown on page 32.

The N2000 Overload Relay is a solid-state overload relay designed to protect a motor against excessive heavy loads.

The N2000 is available in five current ranges:

- | | |
|---|---|
| <ul style="list-style-type: none"> • Size A.....(0.25 to 18A) • Size B.....(9 to 32A) • Size C.....(16 to 72A) • Size D.....(31 to 135A) • Size E.....(135A and above - requires external CTs) | <ul style="list-style-type: none"> • Motor trip current setting (no heater coils required) • Separate trip curves available for standard, high efficiency and high inertia motors • Phase-loss protection • Phase-unbalance protection • JAM protection • Auto-rest • Undercurrent trip • Emergency run |
|---|---|

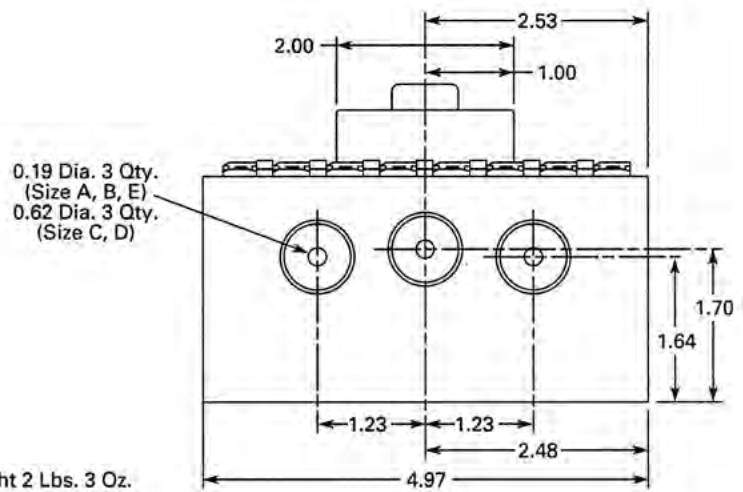
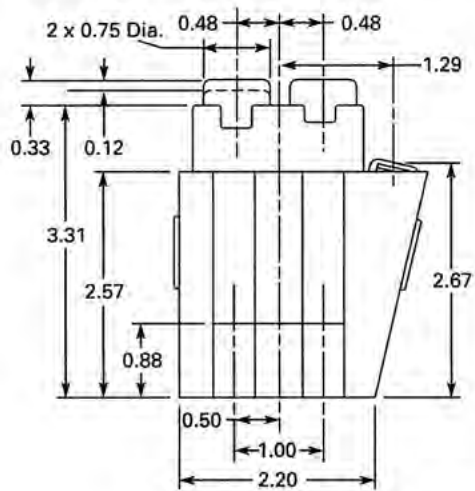
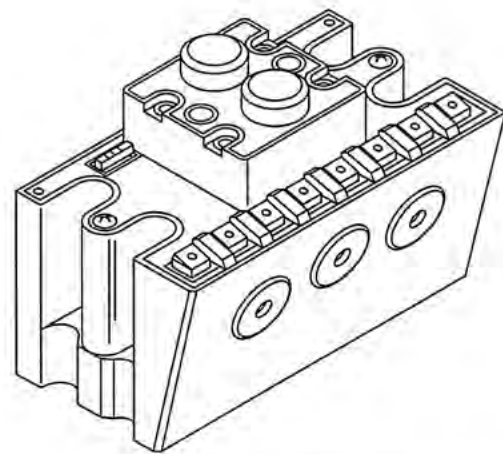
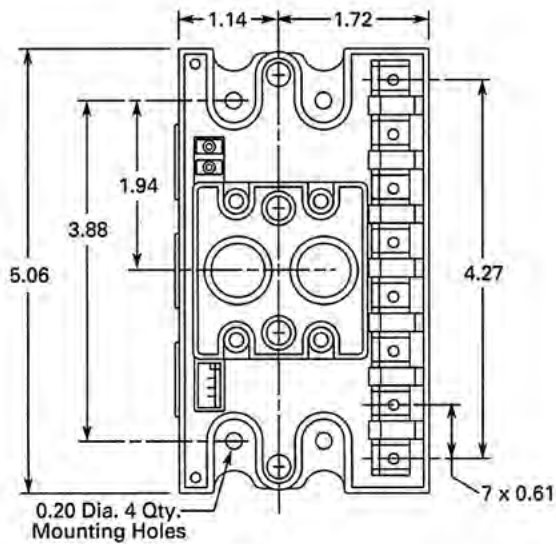
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TYPE 6957ED104 Navy Electronic Overload Relay-N2000

APPROXIMATE DIMENSIONS IN INCHES



Net Weight 2 Lbs. 3 Oz.

Controller & Starter Components








TYPE 6991ED27 Navy Communication Module-N2001



N2001

A more capable and upgraded product is the NEMO found on pages 22-23.

FEATURES

-  MIL-DTL-2212
-  0-65°C
-  OPEN
-  95% NON-CONDENSING
-  ELECTRONIC
-  NETWORK COMMUNICATION FOR N2000
 - PROFIBUS DP, Slave Copper
 - MODBUS RTU, Slave Copper
 - Network Disable Function
 - Low Voltage Release Function
-  N2001 CONFIGURATION TOOL REQUIRED

GENERAL

The N2001 Navy Communication Module (NCM) connects the N2000 Navy Electronic Overload Relay (NEOLR) to a Profibus or Modbus-RTU communication network. The NCM is designed to mount under the NEOLR on a controller panel. A receptacle on the top of the NCM connects directly into a plug on the bottom of the NEOLR. The NCM and NEOLR provide users with the ability to control and monitor the controller operation. The NCM also includes independent discrete inputs and outputs that can be monitored and controlled over the network.

INPUT POWER

Voltage	115V AC or 440V AC, +10% -20% (model dependent)
Frequency	60 Hz ±3%
Burden	10 VA

AUXILIARY INPUT

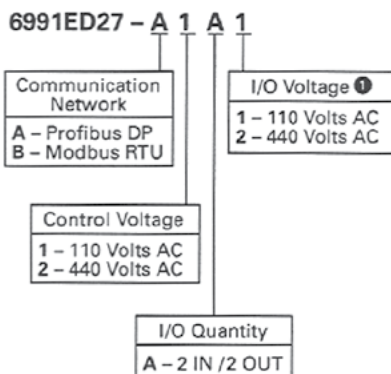
Voltage	115V AC or 440V AC, +10% -20% (model dependent)
Frequency	60 Hz ±3%
Burden	2.7 mA @115V AC, 5 mA @ 440V AC
Turn ON delay	32 milliseconds
Turn OFF delay	32 milliseconds
Turn ON level	92V AC minimum for 115V AC 352V AC minimum for 440V AC
Turn OFF level	12V AC maximum for 115V AC 44V AC maximum for 440V AC
Withstand voltage	1880V AC for 1 minute

AUXILIARY OUTPUT

Output circuit has two triacs in series.

Voltage	115V AC or 440V AC, +10% -20% (model dependent)
Frequency	60 Hz ±3%
Continuous rating	200 mA
Holding current	20 mA minimum
OFF leakage current	5 mA maximum
Inrush ratio	14A for 100 ms
Turn ON delay	32 milliseconds
Turn OFF delay	32 milliseconds
Withstand voltage	1880V AC for 1 minute

CATALOG NUMBER FORMAT – N2001 COMMUNICATION MODULE



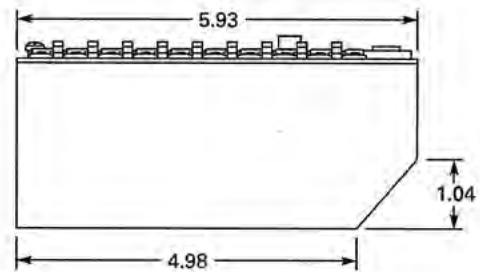
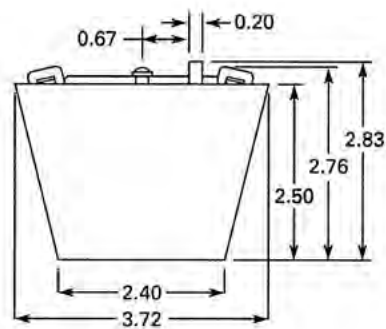
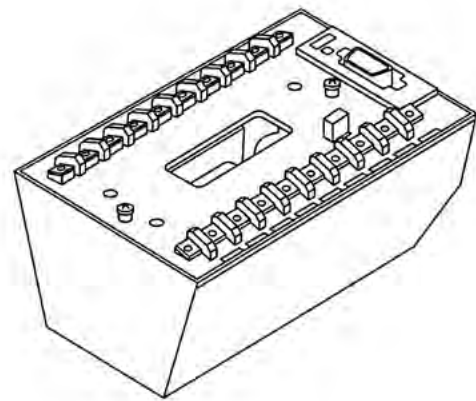
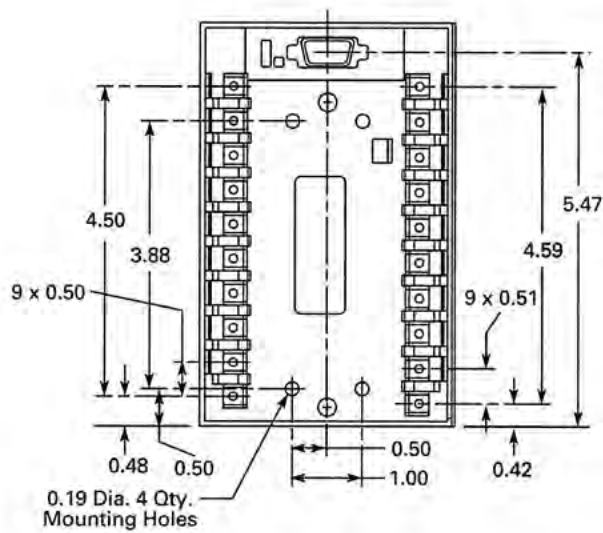
❶ I/O Voltage must be the same as the Control Voltage.

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TYPE 6991ED27 Navy Communication Module

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHT



Net Weight 2 Lbs. 14 oz.








Controller & Starter Components

TYPE 6957 AC Navy Overload Relay- N750



6957ED14-1A

FEATURES

-  MIL-DTL-2212
-  65°C
-  OPEN
-  INTERMITTENT
-  EUTECTIC ALLOY HEATER COIL CURRENTS
Manual Magnetic Reset
-  AC MOTOR OVERLOAD
Monitors Two Phases | Current Range .5 to 100A
-  CONTACT FACTORY FOR REMOTE SOLENOID RESET OPTION.
 - Starting reactors bypass
 - Current transformers

OVERLOAD RELAYS

Number of Buttons	Terminal Rating Amperes	Markings	Catalog Number
-------------------	-------------------------	----------	----------------

STANDARD DEVICES

1	50 100	RESET	6957ED14-1A 6957ED14-6A
	50 100	RESET ❶	6957ED14-26A 6957ED14-36A
	50 100	RESET ❷	6957ED14-24A 6957ED14-25A
2	50 100	STOP – RESET	6957ED14-27A 6957ED14-34A
	50 100	START – STOP/RESET	6957ED14-2A 6957ED14-7A
	50 100	EM. RUN – STOP/RESET	6957ED14-4A 6957ED14-9A
3	50 100	START – RESET	6957ED14-5A 6957ED14-10A
	50 100	EM RUN – START – STOP/RESET	6957ED14-3A 6957ED14-8A

❶ Device has a Form C contact alarm circuit. Consult factory for application.

❷ Device supplied with extra terminals.

REPLACEMENT OPERATOR BOOTS

Number of Buttons	Boot Part Number
1	32-17
2	32-251
3	32-20

APPROXIMATE DIMENSIONS IN INCHES

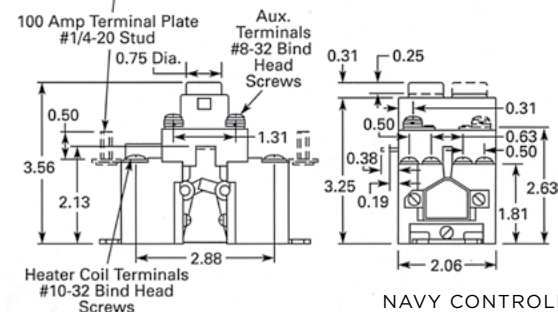
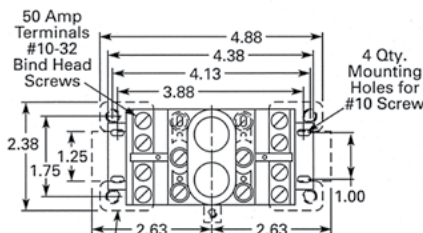
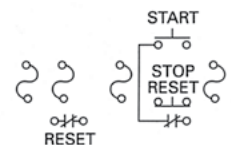


DIAGRAM SYMBOLS



Approximate Weight
1.0 lbs.

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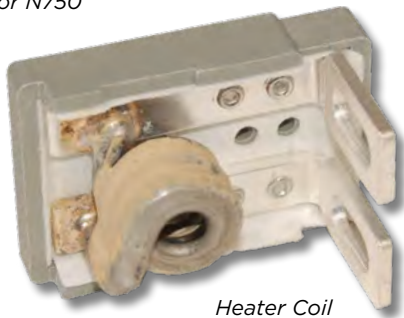
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TYPE 9104 AC Heater Coils

Overload Heater Coils
for N750



GENERAL

The 9104 Heater Coils listed at right are for use on the following AC Magnetic Starters with the N750 Overload Relay:

- 6262.....6963
- 6966.....6967
- 6968.....6999

HEATER SELECTION

For Navy standard motors rated 1.0 service factor, select a heater coil one or two sizes smaller.

Check that the motor operating current is below the ultimate tripping current of the heater coil, equal to approximately 1.2 times the minimum current listed in table.

FOR SIZE 1-3 CONTROLLER

Motor Amperes ¹		Catalog Number ²	Motor Amperes ¹		Catalog Number ²	Motor Amperes ¹		Catalog Number ²
Min.	Max.		Min.	Max.		Min.	Max.	
0.5	0.53	H3815	3.53	3.79	H3934	22.5	24.1	H3958
0.54	0.57	H3816	3.8	4.06	H3935	24.2	26.1	H3959
0.59	0.63	H3817	4.07	4.36	H3936	26.2	28.4	H3960
0.66	0.69	H3818	4.37	4.74	H3937	28.5	30.7	H3961
0.7	0.74	H3819	4.75	5.14	H3938	30.8	33.1	H3962
0.817	0.866	H3915	5.15	5.56	H3939	33.2	35.9	H3963
0.867	0.941	H3916	5.57	6.04	H3940	36	38.7	H3964
0.942	1.01	H3917	6.05	6.51	H3941	38.8	42.2	H3965
1.02	1.1	H3918	6.52	6.99	H3942	42.3	45.8	H3966
1.11	1.17	H3919	7	7.55	H3943	45.9	49.2	H3967
1.18	1.28	H3920	7.56	8.15	H3944	49.3	53	H3968
1.29	1.39	H3921	8.16	8.74	H3945	53.1	57.6	H3969
1.4	1.51	H3922	8.75	9.57	H3946	57.7	61.8	H3970
1.52	1.6	H3923	9.58	10.2	H3947	61.9	67.3	H3971
1.61	1.75	H3924	10.3	11.2	H3948	67.4	72.4	H3972
1.76	1.88	H3925	11.3	12.1	H3949	72.5	78.7	H3973
1.89	2.05	H3926	12.2	13	H3950	78.8	84.9	H3974
2.06	2.21	H3927	13.1	14	H3951	85	91.6	H4078
2.22	2.38	H3928	14.1	15.1	H3952	91.7	99.9	H4079
2.39	2.59	H3929	15.2	16.3	H3953			
2.6	2.77	H3930	16.4	17.8	H3954			
2.78	2.96	H3931	17.9	19.2	H3955			
2.97	3.24	H3932	19.3	20.8	H3956			
3.25	3.52	H3933	20.9	22.4	H3957			

FOR CONTROLLER WITH CURRENT TRANSFORMERS

Size 3 and 4 For use with 30.9:1 Transformer			Sizes 5 and 5 SP For Use With 62:1 Transformer			Size 6 For use with 120:1 Transformer		
Motor Amperes ¹		Catalog Number ²	Motor Amperes ¹		Catalog Number ²	Motor Amperes ¹		Catalog Number ²
Min.	Max.		Min.	Max.		Min.	Max.	
53.2	57.1	H3925	84.3	91.5	H3922	227	246	H3926
57.2	62.1	H3926	91.6	97.4	H3923	247	265	H3927
62.2	66.9	H3927	97.5	105	H3924	266	285	H3928
67	72.2	H3928	106	113	H3925	286	311	H3929
72.3	78.4	H3929	114	123	H3926	312	332	H3930
78.5	83.1	H3930	124	135	H3927	333	355	H3931
83.2	89.1	H3931	136	145	H3928	356	389	H3932
89.2	97.4	H3932	146	156	H3929	390	422	H3933
97.5	105	H3933	157	167	H3930	423	455	H3934
106	113	H3934	168	177	H3931	456	487	H3935
114	121	H3935	178	193	H3932	488	523	H3936
122	130	H3936	194	203	H3933	524	569	H3937
131	141	H3937	204	223	H3934			
142	153	H3938	224	240	H3935			
			241	257	H3936			
			258	279	H3937			
			280	303	H3938			
			304	328	H3939			
			329	362	H3940			
			363	390	H3941			
			391	419	H3942			
			420	453	H3943			

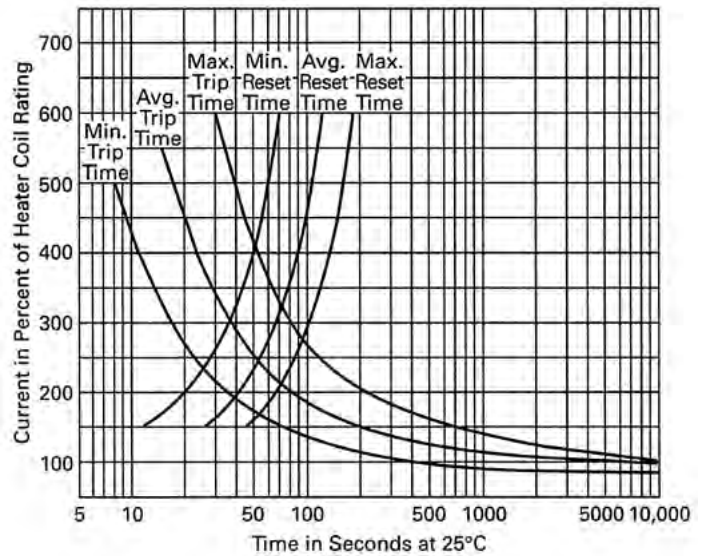
¹ Based on relay inside a controller and all in a 50°C ambient.
² Catalog number must have a 9104 prefix to be complete. Example: 9104H3945. Each catalog number above covers one heater coil only. Two are required for a three-phase application.

AC Navy Overload Relay

TRIP ADJUSTABILITY

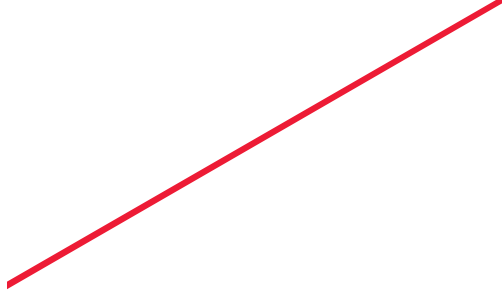
The relay may be adjusted to trip at a value between 90 and 110 percent of the rated coil current. Loosening the binding screws that hold the relay heater coil and moving the heater coil out away from the relay will increase the value of current required to trip the relay. Moving the heater coil assembly in will decrease the value of current required to trip the relay. Serrations on the terminal plates and on the underside of the slotted brackets of the heater coil assembly securely lock the heater coil in position when the binding head screws are tightened.

TRIP CURVES



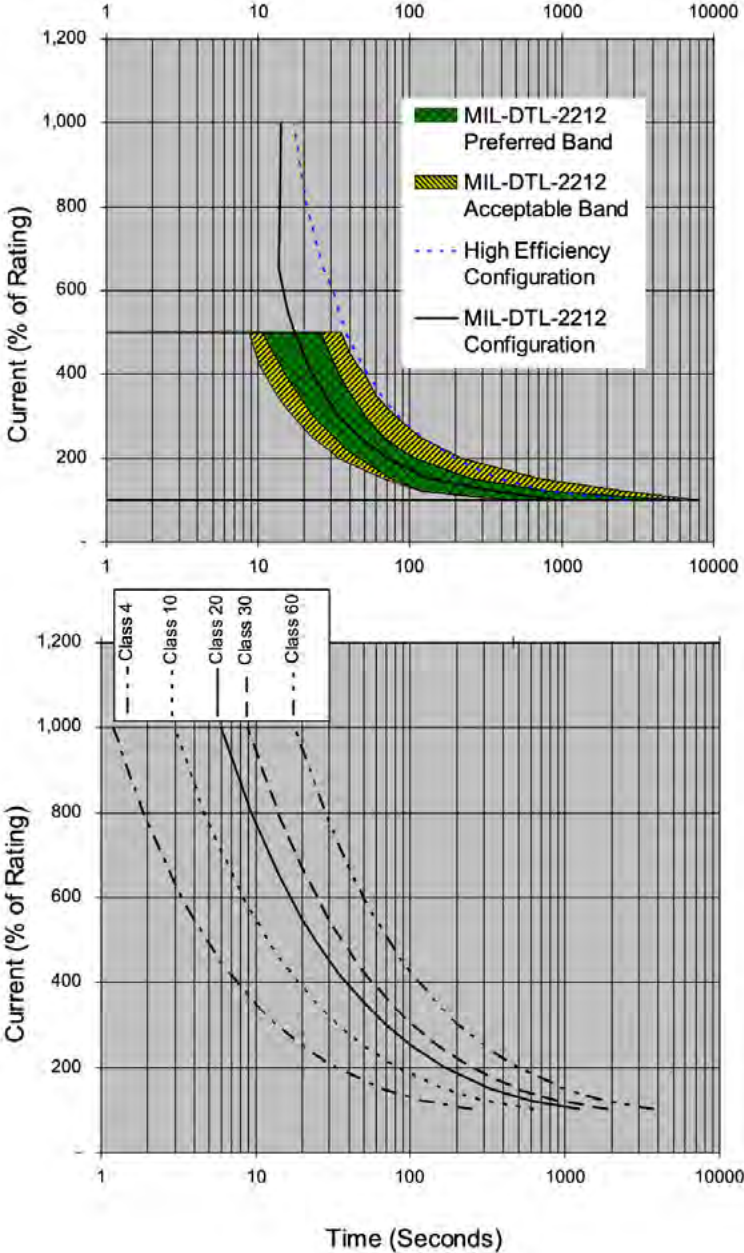
OVERLOAD TRIP CLASS AVAILABILITY

Trip Class	N750	N2000	NEMO
MIL-DTL-2212	Yes	Default	Default
NEMA 4	—	Minimum	Minimum
NEMA 60	—	Maximum	Maximum
High Efficiency	—	Yes	Yes
Custom	—	—	Yes



AC Navy Overload Relay Thermal Trip Curves

THERMAL OVERLOAD TIME-CURRENT CHARACTERISTICS










Controller & Starter Components

TYPE N2000HHP N2000 Hand Held Programmer



N2000HHP

FEATURES

-  COTS
-  0-50°C
-  GENERAL
-  95% RH NON-CONDENSING
-  ELECTRONIC Local Operation
-  N2000 DEDICATED USE
-  N2000 PARAMETER CONFIGURATION

GENERAL

The N2000 Hand Held Programmer (N2000HHP) is designed to facilitate the setup of the N2000 Overload Relay. The N2000 Overload Relay family contains configurable motor protection and control. The N2000HHP is able to access and modify all of the configurable parameters of the N2000 Overload Relay. These parameters may be accessed directly via the function select keys, or indirectly by means of stored setups.

The N2000HHP supports 20 customer definable setups. In addition to the configuration functions, the N2000HHP also supports diagnostic and monitoring functions such as start/stop and current display. The N2000HHP is designed to power the N2000 Overload Relay for configuration when the N2000 Overload Relay is not energized.

SPECIFICATIONS

RATINGS

- Recharger power supply110/220V AC, 50/60 Hz, requirements 9V DC, 300 mA
- Operating and storage temperature..... 0-50°C ambient, 95% RH non-condensing
- Battery requirements..... 4 AA 60 mAh NiCd rechargeable batteries

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Controller & Starter Components



Adapter Kit

TYPE 6999ED1866A N2001 Configuration Tool

GENERAL

The Profibus Configuration Tool configures, operates, monitors and manages both the N2001 Profibus Communication Module (a N2000 Overload Relay) via the N2001 a Profibus port using a ProfiNet adapter. The Configuration Tool can read, revise and save configurable parameters via a standard 100 Mbit Ethernet port of a users computer.

Profibus Configuration Tool includes:

- (1) Instruction Manual and Adapter Driver (CD)
- (1) ProfiNet to Profibus Adapter
- (1) Ethernet Cable (10 ft.)

FEATURES



COTS



0-40°C



GENERAL



95% RH
NON-CONDENSING



ELECTRONIC
Local Operation



N2000
DEDICATED USE



N2001 PARAMETER CONFIGURATION
N2000 PARAMETER CONFIGURATION

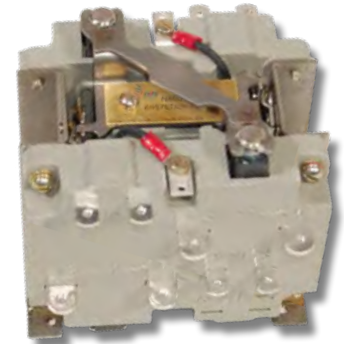
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Controller & Starter Components



6957ED25-1C

TYPE 6957 AC Contactors N850/N851-Size 1 N1291-Size 0

FEATURES

-  MIL-DTL-2212
-  65°C
-  OPEN
-  CONTINUOUS
-  MAGNETIC OPERATION
-  AC MOTOR STARTING
-  AC HEATER/LIGHTING

ELECTRICAL DATA (ENCLOSED)

	N850	N851	N1291
Number of Poles	4	5	3
Ampere Rating	27	27/13.5	18
Horsepower Rating - 440V, 3-Phase, 60 Hz	10	10	5
Maximum Break - Amperes at 484V, 40% PF	162	162	108
No. of Interlocks - Hi-Shock NO	2	2	1
NC	2	1	—

INTERLOCK CONTACT

	Amperes		
	Make	Break	Continuous
440V AC	6	1	15
115VAC AC	15	1	15

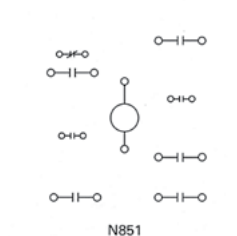
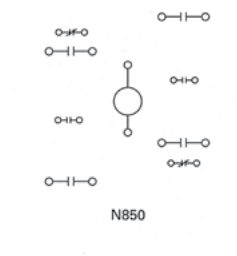
COIL DATA - 60 Hz (ALL DEVICES)

		440V	115VAC
Inrush	Amperes	0.46	1.84
	Watts	170	170
	VA	200	200
Sealed	Amperes	0.04	0.16
	Watts	5.4	5.4
	VA	17.8	17.8

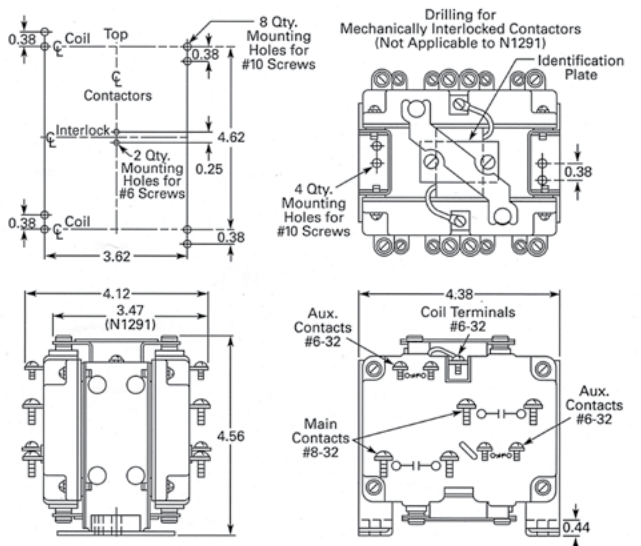
CONTACTOR WEIGHT

	N850	N851	N1291
lbs.	3.1	3.1	3.0

DIAGRAM SYMBOLS



APPROXIMATE DIMENSIONS IN INCHES



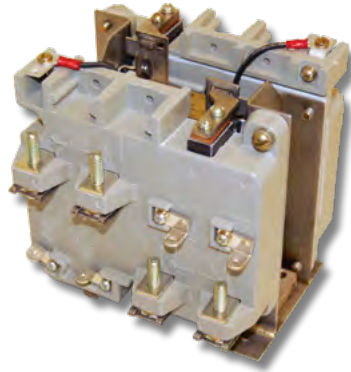
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Controller & Starter Components



6957ED29-2A

TYPE 6957 AC Contactors N894/N895- Size 2

ELECTRICAL DATA (ENCLOSED)

	N894	N895
Number of Poles	4	5
Ampere Rating	45	45/22.5
Horsepower Rating - 440V, 3-Phase, 60 Hz	25	25
Maximum Break - Amperes at 484V, 40% PF	270	270
No. of Interlocks - Hi-Shock NO	2	1
NC	2	2

INTERLOCK CONTACT

	Amperes		
	Make	Break	Continuous
440V AC	6	1	15
115VAC AC	15	1	15

COIL DATA - 60 Hz (ALL DEVICES)

		440V	115VAC
Inrush	Amperes	0.56	2.24
	Watts	220	220
	VA	245	245
Sealed	Amperes	0.03	0.12
	Watts	5.6	5.6
	VA	13.1	13.1

CONTACTOR WEIGHT

	N894	N895
lbs.	5.25	5.4

FEATURES







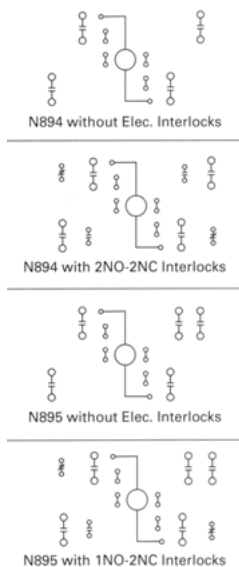
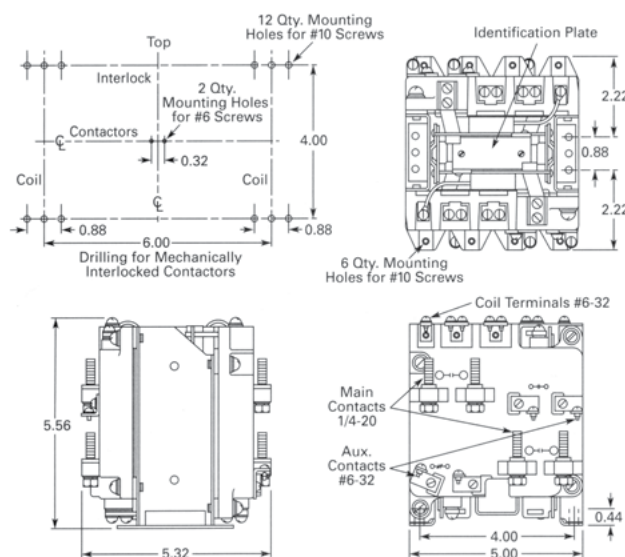
-  MIL-DTL-2212
-  65°C
-  OPEN
-  CONTINUOUS
-  MAGNETIC OPERATION
-  AC MOTOR STARTING
AC HEATER/LIGHTING

DIAGRAM SYMBOLS



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6957ED31-2C

TYPE 6957 AC Contactors N846/N847- Size 3

FEATURES



MIL-DTL-2212



65°C



OPEN



CONTINUOUS



MAGNETIC OPERATION



AC MOTOR STARTING
AC HEATER/LIGHTING

ELECTRICAL DATA (ENCLOSED)

	N846	N847
Number of Poles	4	5
Ampere Rating - Enclosed	90	90/45
Horsepower Rating - 440V, 3-Phase, 60 Hz	50	50
Maximum Break - Amperes at 484V, 40% PF	540	540
No. of Interlocks - Hi-Shock NO	4	3
NC	4	3

INTERLOCK CONTACT

	Amperes		
	Make	Break	Continuous
440V AC	6	1	15
115VAC AC	15	1	15

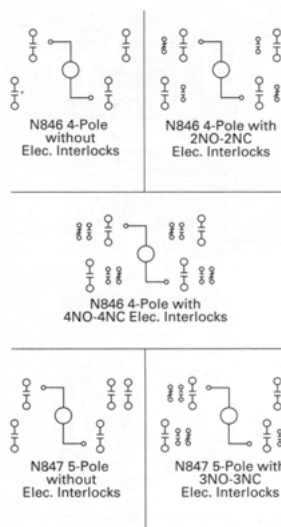
COIL DATA - 60 Hz (ALL DEVICES)

		440V	115VAC
Inrush	Amperes	1.3	5.2
	Watts	309	309
	VA	570	570
Sealed	Amperes	0.044	0.18
	Watts	8.8	8.8
	VA	19.5	19.5

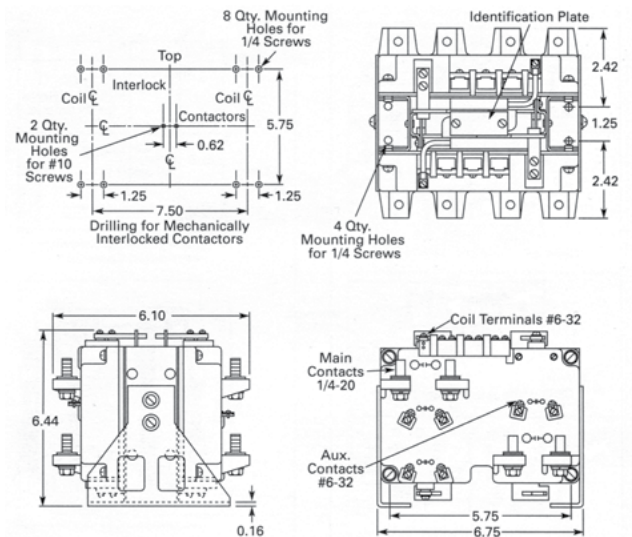
CONTACTOR WEIGHT

	N846	N847
lbs.	9.6	10.0

DIAGRAM SYMBOLS



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Controller & Starter Components



6957ED33-2CA

ELECTRICAL DATA (ENCLOSED)

	N862	N863
Number of Poles	4	5
Ampere Rating - Enclosed	135	135/67.5
Horsepower Rating - 440V, 3-Phase, 60 Hz	100	100
Maximum Break - Amperes at 484V, 40% PF	810	810
No. of Interlocks - Hi-Shock NO	4	3
NC	4	3

INTERLOCK CONTACT

	Amperes		
	Make	Break	Continuous
440V AC	6	1	15
115VAC AC	15	1	15

COIL DATA - 60 Hz (ALL DEVICES)

		440V	115VAC
Inrush	Amperes	1.3	5.2
	Watts	309	309
	VA	570	570
Sealed	Amperes	0.044	0.18
	Watts	8.8	8.8
	VA	19.5	19.5

CONTACTOR WEIGHT

	N862	N863
lbs.	12.5	12.9

TYPE 6957 AC Contactors N862/N863- Size 4

FEATURES







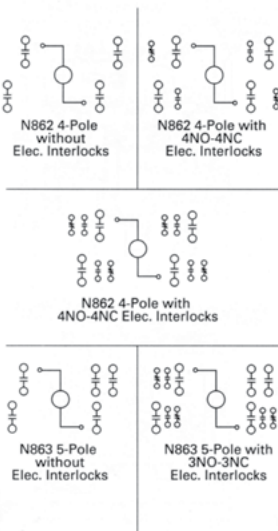
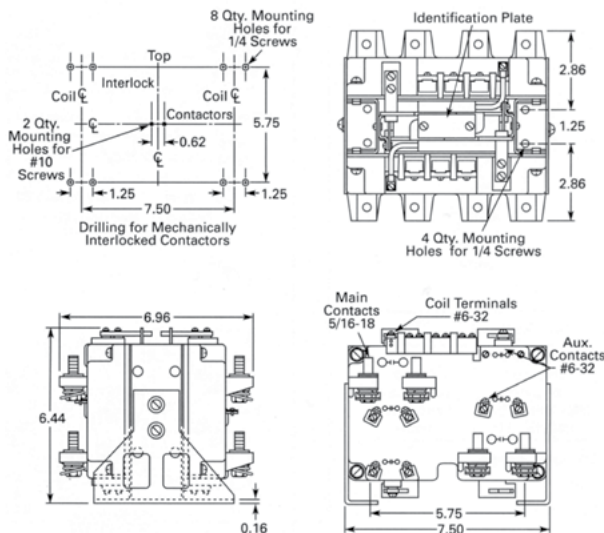
-  MIL-DTL-2212
-  65°C
-  OPEN
-  CONTINUOUS
-  MAGNETIC OPERATION
-  AC MOTOR STARTING
AC HEATER/LIGHTING

DIAGRAM SYMBOLS



APPROXIMATE DIMENSIONS IN INCHES



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Controller & Starter Components

TYPE 6957 AC Contactors N878-Size 5 N1178-Size 5 SP

FEATURES



MIL-DTL-2212



65°C



OPEN



CONTINUOUS



MAGNETIC OPERATION



AC MOTOR STARTING
AC HEATER/LIGHTING

ELECTRICAL DATA (ENCLOSED)

	N878	N1178
Number of Poles	4	3
Ampere Rating - Enclosed	270	420
Horsepower Rating - 440V, 3-Phase, 60 Hz	200	375
Maximum Break - Amperes at 484V, 40% PF	1620	2520
No. of Interlocks - Hi-Shock NO	1, 2, 4	1, 2, 4
NC	1, 2, 4	1, 2, 4

INTERLOCK CONTACT

	Amperes		
	Make	Break	Continuous
440V AC	6	1	15
115VAC AC	15	1	15

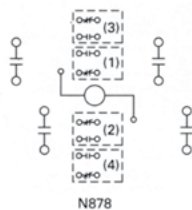
COIL DATA - 60 Hz (ALL DEVICES)

		440V	115VAC
Inrush	Amperes	4.1	16.4
	Watts	210	210
	VA	1750	1750
Sealed	Amperes	0.02	0.8
	Watts	36	36
	VA	88	88

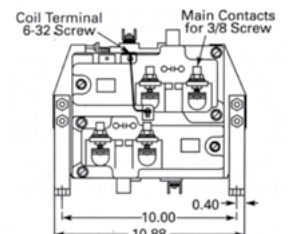
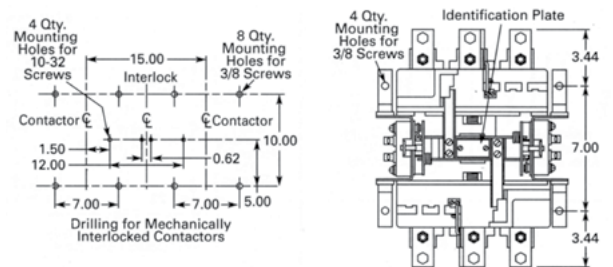
CONTACTOR WEIGHT

	N878	N1178
lbs.	40	41

DIAGRAM SYMBOLS



APPROXIMATE DIMENSIONS IN INCHES



Interlocks	Use Position
1NO-2NC	1
2NO-2NC	1 and 2
4NO-4NC	1-2-3 and 4
2NO-1NC-1NC LO	1 and 2 (LO)
1NO-1NC LO	1 (LO)

LO - Late Opening

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Controller & Starter Components

TYPE 6957 AC Contactors Common Part Numbers

COMMON PART

Size	Device Number	Main Contacts		Auxiliary Contacts	Standard	"Quiet" ^②
		Rating (Amperes)	Numbers		Catalog Number ^①	Catalog Number ^①
0	N1291	18	3NO	1NO	6957ED58-1_	6957ED58-1_Q
1	N850	27	4NO 3NO	2NO-2NC 2NO-1NC	6957ED25-1_ 6957ED25-4_	6957ED25-1_Q 6957ED25-4_Q
	N851	27	5NO ^③	2NO-1NC	6957ED26-1_	6957ED26-1_Q
2	N894	45	4NO 3NO	2NO-2NC 2NO-2NC	6957ED29-2_ 6957ED29-4_	6957ED29-2_Q 6957ED29-4_Q
	N895	45	5NO ^③	1NO-2NC	6957ED30-2_	6957ED30-2_Q
3 ^④	N846	90	4NO	2NO-2NC	6957ED31-2_	6957ED31-2_Q
			4NO	4NO-4NC	6957ED31-3_	6957ED31-3_Q
			3NO	2NO-1NC	6957ED31-7_	6957ED31-7_Q
			3NO	3NO-3NC	6957ED31-8_	6957ED31-8_Q
	N847	90	5NO ^③	3NO-3NC	6957ED32-2_	6957ED32-2_Q
4 ^④	N862	135	4NO	2NO-2NC	6957ED33-2_	6957ED33-2_Q
			4NO	4NO-4NC	6957ED33-3_	6957ED33-3_Q
			3NO	2NO-1NC	6957ED33-7_	6957ED33-7_Q
			3NO	3NO-3NC	6957ED33-8_	6957ED33-8_Q
	N863	135	5NO ^③	3NO-3NC	6957ED34-2_	6957ED34-2_Q
5 ^④	N878	270	4NO 4NO	2NO-2NC 4NO-4NC	6957ED39-2_ 6957ED39-3_	6957ED39-2_Q 6957ED39-3_Q
5 SP ^④	N1178	420	3NO 3NO	2NO-2NC 4NO-4NC	6957ED53-2_ 6957ED53-3_	6957ED53-2_Q 6957ED53-3_Q
6	N630	540	3NO	1NO	6957ED6-_ ^④	—

MAGNETIC COIL SUFFIX

Coil Voltage (60Hz)	Suffix Letter	
	Size 0 and 1 thru 5 SP	Size 6 Only
440	A	C
220	B	B
110	C	A

① Add or insert Magnet Coil Suffix letter from table at left.
Examples: 6957ED58-1A. 6957ED58-1AQ.

② "Quiet" devices meet MIL-STD-740B.

③ One pole has half rating.

④ Contactor factory. Mounted to a plywood panel. Latching relay not included.

⑤ NO-NC auxiliary contacts in the same cavity (adjacent to each other) must be wired with the same voltage and polarity.

⑥ Contact factory for other configurations of contacts and coils.

NOTE: Special Application Contactors: High Temperature Very Quiet (HTVQ) and Extra Quiet (EQ) devices designed meet MIL-STD-740-2. HTVQ devices operate up to 75°C. Contact factory for more information.

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Controller & Starter Components

TYPE 6957 AC Magnetic Pneumatic Timing Relay-N907

FEATURES



MIL-DTL-2212 ①



65°C



OPEN



CONTINUOUS



MAGNETIC, PNEUMATIC OPERATION
.05 to 360 seconds, adjustable



CONTROL LOGIC TIMING

This timing relay can be supplied for either ON Delay or OFF Delay timing, but is not convertible from one to the other.

① Solenoid plunger may move during shock and cause contacts to operate. An energized timing relay may even recycle.
See page 85.

AC PNEUMATIC TIMING RELAY

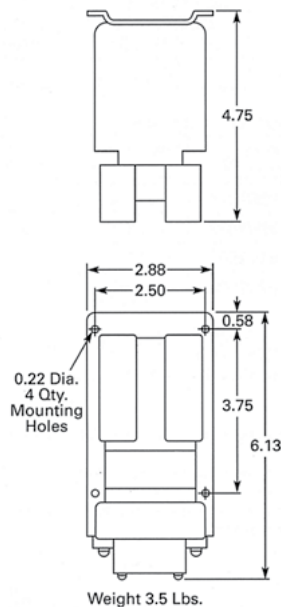
Type	Contacts		Catalog Number ②	Coil Suffix Letter	
	Main	Timing		440V 60Hz	115VAC 60Hz
Timer (ON Delay)	1NO-1NC	TIMED	6957ED41-1_	A	B
	1NO-1NC	TIMED INST.	6957ED41-3_	A	B
	1NO-1NC 2NO-2NC	TIMED INST.	6957ED41-5_	A	B
Timer (OFF Delay)	1NO-1NC	TIMED	6957ED41-2_	A	B
	1NO-1NC 1NO-1NC	TIMED INST.	6957ED41-4_	A	B
	1NO-1NC 2NO-2NC	TIMED INST.	6957ED41-6_	A	B

② Complete Catalog Number consists of the Basic Number, plus the Suffix Letter. Example: 6957ED41-1A.

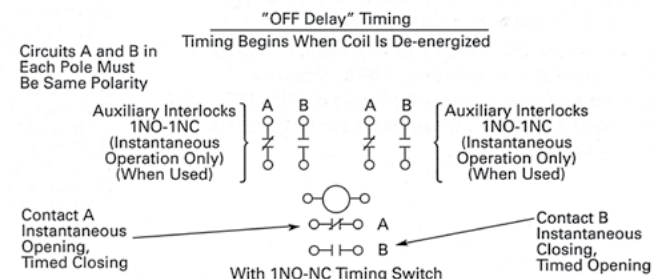
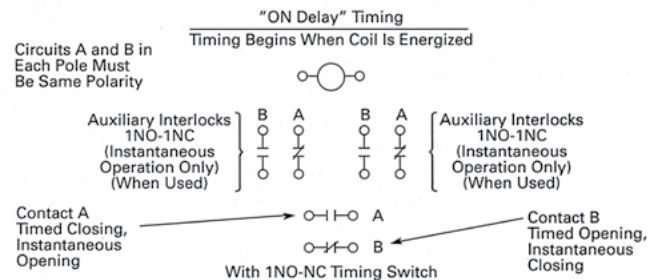
CONTACT AMPERE RATING - AC PILOT DUTY

	Continuous	Maximum Interrupting	Maximum Inrush
440V AC	15	6	10
115VAC AC	15	15	40

APPROXIMATE DIMENSIONS IN INCHES



CONNECTION DIAGRAMS



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Controller & Starter Components



6957ED59-10C
8-Pole

COIL DATA – 60 Hz (ALL DEVICES)

	440V	115VAC
Inrush	0.46A 170W 200VA	1.84A 170W 200VA
Sealed	0.04A 5.4W 17.8VA	0.16A 5.4W 17.8VA

Suffix	Coil Voltage
A	440V
B	220V
C	115VAC

AC MAGNETIC CONTROL RELAY

Catalog Number ① ②	Contact Poles	
	NO	NC
6957ED59-1	4	0
6957ED59-2	3	1
6957ED59-3	2	2
6957ED59-4	1	3
6957ED59-5	0	4
6957ED59-6	8	0
6957ED59-7	7	1
6957ED59-8	6	2
6957ED59-9	5	3
6957ED59-10	4	4
6957ED59-11	3	5
6957ED59-12	2	6
6957ED59-13	1	7
6957ED59-14	0	8

- ① Add magnet coil suffix to part number for appropriate coil voltage. Example: 6957ED59-2A for 440V AC coil.
- ② Add "Q" suffix to part number for "Quiet" version. Example: 6957ED59-2AQ. Quiet devices meet MIL-STD-740B.

FEATURES

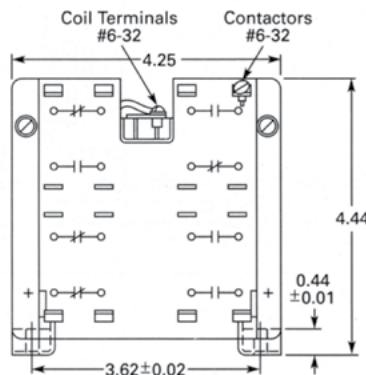
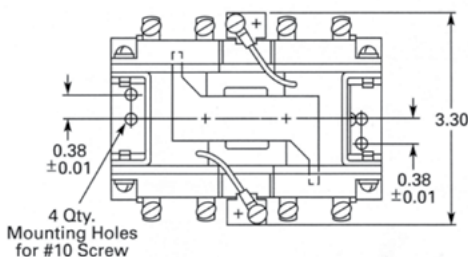
- MIL-DTL-2212
- 65°C
- OPEN
- CONTINUOUS
- MAGNETIC OPERATION
- CONTROL LOGIC SEQUENCE
- CONTROL VOLTAGE DIFFERENCE

INTERLOCK CONTACT

	Amperes		
	Make	Break	Continuous
440V AC	6	1	15
115VAC	15	1	15

APPROXIMATE DIMENSIONS IN INCHES

Approximate weight: 2.4 lbs.



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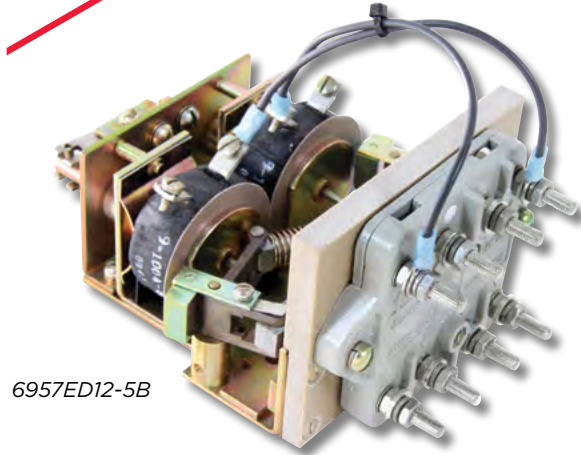
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Controller & Starter Components

TYPE 6957 AC Magnetic Latch Relay– N639



6957ED12-5B

FEATURES



MIL-DTL-2212



65°C



OPEN



CONTINUOUS



MAGNETIC, TWO-POSITION
MECHANICAL LATCH



CONTROL LOGIC SEQUENCE

Type	Contacts	Catalog Number ①	Coil Suffix Letter	
			440V 60Hz	115VAC 60Hz
Latch	1NO-1NC	6957ED12-5	B	C

① Complete catalog number consists of the basic number, plus the suffix.
Example: 6957ED12-5B.

AMPERE RATING – AC PILOT DUTY

	Continuous	Maximum Interrupting	Maximum Inrush
440V AC	15	6	10
115VAC	15	15	40

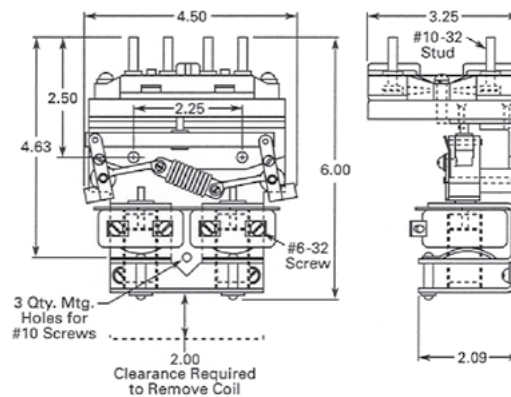
GENERAL

The contact setting on this relay is retained or latched with a two-position toggle mechanism. No permanent latching magnets are used.

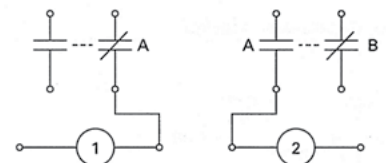
The set of contacts marked “A” are designed for control of the coil circuits and is not adaptable for other circuits. The set of contacts marked “B” are available for control of external circuits.

The coils are energized momentarily to position the switch and are de-energized by the opening of the corresponding “A” contacts on the switch.

APPROXIMATE DIMENSIONS IN INCHES



TYPICAL WIRING DIAGRAM



NOTE: In each A-B contact pair, the contacts must be wired with the same polarity.

Approximate weight: 2.0 lbs.

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Controller & Starter Components

ELECTRICAL DATA (ENCLOSED)

	N1310
Number of Poles	3
Ampere Rating - Enclosed	18
Horsepower Rating - 440V, 3-Phase, 60 Hz	5
Maximum Break - Amperes at 484V, 40% PF	1620
No. of Interlocks - Hi-Shock NO	

INTERLOCK CONTACT

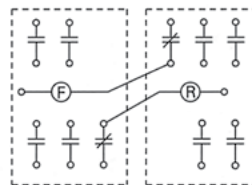
	Amperes		
	Make	Break	Continuous
440V AC	6	1	15
115VAC AC	15	1	15

COIL DATA - 60 Hz

	440V	115VAC
Inrush	0.46A 170W 200VA	1.84A 170W 200VA
Sealed	0.04A 5.4W 17.8VA	0.16A 5.4W 17.8VA







ⓘ This NC contact is factory wired for electrical interlocking. It cannot be used in other circuits.

WIRING DIAGRAM SYMBOL



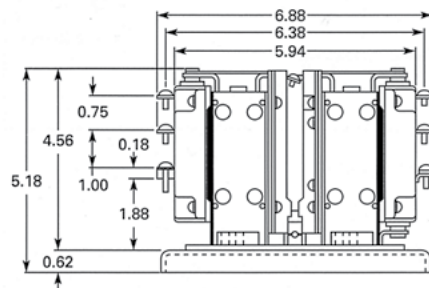
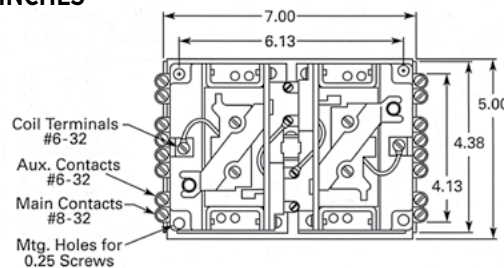
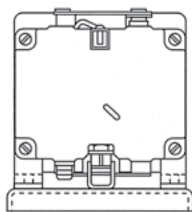
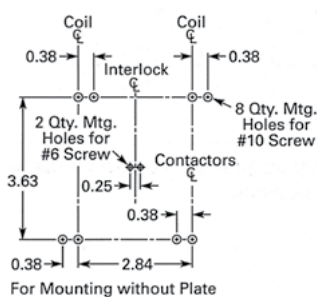
TYPE 6956 AC Magnetic Reverser Size 0 N1310 Pair

FEATURES

-  MIL-DTL-2212
-  65°C
-  OPEN
-  CONTINUOUS
-  MAGNETIC
-  AC MOTOR STARTING/REVERSING

Size	Catalog Number	Suffix Letter		
		440V	220V	115VAC
0	6956ED464-1	A	B	C

APPROXIMATE DIMENSIONS IN INCHES



Approximate weight: 7.0 lbs.

GENERAL

The Size "0" Reverser is a special purpose assembly consisting of two N1310 contactors, which are electrically and mechanically interlocked. The assembly is suited for reversing applications that have space limitations.

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TYPE 6938 DC Magnetic Contactors and Relays

FEATURES



MIL-DTL-2212 ①



65° C



OPEN



MAGNETIC

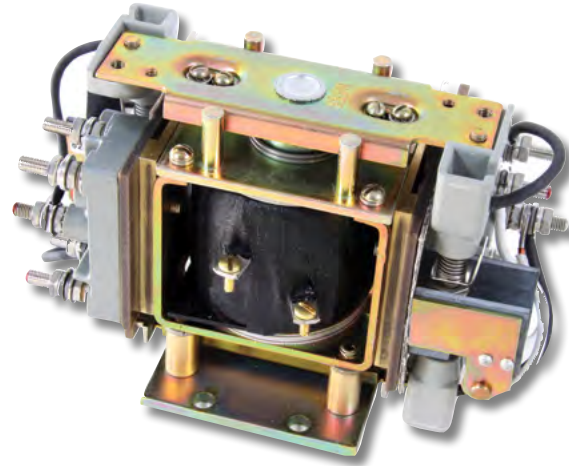


DC MOTOR STARTING
CONTROL LOGIC SEQUENCE

① See page 85.

WHEN ORDERING SPECIFY

- Base catalog number
- Coil voltage
- Auxiliary contact needs
- Thickness of mounting panel, if appropriate
Melamine mounted contactors are shipped mounted to a plywood base of the stated thickness. This configures the parts in a correct relationship and provides mounting hardware of the proper length for the application.



N668 - Size 1 Contactor 25 Amp

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TYPE 6938

DC Magnetic Contactors and Relays

CONTACTORS - INCLUDE BLOW-OUT COILS

Size	Device Number	Main Contacts		Available ^① Aux. Contacts	Available Coil Voltage (DC)	Base Catalog ^{②③} Number	Dim. Ref.
		Rating	Poles				
1	N668	25A	2NO	1NO-1NC	115, 230, 250	6938ED18	A
2	N669	50A	2NO	2NO-2NC	115, 230, 250	6938ED19	B
3	N700	100A	2NO	2NO-2NC	115, 230, 250	6938ED20	C
4	N701	150A	2NO	2NO-2NC	115, 230, 250	6938ED21	D
5	N542 ^④	300A	1NO	1NO-1NC	115, 230, 250	6938ED7	E
6	N545 ^④	600A	1NO	2NO-1NC	115, 230, 250	6938ED8	F
—	N546 ^④	1200A	1NO	1NO	115, 230	6938ED9	G

CONTACTORS - NO BLOW-OUT COILS

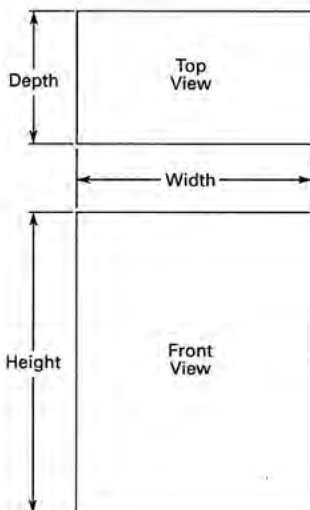
Size	Device Number	Main Contacts		Available ^① Aux. Contacts	Available Coil Voltage (DC)	Base Catalog ^{②③} Number	Dim. Ref.
		Rating	Poles				
2	N912	50A	1NO	1NO-1NC	115, 230, 250	6938ED38	H
4	N913	150A	1NO	1NO-1NC	115, 230, 250	6938ED39	J

RELAYS - NO BLOW-OUT COILS

Type	Device Number	Description	Contacts	Available Coil Voltages (DC)	Base Catalog ^{②③} Number	Dim. Ref.
Control Timer	N617	Control Circuit	4NO-4NC	115, 230, 250	6938ED16	K
Duplex Timer	N867	Duplex Timer	2NO-2NC	115, 230, 250	6938ED37	L
Timer	N907	ON/OFF Delay	1NO-1NC	115, 230, 250	6938ED46	M
Overload Series	N709	Magnetic Operation	1NC	115, 230, 250	6938ED22 ^⑤	N
Latch ^④	N175	Current Sensitive	1NC	Not Applicable	6938ED3	P
	N621	Special Purpose	2NO-2NC	115, 230, 250	6938ED17	R

^① Some devices offer various auxiliary contact configurations. Data shown is maximum available. ^② Catalog Numbers shown are not complete. A suffix is required to identify coil voltage, auxiliary contact configuration and panel thickness. Contact factory for assistance. ^③ The Catalog Number do not include economizing resistors. Contact factory for assistance. ^④ For two-pole (main contact) applications, use of N621 is required. Contact factory for assistance. ^⑤ Need motor full load rating.

APPROXIMATE DIMENSIONS IN INCHES



DIMENSION REFERENCE TABLE







Ref.	Panel Space in Inches			Weight lbs.	Mount to Steel Panel
	Footprint		Depth Required		
	Width	Height			
A	4.5	6.5	4.5	5	Yes
B	5.5	6	6	10	Yes
C	7	8	6.5	16	Yes
D	8	8.5	7.5	25	No
E	7.5	14	8.5	28	No
F	8	23	8.5	42	No
G	10.5	12.5	14.5	137	No
H	7.5	11	5.5	7	Yes
J	4.5	12.5	8	8	Yes
K	4	6.5	6	7	No
L	4.5	7.5	5.5	8	Yes
M	4	6.5	5	4	Yes
N	4.5	9.5	5.5	4	No
P	3.8	4.5	5	2	Yes
R	3.8	6.5	5.8	7	No

Controller & Starter Components

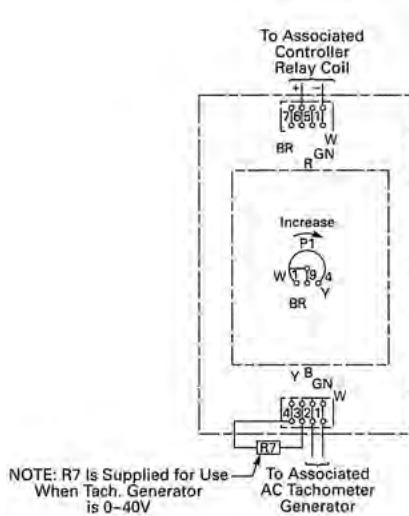
TYPE 6999 Overspeed Trip Device

Description	Tachometer Voltage	Catalog Number
Overspeed Trip Device	0 - 40V 0 - 60V	6999ED203A4 6999ED203A5

FEATURES

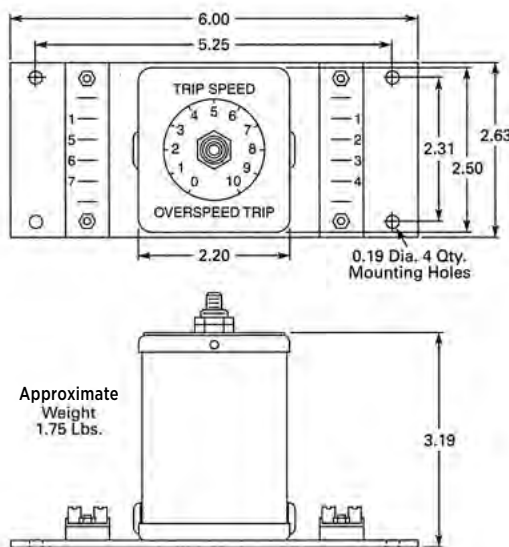
-  MIL-E-917
MIL-S-901
-  65° C
-  OPEN
-  CONTINUOUS
-  ELECTRONIC
Tachometer input 0-40V or 0-60V AC.
Maximum voltage on terminals 1 through 6, 100V DC.
Maximum application voltage with control relay,
250V DC nominal (180V-355V submarine)
-  OVERSPEED SHUTDOWN

TYPICAL WIRING DIAGRAM



GENERAL

The Overspeed Trip Device is designed to prevent overspeeding on DC driven M-G sets, centrifugal pumps, etc., by measuring tachometer voltage of the driven machine and stopping the motor at a predetermined voltage. Stopping is accomplished by de-energizing the coil of a DC control relay (not included), which then opens the main motor controller contactor.



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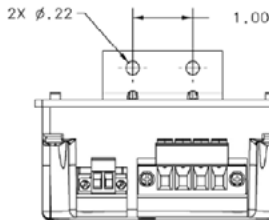
PHYSICAL CHARACTERISTICS

DIMENSIONS	4.00W x 4.00H x 1.98D INCHES (10.2 x 10.2 x 5.1 CM)
FOUR CORNER MOUNTING HOLES	3.58 x 3.58 INCHES (9.1 x 9.1 CM) 0.5 INCHES (1.3 CM) THICK 0.193 INCH DIAMETER
WEIGHT	0.58 LBS. (283 G)
OPTIONAL BRACKET WEIGHT	0.72 LBS. (308 G)

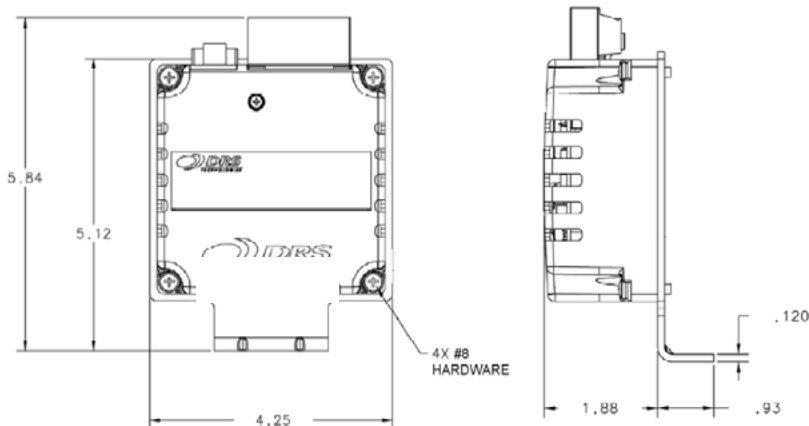
FUNCTIONAL RATINGS

INPUT CHARACTERISTICS	
ON STATE VOLTAGE	15 TO 40 VDC
ON STATE BURDEN	MAX. 60 mADC
ISOLATION INPUT TO CHASSIS (1 MINUTE)	MIN. 500 VDC
ISOLATION INPUT TO OUTPUT (1 MINUTE)	MIN 3000 VDC
OUTPUT CHARACTERISTICS	
RATED OUTPUT VOLTAGE	20 TO 600 VRMS (800 VPK)
RATED LOAD CURRENT	5 mA TO 2 ARMS AC OR DC
MAXIMUM OVERLOAD CURRENT FOR 1 SECOND	5 ARMS AC OR DC
MAX. SURGE CURRENT (1 LINE CYCLE EVERY 10 SECONDS)	40 APK
NON-REPETITIVE SURGE CURRENT ONE CYCLE	100 APK
OFF STATE LEAKAGE CURRENT	<1 MARMS AC OR DC RESISTIVE
VOLTAGE DROP @ RATED LOAD CURRENT	MAX. 2.7 VRMS AC OR DC
TURN ON TIME	MAX. 25 μ S
TURN OFF TIME	MAX. 5 mS
ISOLATION INPUT TO CHASSIS (1 MINUTE)	2500 V
OUTPUT DV/DT	MIN. 2500 V/ μ S
OUTPUT DC SNUBBER ENERGY	3.0 J IN 50 mS, 3.8 J IN 100 mS

APPROXIMATE DIMENSIONS IN INCHES









SWM with Optional Mounting Bracket and Connectors Installed



AC/DC Solid State Switch Module

FEATURES

-  MIL-DTL-2212, including EMI MIL-STD-461
-  -20 TO 65° C
-  OPEN
-  95% RH Non-condensing
-  ELECTRONIC, 24VDC nominal
-  AC/DC COIL CONTROL
AC/DC SOLENOID CONTROL

WHEN ORDERING SPECIFY

- Part Number: **MC-001684-01**

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Control Terminal Boards/ Fuse Blocks

Terminal Boards

FEATURES



MIL-DTL-2212



65° C



440V AC, 30A



CONTINUOUS



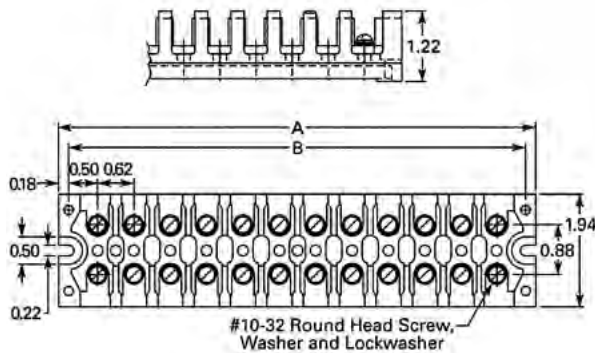
CONTROL CIRCUITS
LOW POWER CIRCUITS

TERMINAL BOARDS

Tie Points	Dimensions In Inches		Part Number
	A	B	
4	3.25	2.88	80-958-4
8	5.75	5.38	80-958-5
12	8.25	7.88	80-958-6

Includes terminal marking strip.

APPROXIMATE DIMENSIONS IN INCHES



Fuse Block

FEATURES



MIL-DTL-2212

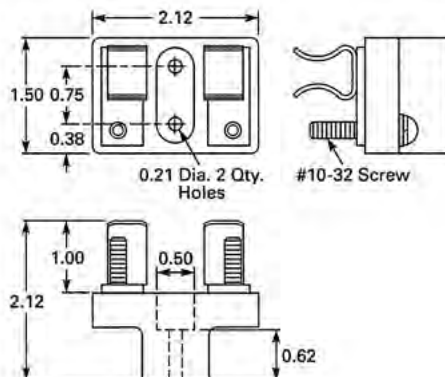


500V AC, 30A
CONTINUOUS

FUSE BLOCKS

Fuse Type	Part Number
F60 (MIL-F-15160/60)	44-1804A

APPROXIMATE DIMENSIONS IN INCHES



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TYPE 6981ED166 Indicating Light



FEATURES

-  MIL-DTL-2212
-  50°C
-  OPEN TYPE FOR WATERTIGHT MOUNTING (3 ft. head - 5 min.)
-  CONTINUOUS
-  ELECTRICAL, DOUBLE LAMP

6981ED166 INDICATING LIGHT ELEMENT CODE DEFINITION

Code	Lens Color	Voltage Loading	Lamp Type	Code	Lens Color	Voltage Loading	Lamp Type
A1	Red	115 VAC 60 Hz	1769	C1	Red	1.6 mA 24 VDC ①	335
A2	Green						
A3	Amber						
A4	Blue						
A5	White						
B1	Red	6.4 MA 440 VAC 60 Hz	1769	D1	Red	40 mA 10 VDC	373
B2	Green						
B3	Amber						
B4	Blue						
B5	White						

① For other DC voltages, each light requires the following series resistance:

Resistors must be separately mounted and are not included.

120V DC - 2800 Ohms, 5 Watts

48V DC - 710 Ohms, 2 Watts

240V DC - 6300 Ohms, 10 Watts

250V DC - 8000 Ohms, 10 Watts (Nominal submarine voltage 180-355V range)

COMMON INDICATING LIGHTS

Element Code	Legend Marking ②	Catalog Number
B1	MOTOR RUNNING	6981ED166-1
A2	MOTOR RUNNING	6981ED166-2
C5	POWER ON	6981ED166-3

② Indicating light legend engraved on lens. Legend marking on lens in contrasting color. Optional bezel marking available.

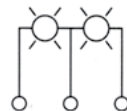
REPLACEMENT TRANSFORMER (INCLUDES LAMPS)

Description	Catalog Number
115V AC to 2V AC Type B-41A	42-1091
440V AC to 2V AC Type B-41B	42-1091-2

DC LED indicator is available, contact factory.

WHEN ORDERING SPECIFY

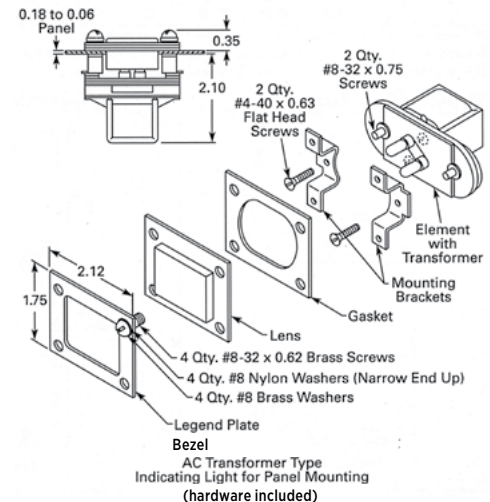
- Complete catalog number with suffix number or by complete description.



DC Approximate Weight: 4 oz



AC Approximate Weight: 7 oz



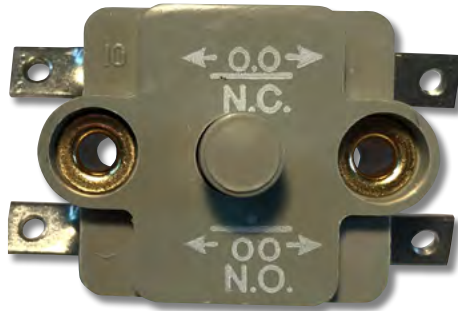
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TYPE 6981ED165 Pushbuttons

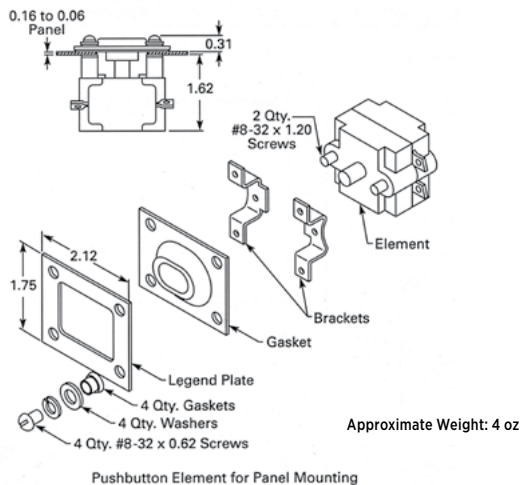
6981ED165 PUSHBUTTON ELEMENT CODE DEFINITION

Element Code	Circuit Symbol	Description
A		Pushbutton - 2NO Contacts
B		Pushbutton - 2NC Contacts
C		Pushbutton - 1NO-1NC Contacts

COMMON PUSHBUTTONS

Element Code	Legend Marking ❶	Catalog Number
C	FAST	6981ED165-1
C	SLOW	6981ED165-2
A	L.P. BYPASS	6981ED165-3
C	FORWARD	6981ED165-4
C	REVERSE	6981ED165-5
C	START	6981ED165-6
C	STOP	6981ED165-7

❶ Legend marking on bezel.



FEATURES

-  MIL-DTL-2212
-  50°C
-  OPEN TYPE FOR WATERTIGHT MOUNTING (3 ft. head - 5 min.)
-  CONTINUOUS
-  MANUAL
-  CONTROL OPERATION

WHEN ORDERING SPECIFY

- Complete catalog number with suffix number or by complete description.

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TYPE 6981ED200 Selector Switch



RATING

Operation	Inductive Load (Amperes)					
	AC 60 Hz			DC		
	115V	220V	440V	115V	230V	355V
Make	30	15	7.5	1.1	0.55	0.4
Break	3	1.5	.75	1.1	0.55	0.4
Carry	10	10	10	10	10	10

FEATURES

-  MIL-DTL-2212
-  50°C
-  OPEN, FOR WATERTIGHT MOUNTING
-  CONTINUOUS
-  2 OR 3 POSITION
-  CONTROL OPERATION

COMMON COMPLETE CATALOG NUMBERS & THEIR DESCRIPTIONS

Element Code	Legend Marking	Catalog Number
1C	(Blank)	6981ED200-1
1B	ON-OFF	6981ED200-2
1C	MAN-AUTO	6981ED200-3
1C	OPEN-CLOSE	6981ED200-10
5P	HAND/-OFF-AUTO	6981ED200-11
1C	ON-OFF	6981ED200-15
6E	STOP-START	6981ED200-54
7A	HAND-OFF-AUTO	6981ED200-63
8E	STOP-RUN-START	6981ED200-92

TABLE 1 – ELEMENT CODE DEFINITION FOR MECHANICAL CONFIGURATIONS

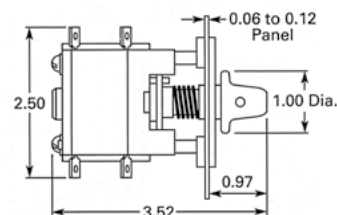
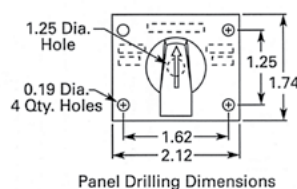
Element Number Code ①	Mechanical Configuration	
	No. of Positions	Operation
1	2	Maintained Contact, Center and CW
2	2	Maintained Contact, Center and CCW
3	2	Spring Return from CW to Center
4	2	Spring Return from CCW to Center
5	3	Maintained Contact
6	3	Spring Return from CW & CCW to Center
7	3	Spring Return from CCW to Center
8	3	Spring Return from CW to Center

① Element Code consists of number from Table 1 plus letter from Table 2 on page 53. The code is not a part number suffix.

WHEN ORDERING SPECIFY

- Order by complete catalog number with numerical suffix.
- Order by complete description, including:
- Type number - 6981ED200
- Element Number Code - Mechanical Operation
- Element Alpha Code - Electrical Circuit
- Legend required MAN-OFF-AUTO

APPROXIMATE DIMENSIONS IN INCHES



Approximate Weight: 8 oz

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TYPE 6981ED200 Selector Switch

TABLE 2 – ELEMENT CODE DEFINITION FOR ELECTRICAL CIRCUITS

Element Alpha Code	Circuit Connections				Schematic Symbol ❶
	Contact	Position ❷			
		CCW	C	CW	
A	1-4	X			
	1-2			X	
	7-6	X			
	7-8			X	
B	1-2		X		
	7-8		X		
C	1-2		X		
	3-4		X		
	5-6			X	
	5-8	X			
D	1-3			X	
	2-4	X			
	5-7			X	
	6-8	X			
E	1-4		X	X	
	3-4	X			
	5-7	X			
	6-8			X	
F	2-4- 5-8			X	
	5-6-8		X		
G	1-4		X		
	1-4- 6-8			X	
	3-4	X			
H	1-2-4	X			
	1-2-3			X	
J	1-3	X			
	5-6	X		X	
K	1-3-4	X			
	3-4- 6-8			X	

Element Alpha Code	Circuit Connections				Schematic Symbol ❶
	Contact	Position ❷			
		CCW	C	CW	
L	1-2- 5-6	X			
	2-3			X	
	6-7			X	
	1-2			X	
M	3-4			X	
	5-6			X	
	7-8			X	
	1-4	X			
	2-3	X			
	5-8	X			
	6-7	X			
N	1-2			X	
	3-4			X	
	5-7		X		
	1-4	X			
P	2-3	X			
	2-3			X	
	1-2			X	
Q	1-4	X	X		
	7-8		X		
	1-2			X	
R	1-4	X	X		
	5-6			X	
	7-8			X	
	5-8	X			
	6-7	X			
	1-2			X	

Element Alpha Code	Circuit Connections				Schematic Symbol ❶
	Contact	Position ❷			
		CCW	C	CW	
S	1-4		X	X	
	3-4	X			
	7-8		X		
T	1-2-4	X			
	1-2-3			X	
	5-6		X		
U	1-4	X	X		
	1-2			X	
	5-6	X			
	6-7		X	X	
W	1-4	X	X		
	1-2			X	
	6-7	X	X		
	7-8			X	
X	1-2	X			
	2-3		X	X	
	5-8		X	X	
	7-8	X			
Y	1-4	X	X		
	1-2			X	
	5-7	X			
	6-8			X	
Z	1-4	X	X		
	1-2			X	
	5-6-8			X	
	5-7-8	X			

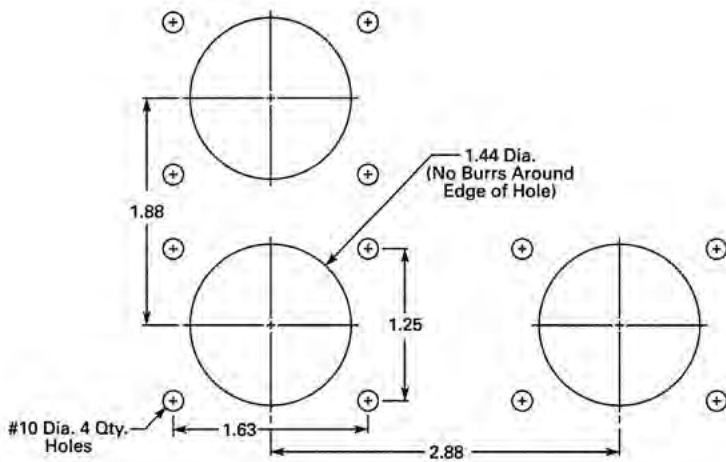
- ❶ Numbers adjacent to circuit diagrams represent terminals.
- ❷ X = Contact closed, all circuits shown with switch in center position.
- ❸ Element with internal jumper between front and rear elements use same voltage and polarity.

TYPE 6981ED

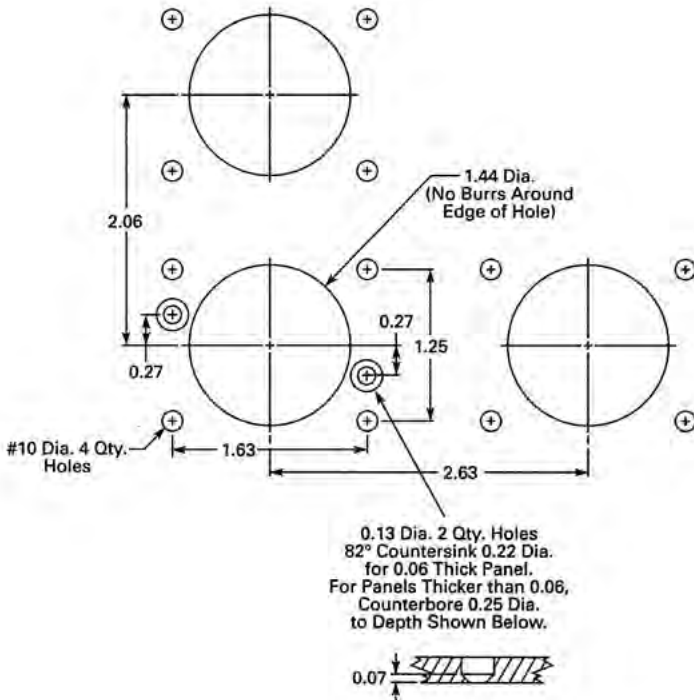
GENERAL INFORMATION FOR PUSHBUTTONS & LIGHTS

DRILLING AND SPACING DIMENSIONS IN INCHES

FLUSH MOUNTING PUSHBUTTON AND SELECTOR SWITCH



FLUSH MOUNTING INDICATING LIGHT - FRONT VIEW OF DOOR



MOUNTING DETAILS - REPLACEMENT PARTS

REPLACEMENT LIGHT TRANSFORMER

Voltage	Catalog Number
115 VAC	42-1091
440 VAC	42-1091-2

REPLACEMENT PUSHBUTTON CONTACT

Code	Description	Catalog Number
A	2 N.O.	86-2369
B	2 N.C.	86-2369-2
C	1 N.C. 1 N.O.	86-2369-3

Controller & Starter Components



Wraparound



Hinged

Optional Features Shown

TYPE 6901 Standard Drip- Proof Hi-Shock Enclosures

TYPE 6901 DRIP-PROOF ENCLOSURES

Enclosure Dimensions in Inches						Interior Panel Dimensions in Inches						Weight lbs.	Catalog Number
Width A	Height B	Depth C	Mounting ①			Width	Height	Panel Mounting			Door to Panel		
			D	E	Holes			Width	Height	Holes			

WRAPAROUND COVER STYLE ②

8.24	11.3	6.68	4.75	9.38	4	6.5	8	4.75	6	4	5.24	17	6901ED101-1A
8.24	15.56	6.68	4.75	13.62	4	6.5	12.25	4.75	10.25	6	5.24	21	6901ED101-2A
9.38	17.3	8.06	6	14.5	4	7.75	13	6	11	6	6.63	26	6901ED101-3A
11.38	19.8	8.94	8	17	4	9.75	15.25	8	13	6	7.45	35	6901ED101-4A
13.74	16.8	8.06	10.24	14.88	4	12	13.5	10.25	11.75	6	6.63	36	6901ED101-5A





HINGED DOOR WITH DIAMOND LATCH STYLE

12.12	18.12	9.76	8.5	16	4	10	14.5	8.5	13	4	8.12	33	6901ED102-1A
14.12	18.12	9.76	10.5	16	4	12	14.5	10.5	13	4	8.12	36	6901ED102-2A
14.12	20.12	9.76	10.5	18	4	12	16.5	10.5	15	6	8.12	40	6901ED102-3A
16.12	20.12	9.76	12.5	18	4	14	16.5	12.5	15	6	8.12	43	6901ED102-4A
16.12	22.12	9.76	12.5	20	4	14	18.5	12.5	17	6	8.12	47	6901ED102-5A
16.12	24.12	9.76	12.5	22	4	14	20.5	12.5	19	6	8.12	50	6901ED102-6A
18.12	26.12	9.76	14.5	24	6	16	22.5	14.5	21	9	8.12	64	6901ED102-7A
22.12	28.12	9.76	18.5	26	6	20	24.5	18.5	23	9	8.12	78	6901ED102-8A

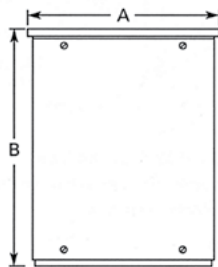
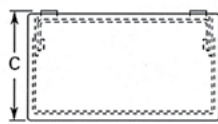
① Enclosures are designed for 0.50 inch diameter mounting bolts.

② Wraparound style enclosures are not suitable for cover mounted control elements.

FEATURES

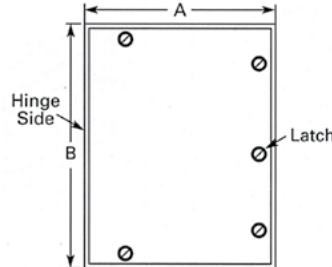
-  MIL-DTL-2212
MIL-DTL-2036
-  DRIP-PROOF
-  50° C
-  HI-SHOCK ENCLOSURE

WRAPAROUND COVER STYLE



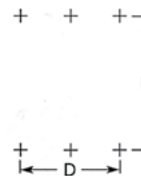
6901ED101 Type

HINGED DOOR STYLE



6901ED102 Type

ENCLOSURE MOUNTING REFERENCE



GENERAL

Other sizes and classes (e.g. Watertight, Non-magnetic, Spraytight) are available. Contact the factory for price and availability.

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PRIDE



PERFORMANCE



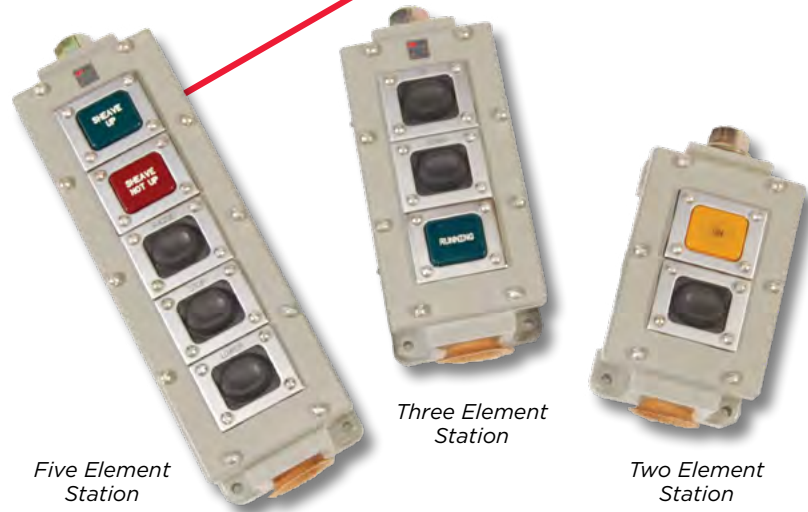
PURPOSE



REMOTE CONTROL STATIONS

Remote Control Stations

TYPE 6981 Control Stations— Molded Case



Using Pushbuttons, Indicating Lights and Selector Switches

FEATURES



MIL-DTL-2212



50°C



WATERTIGHT -
Molded Case
EXPLOSION-
PROOF - pages 62-63
CAST BRASS -
pages 60-61



CONTINUOUS



MANUAL



CONTROL
OPERATION

Type of Element	Continuous Capacity Amps.	Inductive Ratings				
		AC (60 Hz)			DC	
		Volts	Amps Make	Amps Break	Volts	Amps Break
Heavy-Duty Pushbutton	10	440	50	5 ①	250 ①	0.5
	10	220	50	5	230	0.75
	10	110	60	6	115	2.0
Selector Switch	10	440	7.5	0.75	250 ①	0.4
	10	220	15	1.5	230	0.55
	10	110	30	3.0	115	1.1

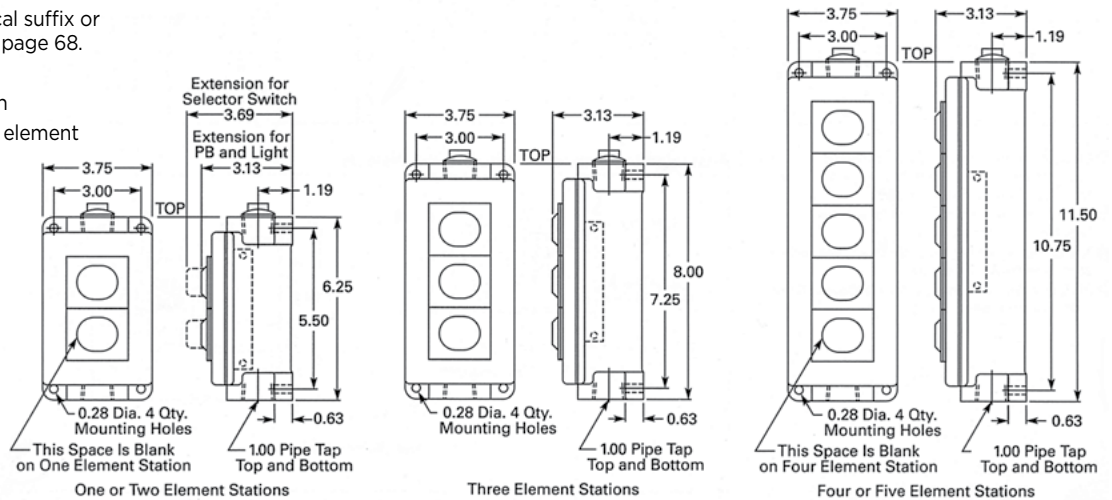
① Nominal submarine voltage (355 volts maximum).

WHEN ORDERING SPECIFY

- Catalog number with numerical suffix or by complete description. See page 68.
- Number of elements
- Element Code and description
- Legend and location for each element

- For pushbutton element details see page 51.
 - For selector switch element details see pages 52-53.
 - For indicating light technical data see page 50.
- NOTE:** Element Alpha Code is different for Control Stations.

APPROXIMATE DIMENSIONS IN INCHES



BASE CATALOG PART NUMBER SELECTION

Number of Elements	Base Catalog Number	Base Weight	Protective Cover Weight
1	6981ED171	2 lbs., 3 oz.	6 oz.
2	6981ED172	2 lbs., 2 oz.	6 oz.
3	6981ED173	2 lbs., 6 oz.	7 oz.
4	6981ED174	3 lbs., 5 oz.	10 oz.
5	6981ED175	3 lbs., 4 oz.	10 oz.

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TYPE 6981

Control Stations - Molded Case

EXAMPLES OF SOME COMMON CATALOG NUMBERS AND THEIR DESCRIPTIONS

Element Identification Code and Marking ❶					Catalog Number	Weight lbs.-oz.
Position 1 (Top)	Position 2	Position 3	Position 4	Position 5		

ONE ELEMENT STATIONS

C - STOP	—	—	—	—	6981ED171-1	2-7
C - START	—	—	—	—	6981ED171-2	2-7
C - EM. RUN	—	—	—	—	6981ED171-3	2-7
C - EM. STOP	—	—	—	—	6981ED171-4	2-7
E4 - CLOSED	—	—	—	—	6981ED171-8	2-9

TWO ELEMENT STATIONS

C - START	C - STOP	—	—	—	6981ED172-1	2-10
C - OPEN	C - CLOSE	—	—	—	6981ED172-2	2-10
C - HOIST	C - LOWER	—	—	—	6981ED172-3	2-10
C - EM. START	C - EM. STOP	—	—	—	6981ED172-4	2-10
E2 - FAST	E2 - SLOW	—	—	—	6981ED172-5	2-14
E3 - OPEN	E4 - CLOSED	—	—	—	6981ED172-6	2-14
E5 - POWER ON	A - START	—	—	—	6981ED172-7	2-12
E5 - FAST	E5 - SLOW	—	—	—	6981ED172-14	2-14
A - START	C - STOP	—	—	—	6981ED172-20	2-10

THREE ELEMENT STATIONS

C - FORWARD	C - REVERSE	C - STOP	—	—	6981ED173-1	3-0
C - FAST	C - SLOW	C - STOP	—	—	6981ED173-2	3-0
C - HOIST	C - LOWER	C - STOP	—	—	6981ED173-3	3-0
D2 - MOTOR RUN	C - START	C - STOP	—	—	6981ED173-4	3-2
E2 - MOTOR RUN	C - START	C - STOP	—	—	6981ED173-19	3-2
C - EM. RUN	C - START	C - STOP	—	—	6981ED173-6	3-0
E5 - ON	C - ON	C - OFF	—	—	6981ED173-9	3-2
C - UP	C - DOWN	C - JOG	—	—	6981ED173-11	3-0
C - TEST	C - START	C - STOP	—	—	6981ED173-14	3-0

FOUR ELEMENT STATIONS

C - E.M RUN	C - FORWARD	C - REVERSE	C - STOP	—	6981ED174-1	4-5
E2 - MOTOR RUN	C - EM. RUN	C - START	C - STOP	—	6981ED174-2	4-7
E3 - OPEN	E4 - CLOSED	C - OPEN	C - CLOSE	—	6981ED174-3	4-9
E5 - POWER ON	E2 - HEATER ON	C - START	C - STOP	—	6981ED174-4	4-9
C - HOIST	C - LOWER	C - FORWARD	C - REVERSE	—	6981ED174-9	4-5

FIVE ELEMENT STATIONS

E2 - FAST	E2 - SLOW	C - FAST	C - SLOW	C - STOP	6981ED175-1	4-12
E3 - OPEN	E4 - CLOSED	C - OPEN	C - CLOSE	C - STOP	6981ED175-2	4-12

ELEMENT SYMBOL IDENTIFICATION

Pushbuttons	Indicating Lights	
	Alpha Code	Numeric Code ❷
A - 2NO Contact Pushbutton B - 2NO Contact Pushbutton C - 1NO-1NC Contact Pushbutton	D - 115VAC, 60 Hz E - 440V, 60 Hz F - 24V DC G - 10V DC H - 48V DC	1 - Red Lens 2 - Green Lens 3 - Amber Lens 4 - Blue Lens 5 - White Lens

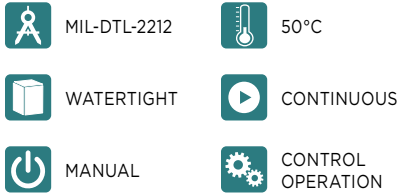
❶ For pushbutton element details see page 51. For selector switch element details see pages 52-53.

❷ For indicating light technical data see page 50. **NOTE:** Element Alpha Code is different for Control Stations.

Remote Control Stations

TYPE 6981 Control Stations— Brass Case

FEATURES



WHEN ORDERING SPECIFY

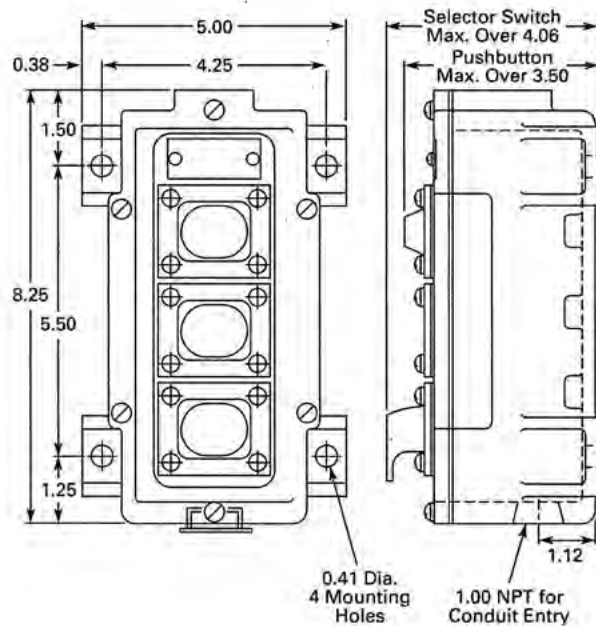
- Catalog number with numerical suffix or by complete description. See page 61.
- Number of elements
- Element Code and description
- Legend and location for each element
- For pushbutton element details see page 51. For selector switch element details see pages 52-53.
- For indicating light technical data see page 50. **NOTE:** Element Alpha Code is different for Control Stations.

RATINGS

Type of Element	Continuous Capacity Amps	Inductive Rating				
		AC (60 Hz)			DC	
		Volts	Amperes		Volts	Amperes
Make	Break		Volts	Break		
Heavy Duty Pushbutton	10	440	50	5	250 ^③	0.5
	10	220	50	5	230	0.75
	10	110	60	6	115	2
Selector Switch	10	440	7.5	0.75	250 ^③	0.4
	10	220	15	1.5	230	0.55
	10	110	30	3	115	1.1

^③ Nominal submarine voltage (355V maximum).

APPROXIMATE DIMENSIONS IN INCHES



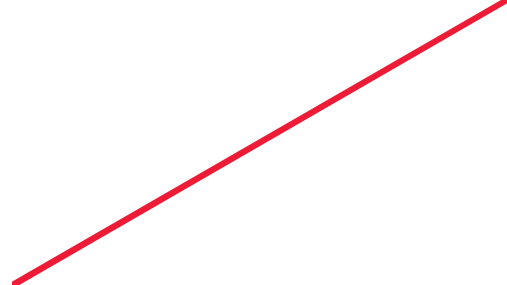
BASE CATALOG PART NUMBER SELECTION

Number of Elements	Base Catalog Number ^①	Base Weight	Protective Cover Weight
1	6981ED241	12 lbs.	7 oz.
2	6981ED242	12 lbs.	7 oz.
3	6981ED243	12 lbs.	7 oz.

^① Enclosure size the same for all stations.

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TYPE 6981 Control Stations–Brass Case

EXAMPLES OF SOME COMMON CATALOG NUMBERS AND THEIR DESCRIPTIONS

Element Identification Code and Marking ¹			Catalog Number
Position 1 (Top)	Position 2	Position 3	

ONE ELEMENT STATIONS

A - START	—	—	6981ED241-1
C - EMERG RUN	—	—	6981ED241-2
A - ON	—	—	6981ED241-3

TWO ELEMENT STATIONS

C - OPEN	C - CLOSE	—	6981ED242-3
A - START	A - STOP	—	6981ED242-4
A - ON	A - OFF	—	6981ED242-6
A - HOIST	A - LOWER	—	6981ED242-7

THREE ELEMENT STATIONS

C - START	C - STOP	C - EMERG RUN	6981ED243-1
A - START	B - STOP	A - EMERG RUN	6981ED243-4
D3 - POWER ON	C - START	C - STOP	6981ED243-5
E2 - MOTOR RUNNING	8E - START/STOP	C - EMERG RUN	6981ED243-6

ELEMENT SYMBOL IDENTIFICATION

Pushbuttons	Indicating Lights	
	Alpha Code	Numeric Code ²
A - 2NO Contact Pushbutton	D - 115VAC, 60 Hz	1 - Red Lens
B - 2NO Contact Pushbutton	E - 440V, 60 Hz	2 - Green Lens
C - 1NO-1NC Contact Pushbutton	F - 24V DC	3 - Amber Lens
	G - 10V DC	4 - Blue Lens
	H - 48V DC	5 - White Lens

¹ For pushbutton element details see page 51. For selector switch element details see pages 52-53.

² For indicating light technical data see page 50. **NOTE:** Element Alpha Code is different for Control Stations.

Remote Control Stations

TYPE 6981 Explosion-Proof Control Stations— Aluminum Case

FEATURES



MIL-DTL-2212 ①



50°C



NEMA-7
EXPLOSION-PROOF
CLASS 1, GROUP D



CONTINUOUS



MANUAL



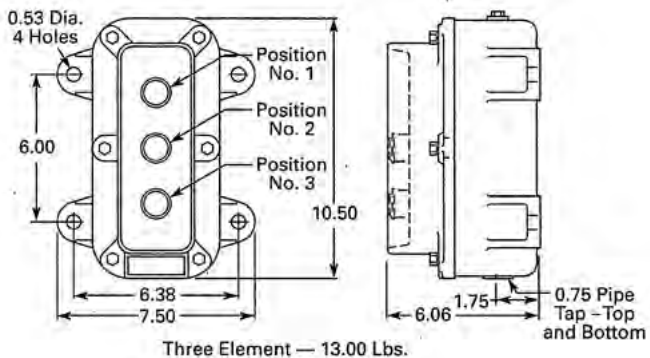
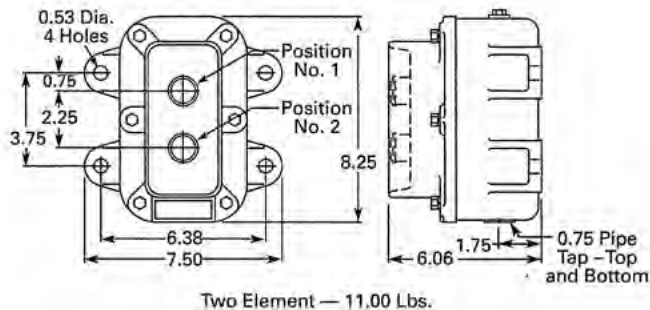
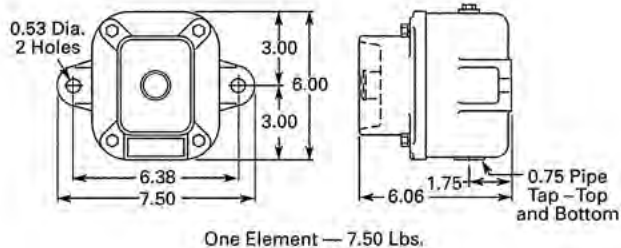
CONTROL
OPERATION

① See page 85.

BASE CATALOG NUMBER SELECTION

Number of Elements	Base Catalog Number ①	Approximate Weight
1	6981ED202	7.5 lbs.
2	6981ED203	11.0 lbs.
3	6981ED204	13.0 lbs.

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHTS



WHEN ORDERING SPECIFY

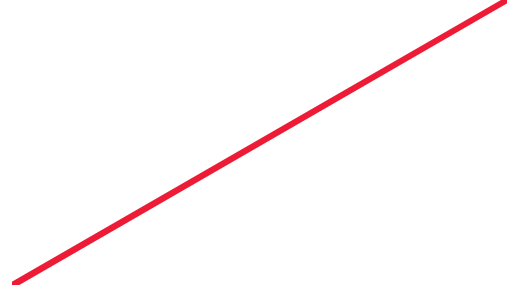
- Catalog number with numerical suffix or by complete description. See page 68.
- Number of elements
- Element Code and description
- Legend and location for each element

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TYPE 6981 Explosion-Proof Control Stations

RATINGS

Type of Element	Continuous Capacity Amps	Inductive Rating				
		AC (60 Hz)			DC	
		Volts	Amperes		Volts	Amperes
			Make	Break		
Heavy Duty Pushbutton	10	440	50	5	250 ^③	0.5
	10	220	50	5	230	0.75
	10	110	60	6	115	2
Selector Switch	10	440	7.5	0.75	250 ^③	0.4
	10	220	15	1.5	230	0.55
	10	110	30	3	115	1.1

^③ Nominal submarine voltage (355V maximum).

EXAMPLES OF SOME COMMON CATALOG NUMBERS AND THEIR DESCRIPTIONS

Element Identification Code and Marking ^①			Catalog Number
Position 1 (Top)	Position 2	Position 3	

ONE ELEMENT STATIONS

C - STOP	—	—	6981ED202-1
C - START	—	—	6981ED202-2
C - EMERG. RUN	—	—	6981ED202-3
5A - MAN/OFF/AUTO	—	—	6981ED202-6
1P - ON/OFF	—	—	6981ED202-8

TWO ELEMENT STATIONS

C - START	C - STOP	—	6981ED203-1
C - OPER.	C - CLOSE	—	6981ED203-2
C - HOIST	C - LOWER	—	6981ED203-3
A - START	B - STOP	—	6981ED203-24
A - OPER.	A - CLOSE	—	6981ED203-25
C - UP	C - DOWN	—	6981ED203-36

THREE ELEMENT STATIONS

C - FORWARD	C - REVERSE	C - STOP	6981ED204-1
C - FAST	C - SLOW	C - STOP	6981ED204-2
C - HOIST	C - LOWER	C - STOP	6981ED204-3
A - UP	B - DOWN	B - STOP	6981ED204-23

ELEMENT SYMBOL IDENTIFICATION

Pushbuttons	Indicating Lights	
	Alpha Code	Numeric Code ^②
A - 2NO Contact Pushbutton B - 2NO Contact Pushbutton C - 1NO-1NC Contact Pushbutton	D - 115VAC, 60 Hz E - 440V, 60 Hz F - 24V DC G - 10V DC H - 48V DC	1 - Red Lens 2 - Green Lens 3 - Amber Lens 4 - Blue Lens 5 - White Lens

^① For pushbutton element details see page 51. For selector switch element details see pages 52-53.

^② For indicating light technical data see page 50. **NOTE:** Element Alpha Code is different for Conatrol Stations.

Remote Control Stations

TYPE 6981 “Emergency Stop” Pushbutton Stations



FEATURES

-  MIL-DTL-2212
-  50°C
-  WATERTIGHT EXPLOSION-PROOF
-  CONTINUOUS
-  MANUAL, MOMENTARY
-  CONTROL OPERATION

RATINGS

Inductive Rating	Maximum Amperes					
	AC 60 Hz			DC		
	115VAC	220V	440V	115V	230V	355V
Make	60	50	50	2	0.75	0.5
Break	6	5	5	2	0.75	0.5

Catalog Number	Pushbutton Contacts
----------------	---------------------

WATERTIGHT ENCLOSURE

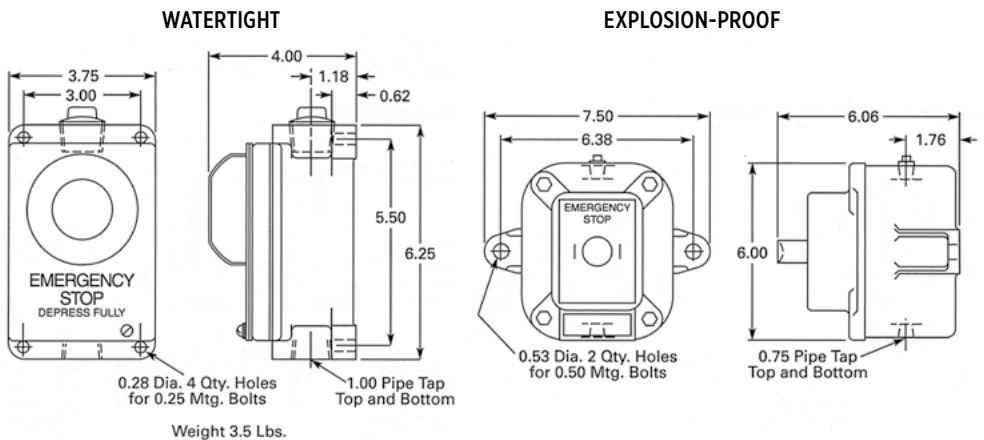
6981ED236-1	2NO
6981ED236-2	2NC
6981ED236-3	1NO-1NC
6981ED236-4NM ①	2NO
6981ED236-5NM ①	2NC
6981ED236-6NM ①	1NO-1NC

EXPLOSION-PROOF ENCLOSURE ②

6981ED239-1	2NO
6981ED239-2	2NC
6981ED239-3	1NO-1NC

- ① Non-magnetic construction.
- ② Class 1, Group D, unless specifically defined otherwise.

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHTS



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PRIDE



PURPOSE



PERFORMANCE



DRUM, MASTER & LIMIT SWITCHES

Drum, Master & Limit Switches

TYPE 6982-T5 Drum Type Selector Switch

FEATURES



MIL-DTL-2212



50°C



OPEN FOR
WATERTIGHT,
FLUSH MOUNTING



CONTINUOUS



MANUAL



CONTROL, OPERATION

2-, 3-, 4- or 5- position

4 Fingers Long - Total 8 fingers (maximum).

Can be supplied 2-, 3-, 4- or 5-position.

Spring return can be supplied but unit is limited to 3 Fingers maximum length.

7 Fingers Long - Total 14 fingers (maximum).

Can be supplied 2-, 3-, 4- or 5-position.

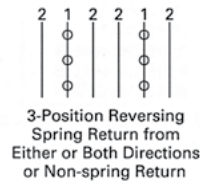
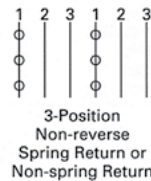
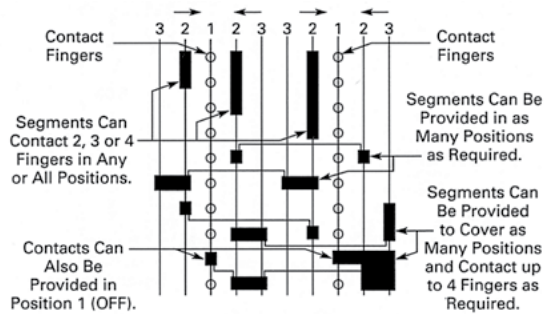
Spring return can be supplied but unit is limited to 6 Fingers maximum length.

RATINGS – PILOT CIRCUITS ONLY

Inductive Rating	Maximum Amperes					
	AC 60 Hz			DC		
	115VAC	220V	440V	115V	230V	250V ^①
Make	40	25	12	2	2	2
Break	4	2	1	1.5	0.75	0.2
Carry (cont.)	15	15	15	15	15	15

① Nominal submarine voltage (355V maximum)

CONTACT ARRANGEMENT ② ③



② A 10 Finger long device is shown to display capability. The maximum length available in a flush mount is 7 Fingers.

③ Diagram for 5-position reversing selector switch showing typical contact segment combinations which are available.

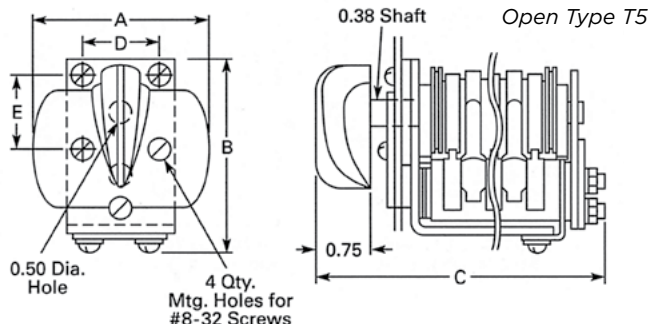
WHEN ORDERING SPECIFY

- Type number - 6982-T5
- Circuit arrangements
- Number of positions
- Self-centering or no-self-centering
- Legend marking

APPROXIMATE DIMENSIONS AND WEIGHTS

Type	Dimensions in Inches					Weight lbs.
	Width	Height	Depth	Mounting		
	A	B	C	D	E	
4 Finger	2.5	2.875	5.19	1.06	1.06	0.75
7 Finger	2.5	2.875	6.875	1.06	1.06	1.5

APPROXIMATE DIMENSIONS IN INCHES



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Drum, Master & Limit Switches



TYPE 6982-T5 Drum Type Selector Switch Station

RATINGS – PILOT CIRCUITS ONLY

Inductive Rating	Maximum Amperes				
	AC 60 Hz		DC		
	115VAC	440V	115V	230V	250V ^①
Make	40	12	2	2	2
Break	4	1	1.5	0.75	0.2
Carry (cont.)	15	15	15	15	15

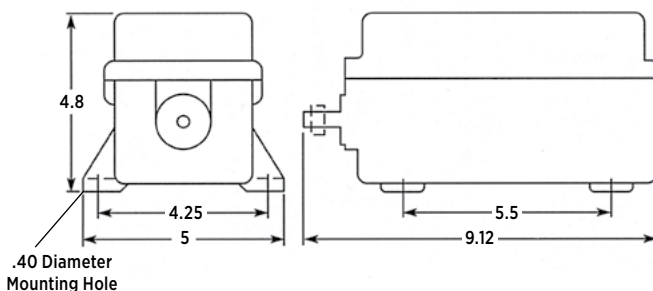
① Nominal submarine voltage (355V maximum)

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHTS

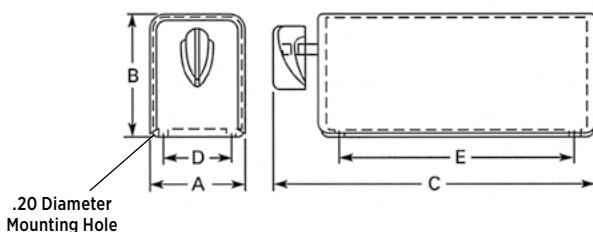
Type	Dimensions in Inches					Weight lbs.
	Width A	Height B	Depth C	Mounting		
				D	E	
7 Finger	2.38	3.25	8.13	1.75	5.88	1.5
10 Finger	2.38	3.25	9.88	1.75	7.88	2.25

APPROXIMATE DIMENSIONS IN INCHES

WATERTIGHT TYPE T5



DRIP-PROOF TYPE T5 (TEARDROP HANDLE)



FEATURES



MIL-DTL-2212



50°C



WATERTIGHT OR DRIP-PROOF



CONTINUOUS



MANUAL



CONTROL OPERATION

2-, 3-, 4- or 5- position
7 Fingers Long - Total 14 fingers (maximum).
 Can be supplied 2-, 3-, 4- or 5-position.
 Spring return can be supplied but unit is limited to 6 Fingers maximum length.
10 Fingers Long - Total 20 fingers (maximum).
 Can be supplied 2-, 3-, 4- or 5-position.
 Spring return can be supplied but unit is limited to 9 Fingers maximum length.

WHEN ORDERING SPECIFY

- Type number - 6982-T5
- Circuit arrangements
- Number of positions
- Self-centering or non-self-centering
- Type of enclosure
- Legends markings
- Type of handle (counterbalanced lever, round knob or teardrop knob)
- Bulkhead or surface mounting

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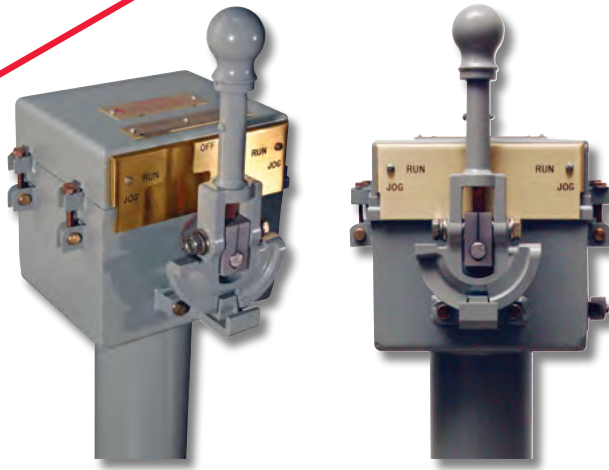
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Drum, Master & Limit Switches

TYPE 6982-T8 Cam Type Master Switch



FEATURES



MIL-DTL-2212 ①



50°C



WATERTIGHT



CONTINUOUS



MANUAL



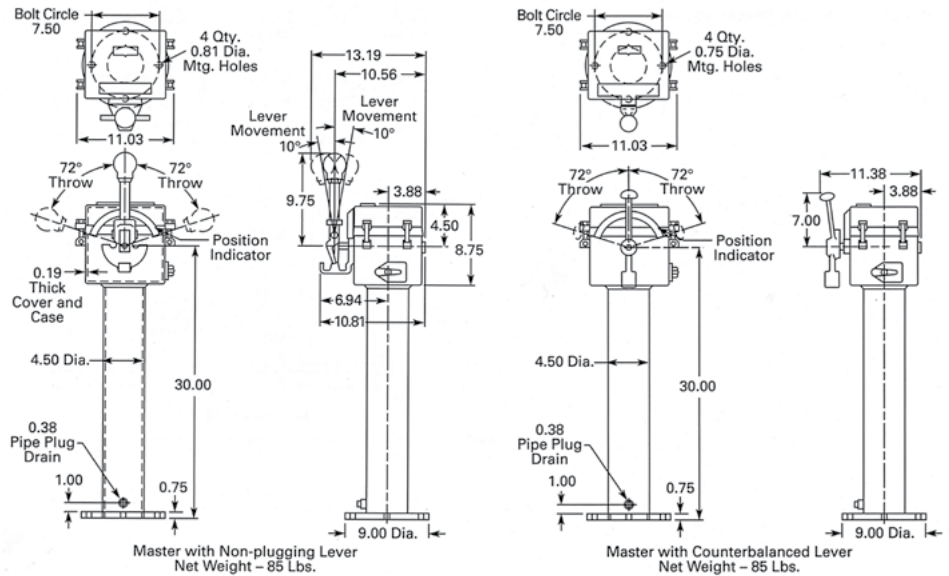
CONTROL, OPERATION
6 circuits | 3 to 9 positions | T5 switch option

RATINGS – PILOT CIRCUITS ONLY

Inductive Rating	Maximum Amperes			
	AC 60 Hz		DC	
	115VAC	440V	115V	230V
Make	40	10	3	1.5
Break	10	2.5	3	1.5
Carry (cont.)	10	10	10	10

① Master switch contacts are non-closing on Class HI-Shock. Contacts may momentarily bounce open on Class HI-Shock.

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHTS



WHEN ORDERING SPECIFY

- Type number – 6982-T8
- Circuit arrangement
- Self-centering or non-self-centering
- Legend marking
- Non-plugging or counterbalanced lever
- T5 switch option
- **When Ordering Renewal Parts –**
For a master switch in service, be sure to give nameplate data and description of parts required.

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Drum, Master & Limit Switches

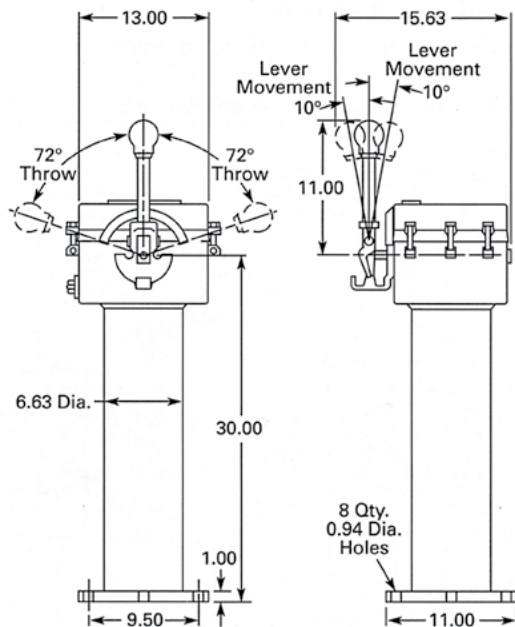
TYPE 6982-T9 Cam Type Master Switch

RATINGS – PILOT CIRCUITS ONLY

Inductive Rating	Maximum Amperes			
	AC 60 Hz		DC	
	115VAC	440V	115V	230V
Make	40	10	3	1.5
Break	10	2.5	3	1.5
Carry (cont.)	10	10	10	10







❶ Master switch contacts are non-closing on Class HI-Shock. Contacts may momentarily bounce open on Class HI-Shock.

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHT



Net Weight – 110 Lbs.

FEATURES

-  MIL-DTL-2212 ❶
-  50°C
-  WATERTIGHT
-  CONTINUOUS
-  MANUAL
-  CONTROL, OPERATION
6 circuits | 3 to 11 positions | T5 switch option

WHEN ORDERING SPECIFY

- Type number – 6982-T9
- Self-center or non-self center
- Circuit arrangement
- Legend marking
- Non-plugging or counterbalanced lever
- T5 switch option
- **When Ordering Renewal Parts –**
For a master switch in service, be sure to give nameplate data and description of parts required.

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Drum, Master & Limit Switches

TYPE 6984NL Snap Action Limit Switches

FEATURES

-  MIL-DTL-2212 ①
-  50°C
-  WATERTIGHT
-  CONTINUOUS
-  SNAP ACTION
PRECISION TYPE
-  CONTROL, EQUIPMENT
5 TYPES OF OPERATING HEADS
Four-position | 90° operating head rotation |
360° lever adjustability | Spring return to normal



Counterbalanced Roller Lever



Adjustable Roller Lever



Adjustable Rod Actuator

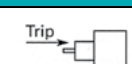

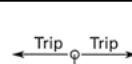

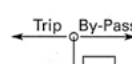



Top Pushbutton Roller

RATINGS – PILOT CIRCUITS ONLY

Contacts	Current Amperes	AC		DC		
		115VAC	440V	115V	230V	355V
NO-NC	Inrush	40	10	-	-	-
	Continuous and Break	15	6	0.5	0.2	0.1
2NO or 2NC	Inrush	17	4.5	-	-	-
	Continuous and Break	3	0.75	0.1	0.05	-

TYPE NL

Description		1NO-1NC ③	2NO	2NC
Type of Operator	Function	Cat. Number	Cat. Number	Cat. Number
Pushbutton		6984H42A	6984H79A	6984H80A
Push Roller		6984H43A	6984H81A	6984H82A
Adjustable Rod Lever		6984H50A	6984H95A	6984H98A
Adjustable Roller Lever		6984H47A	6984H89A	6984H92A
1.5 inch Counterbalance Roller Lever ②		6984H53A ①	6984H83A	6984H86A
Adjustable Rod Lever		6984H51A	6984H96A	6984H99A
Adjustable Roller Lever		6984H48A	6984H90A	6984H93A
1.5 inch Counterbalance Roller Lever ②		6984H54A ①	6984H84A	6984H87A
Adjustable Rod Lever		6984H52A	6984H97A	6984H100A
Adjustable Roller Lever		6984H49A	6984H91A	6984H94A
1.5 inch Counterbalance Roller Lever ③		6984H55A ①	6984H85A	6984H88A

① These switches are electrically "HI-Shock." All others are mechanical "HI-Shock" only.

② Switch with 2.5 inch counterbalance roller lever is available.

③ Must be same polarity

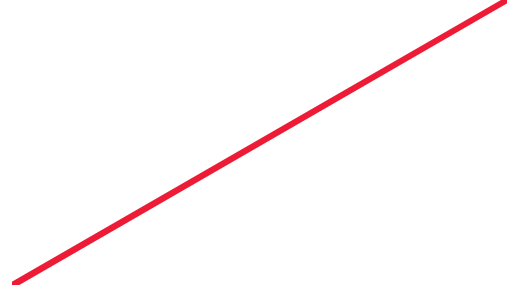
Approximate Weight 1.25 lbs.

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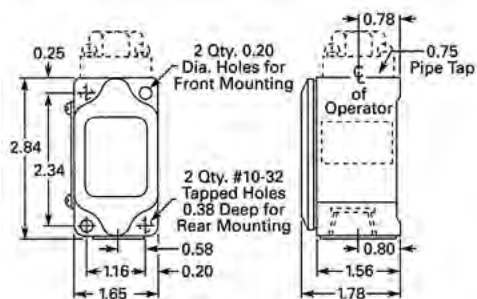
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TYPE 6984NL Snap Action Limit Switches

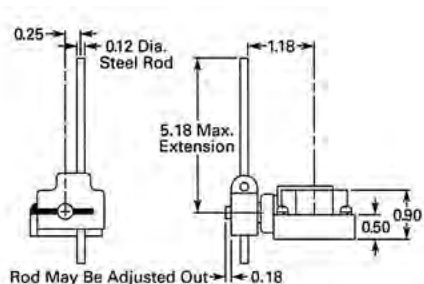
APPROXIMATE DIMENSIONS IN INCHES AND OPERATING DATA

ZINC ALLOY LIMIT SWITCH WITHOUT OPERATING HEAD



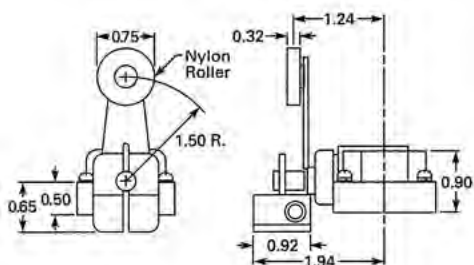
Travel to Close Contacts 10°
 Pounds Force to Trip @ 1.5 inch Radius 2
 Total Travel 50°
 Travel to Reset from Trip Point 4°

ADJUSTABLE ROD ACTUATOR



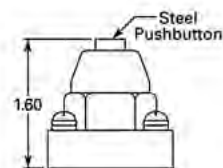
Travel to Close Contacts 10°
 Pounds Force to Trip @ 1.5 inch Radius 2
 Total Travel 50°
 Travel to Reset from Trip Point 4°

COUNTERBALANCED ROLLER LEVER



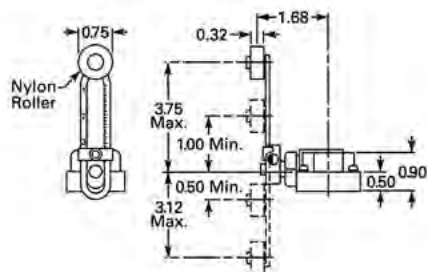
Travel to Close Contacts 10°
 Pounds Force to Trip @ 1.5 inch Radius 2
 Total Travel 50°
 Travel to Reset from Trip Point 4°

TOP PUSHBUTTON



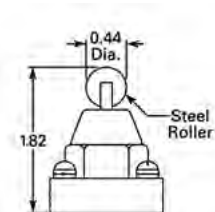
Travel to Close Contacts 0.05 inch
 Pounds Force to Trip Contacts 4.0
 Total Travel 0.28 inch
 Travel to Reset 0.02 inch

ADJUSTABLE ROLLER LEVER



Travel to Close Contacts 10°
 Pounds Force to Trip @ 1.5 inch Radius 2
 Total Travel 50°
 Travel to Reset from Trip Point 4°

TOP PUSH ROLLER



Travel to Close Contacts 0.04 inch
 Pounds Force to Trip Contacts 4.0
 Total Travel 0.28 inch
 Travel to Reset 0.02 inch

Drum, Master & Limit Switches

TYPE 6984NLX-W Explosion-Proof/ Watertight Limit Switches

FEATURES



MIL-DTL-2212 ①



50°C



EXPLOSION-PROOF,
OR WATERTIGHT
(hose test)



CONTINUOUS



SNAP ACTION
PRECISION TYPE



CONTROL, EQUIPMENT
5 TYPES OF OPERATING HEADS
Four-position | 90° operating head rotation |
360° lever adjustability | Spring return to normal

RATINGS – PILOT CIRCUITS ONLY

Contacts	Current Amperes	AC		DC		
		115VAC	440V	115V	230V	355V
NO-NC	Inrush	40	10	-	-	-
	Continuous and Break	15	6	0.5	0.2	0.1
2NO or 2NC	Inrush	17	4.5	-	-	-
	Continuous and Break	3	0.75	0.1	0.05	-

TYPE NLX-W SILICON BRONZE LIMIT SWITCHES

Contacts	Rotation	Operator Type ② – Catalog Number				Weight lbs.
		Top Pushbutton	Top Roller	1.5 inch Counterbalanced Roller Lever	2.5 inch Counterbalanced Roller Lever	
NO-NC ④	-	6984ED64-21	6984ED64-24	-	-	6.25
	CW & CCW	-	-	6984ED64-27 ③	6984ED64-36 ③	
	CCW	-	-	6984ED64-28 ③	6984ED64-40 ③	
	CW	-	-	6984ED64-29 ③	6984ED64-41 ③	
2NO	-	6984ED64-22	6984ED64-25	-	-	6.25
	CW & CCW	-	-	6984ED64-30	6984ED64-37	
	CCW	-	-	6984ED64-31	-	
	CW	-	-	6984ED64-32	-	
2NC	-	6984ED64-23	6984ED64-26	-	-	6.25
	CW & CCW	-	-	6984ED64-33	6984ED64-38	
	CCW	-	-	6984ED64-34	-	
	CW	-	-	6984ED64-35	-	

① Class I, Group D, unless specifically defined otherwise.

② For dimensions and operating characteristics, see dimension drawings on page 75.

③ Only these switches are electrically and mechanically "HI-Shock." All others are mechanically "HI-Shock" only.

④ Both contacts must be the same polarity.

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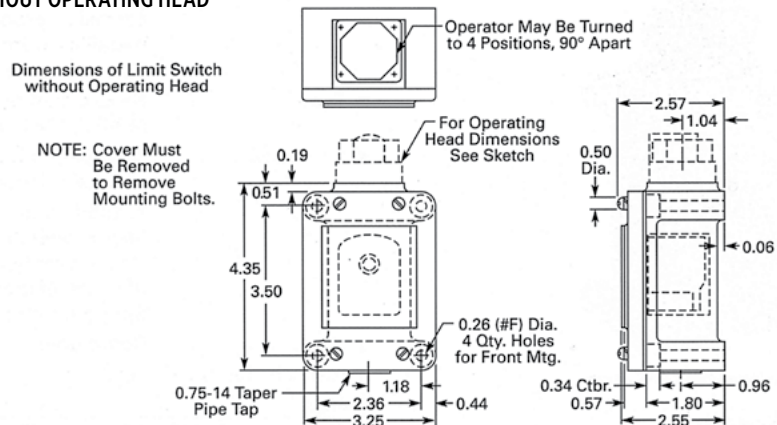
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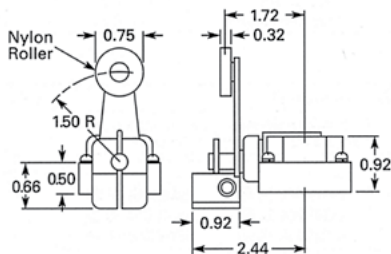
TYPE 6984NLX-W Explosion-Proof/Watertight Limit Switches

APPROXIMATE DIMENSIONS IN INCHES AND OPERATING DATA

SILICON BRONZE LIMIT SWITCH WITHOUT OPERATING HEAD

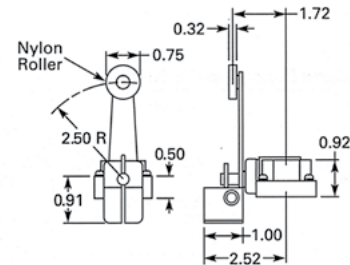


1.5 INCH COUNTERBALANCED ROLLER LEVER WITH NYLON ROLLER



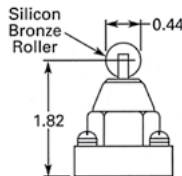
Travel to Trip.....	10°
Pounds Force to Trip @ 1.5 inch Radius.....	2
Total Travel.....	50°
Travel to Reset.....	4°

2.5 INCH COUNTERBALANCED LEVER WITH NYLON ROLLER



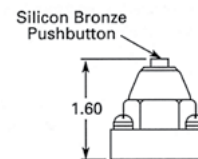
Travel to Trip.....	10°
Pounds Force to Trip @ 2.5 inch Radius.....	1.2
Total Travel.....	50°
Travel to Reset.....	4°

TOP PUSH ROLLER



Travel to Close Contacts (maximum).....	0.05 inch
Pounds Force to Trip Contacts.....	5.75
Total Travel (minimum).....	0.27 inch
Travel to Reset (maximum).....	0.05 inch

TOP PUSHBUTTON

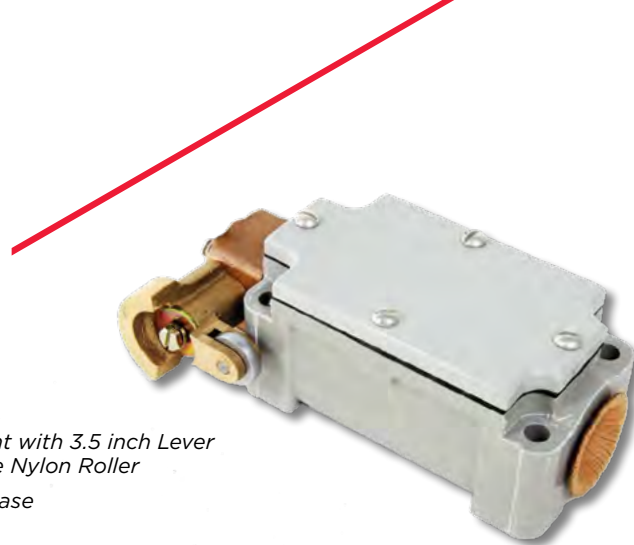


Travel to Close Contacts (maximum).....	0.05 inch
Pounds Force to Trip Contacts.....	5.75
Total Travel (minimum).....	0.27 inch
Travel to Reset (maximum).....	0.05 inch

NOTE: Dimensions are approximate and are not to be used for construction.

Drum, Master & Limit Switches

TYPE 6984-T11, T12 Snap Action Limit Switch



Type T11 -
Watertight with 3.5 inch Lever
and Large Nylon Roller
Molded Case

RATINGS – PILOT CIRCUITS ONLY

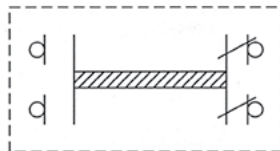
Inductive Rating	Maximum Amperes					
	AC 60 Hertz			DC		
	115VAC	220V	440V	115V	230V	250V ²
Make	60	30	20	10	10	10
Break	6	3	1.5	2.2	1.1	0.5
Carry (Cont.)	10	10	10	10	10	10

- ① Class I, Group D, unless specifically defined otherwise.
- ② Nominal submarine voltage (355V maximum).

ARRANGEMENT OF CONTACTS

TYPE T11

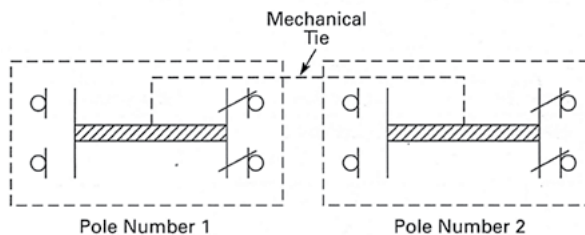
Single-Pole, Double-Throw Switch – Normal Position



Normally open and normally closed contacts should be on the same side of the line.

TYPE T12

Double-Pole, Double-Throw Switch – Normal Position



The poles can be used on opposite sides of the line. Normally open and normally closed contacts on each pole must be on the same side of the line.

FEATURES



MIL-DTL-2212



50°C



WATERTIGHT
OR EXPLOSION-
PROOF ①



CONTINUOUS



SNAP ACTION LIMIT SWITCH



CONTROL, EQUIPMENT
3 TYPES OF OPERATING HEADS
Roller lever operator | Push roller operator |
Pushbutton operator | Spring return to normal position

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TYPE 6984-T11, T12

Snap Action Limit Switch

TYPES T11, T12 – WATERTIGHT OR EXPLOSION PROOF

Description		Type T11 – 1NO-1NC		Type T12 – 2NO-2NC	
Type of Operator	Function	Watertight	Explosion-Proof ❶	Watertight	Explosion-Proof ❶
		Catalog Number	Catalog Number	Catalog Number	Catalog Number
Pushbutton		6984H5C	6984H21B	6984ED89-1	6984ED86-1
Push Roller		6984H6C	6984H22B	6984ED89-2	6984ED86-2
1.19 inch Long Roller Lever, Steel Roller		6984ED5-2	6984ED39-2	6984ED92-1	-
2.5 inch Long Roller Lever, Steel Roller		6984H27A	6984H24A	6984ED90-1	6984ED87-1
3.5 inch Long Roller Lever, Nylon Roller ❷		6984H36A	6984H33A	6984ED91-1	6984ED88-1
1.19 inch Long Roller Lever, Steel Roller		6984ED6-2	6984ED39	6984ED92-2	-
2.5 inch Long Roller Lever, Steel Roller		6984H28A	6984H25A	6984E90-2	6984ED87-3
3.5 inch Long Roller Lever, Nylon Roller ❷		6984H37A	6984H34A	6984ED91-2	6984ED88-2
1.19 inch Long Roller Lever, Steel Roller		6984ED7	-	6984ED92-3	-
2.5 inch Long Roller Lever, Steel Roller		6984H29A	6984H26A	6984ED90-3	6984ED87-4
3.5 inch Long Roller Lever, Nylon Roller ❷		6984H38A	6984H35A	6984ED91-3	6984ED88-3

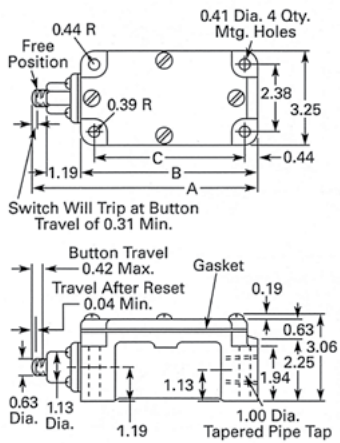
❶ Class I, Group D, unless specifically defined otherwise.

❷ Nylon roller is 1.5 inch diameter.

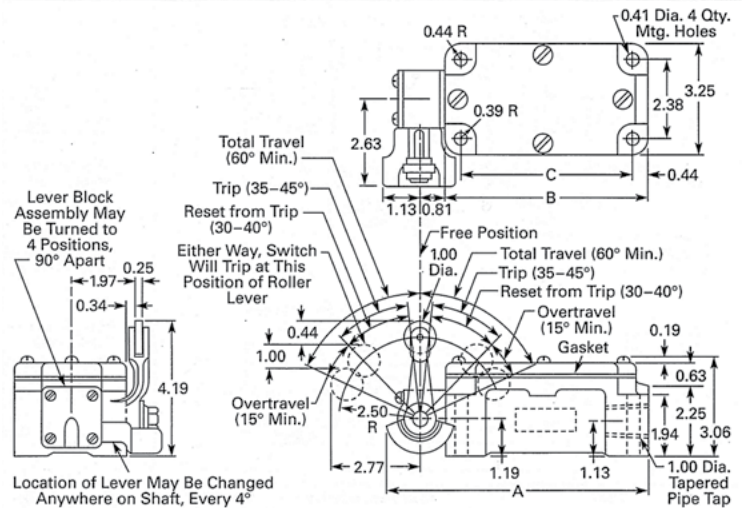
TYPE 6984-T11, T12 Snap Action Limit Switches

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHTS – WATERTIGHT ENCLOSURES

MOLDED LIMIT SWITCH WITH PUSHBUTTON OPERATOR



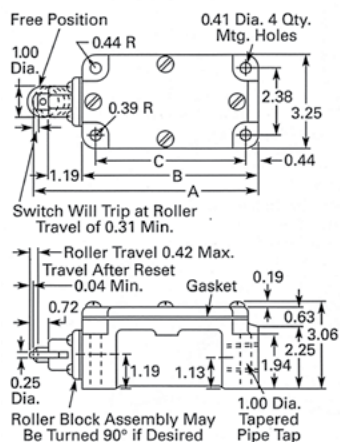
MOLDED LIMIT SWITCH WITH ROLLER LEVER OPERATOR, CLOCKWISE AND COUNTERCLOCKWISE TRIP



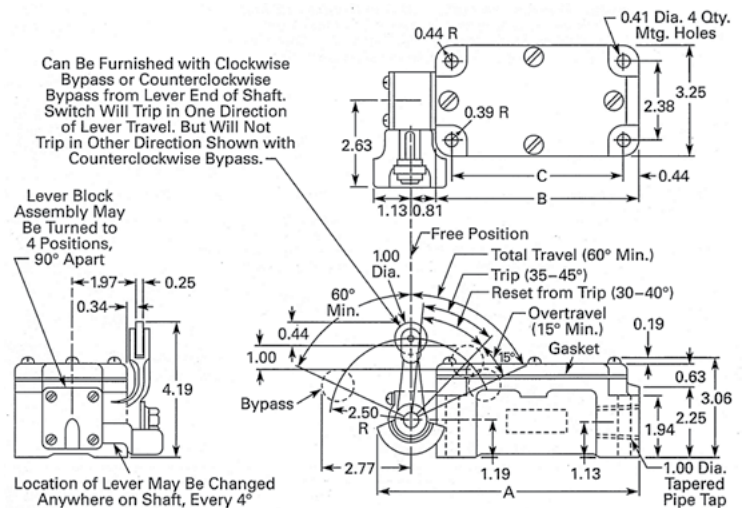
Type	Dimensions in Inches			Weight lbs.
	A	B	C	
T11-Single-Pole, Double Throw	7.91	6.13	5.25	4
T12-Double-Pole, Double Throw	11.03	9.25	8.38	5

Type	Dimensions in Inches			Weight lbs.
	A	B	C	
T11-Single-Pole, Double Throw	8	6.13	5.25	4
T12-Double-Pole, Double Throw	11.25	9.25	8.38	5

MOLDED LIMIT SWITCH WITH PUSH ROLLER OPERATOR



MOLDED LIMIT SWITCH WITH ROLLER LEVER OPERATOR, CLOCKWISE TRIP AND COUNTERCLOCKWISE BYPASS - OR COUNTERCLOCKWISE TRIP AND CLOCKWISE BYPASS



Type	Dimensions in Inches			Weight lbs.
	A	B	C	
T11-Single-Pole, Double Throw	8.03	6.13	5.25	4
T12-Double-Pole, Double Throw	11.16	9.25	8.38	5

Type	Dimensions in Inches			Weight lbs.
	A	B	C	
T11-Single-Pole, Double Throw	8.06	6.13	5.25	4
T12-Double-Pole, Double Throw	11.19	9.25	8.38	5

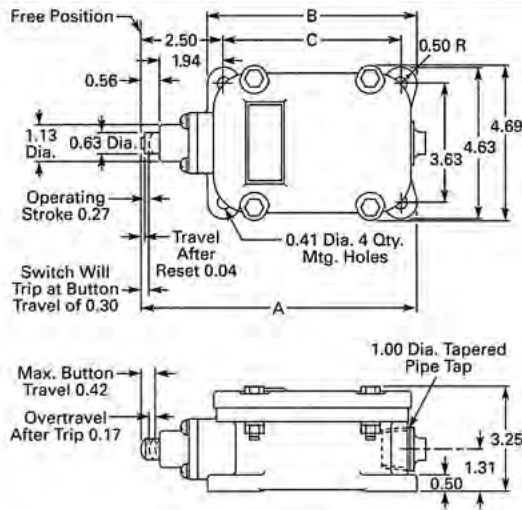
① Nylon Roller is 1.5 inch diameter.

TYPE 6984-T11, T12

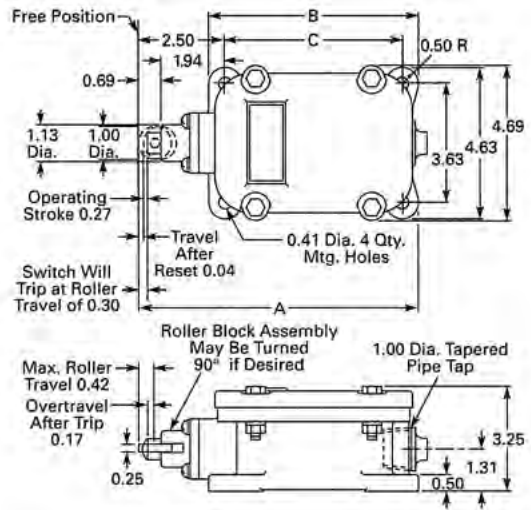
Snap Action Limit Switch

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHTS – EXPLOSION-PROOF ENCLOSURES

BRASS LIMIT SWITCH WITH PUSHBUTTON OPERATOR



BRASS LIMIT SWITCH WITH PUSH ROLLER OPERATOR

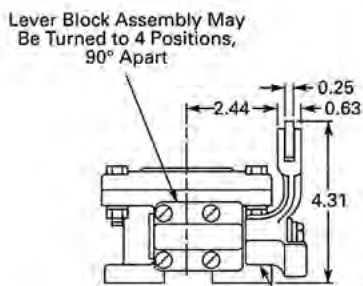


Type	Dimensions in Inches			Weight lbs.
	A	B	C	
T11-Single-Pole, Double Throw	8.38	6.38	5.38	14
T12-Double-Pole, Double Throw	11.5	9.5	8.5	20

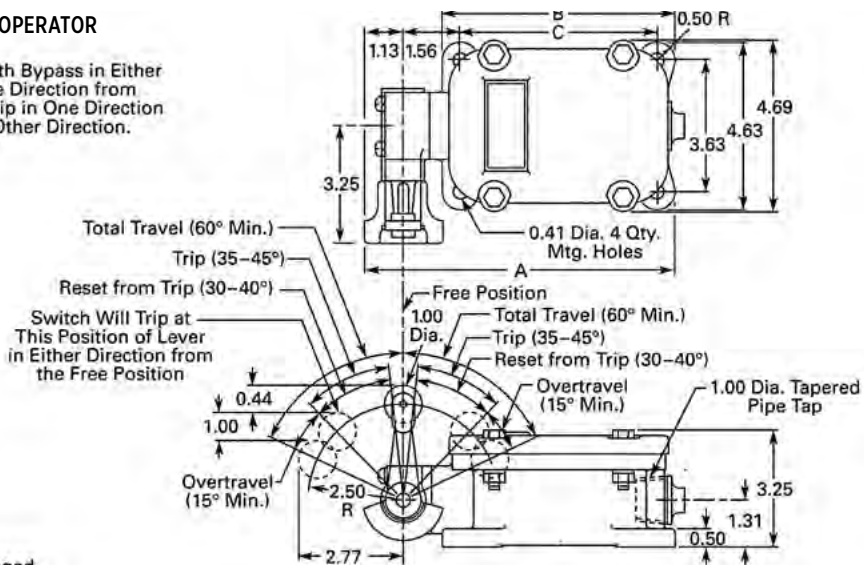
Type	Dimensions in Inches			Weight lbs.
	A	B	C	
T11-Single-Pole, Double Throw	8.5	6.38	5.38	14
T12-Double-Pole, Double Throw	11.63	9.5	8.5	20

BRASS LIMIT SWITCH WITH ROLLER LEVER OPERATOR

Switch Can Also Be Furnished with Bypass in Either Clockwise or Counterclockwise Direction from Lever End of Shaft. Switch Will Trip in One Direction of Travel But Will Not Trip in Other Direction.



Location of Lever May Be Changed Anywhere on Shaft, Every 4°



Type	Dimensions in Inches ①			Weight lbs.
	A	B	C	
T11-Single-Pole, Double Throw	9	6.38	5.38	14
T12-Double-Pole, Double Throw	11.69	9.5	8.5	20






① Nylon roller is 1.5 inch diameter.

Drum, Master & Limit Switches

TYPE 6984 Geared Type Limit Switch



FEATURES

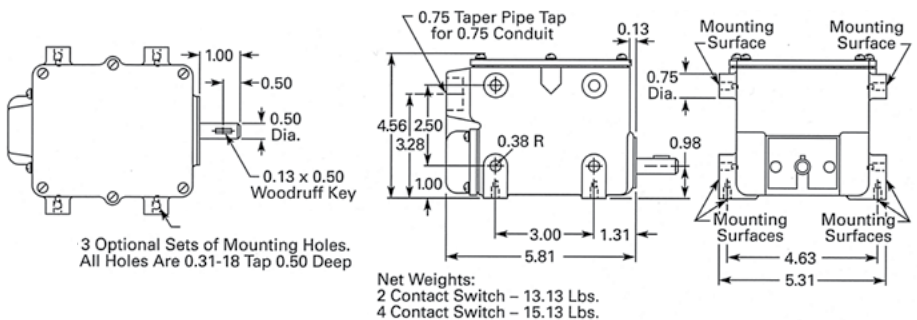
-  MIL-DTL-2212  50°C
-  WATERTIGHT
Brass Case and Cover  CONTINUOUS
-  ROTATING SHAFT DRIVEN
2 contact or 4 contact | Tripping points are adjustable between 1/2 and 100 turns of operating shaft in increments of 1/20th of a shaft turn. | For shaft speeds of 600 rpm (max.), 10 rpm (min.)
-  CONTROL, EQUIPMENT

GEARED LIMIT SWITCH - WATERTIGHT (BRASS)

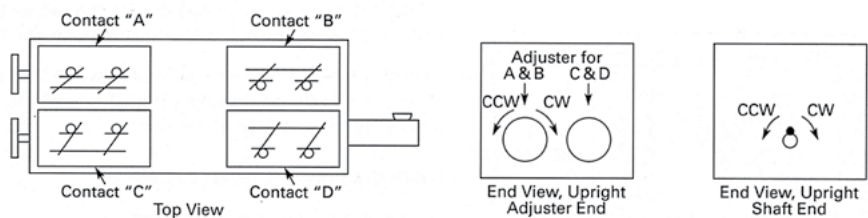
Description	Catalog Number
Rotating Shaft - 2 Contact (A&B)	6984H133A-NM
Rotating Shaft - 4 Contact (A-D)	6984ED84NM

 Contact may open or close momentarily on Class HI-Shock. See page 85.

APPROXIMATE DIMENSIONS IN INCHES AND WEIGHTS



OPERATION



All contacts are closed between limits, the switch construction is such that contact "A" and "D" are normally open before they are mounted in the switch, and contacts "B" and "C" are normally closed before mounting in switch.

Contacts "A" and "C" are opened by clockwise rotation of the adjuster, and clockwise rotation of the shaft. Contact "A" and "C" are set by driving the machine to its end of travel in the direction that turns the adjuster clockwise, and then opening the contacts with the adjuster.

Contacts "B" and "D" are opened by counterclockwise rotation of the adjuster, and the counterclockwise rotation of the shaft. Contacts "B" and "D" are set by driving the machine to its end of travel in the direction that turns the adjuster counterclockwise, and then opening the contacts with the adjuster.

One turn of the adjuster corresponds to 1-1/3 turns of the main shaft.

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PRIDE



Company received prized Army-Navy "E" award March 26, 1943.

PERFORMANCE



PURPOSE



SPECIFICATIONS & TECHNICAL DETAILS

THIS SECTION INCLUDES:

- Applicable Specifications
- Enclosure
- Features
- Customization
- Testing
- Standard Navy Plan
- Quality Assurance
- Technical Manual Inserts

APPLICABLE SPECIFICATIONS

MIL-DTL-2212 is the controlling specification for motor control equipment used on Naval vessels. It invokes 24 other Military Specifications and Standards. Some of these are:

MIL-DTL-917	Electric Power Equipment, Basic Requirements
MIL-DTL-901	Shock Tests, High Impact; Shipboard Machinery, Equipment and Systems, Requirements for
MIL-STD-167-1	Mechanical Vibrations of Shipboard Equipment (I - Environmental and II - Internally Excited)
DOD-STD-1399	Interface Standard for Shipboard Systems Section 300- Electric Power, Alternating Current

ENCLOSURES

Leonardo DRS standard enclosures are constructed of steel with a painted finish. Other designs are available. Enclosure types available are given in table below:

NAVY CLASSIFICATION	NEMA TYPE	NAVY REQUIREMENT	1P CLASS
Drip-proof	2	Protection to 45° inclination	22
Splash-proof	3	15 gallon/minute hose test	54
Spraytight	4	65 gallon/minute hose test	56
Watertight	6P	3 ft of submersion	67
Submersible	-	15 ft of submersion	67 FISH

Explosion-proof enclosure certification is not maintained.

FEATURES

Leonardo DRS AC controllers, components and pilot devices are designed and built to meet the requirements of MIL-DTL-2212.

Some features included are:

- **TEMPERATURE RATING** - 50°C and 65°C.
- **OVERLOAD** - Electronic and thermal relays.
- **COMMUNICATION** - Modbus, Profibus, ASCII.
- **VOLTAGE** - 440V and 115V; other voltages available upon request.
- **HIGH SHOCK** - MIL-DTL-901, Grade A, Class 1, Type A.
- **VIBRATION** - MIL-STD-167-1 to 33 Hz as standard
- **INCLINATION** - Equipment will operate at inclinations up to 45° from the normal mounting orientation.
- **EMI** - MIL-STD-461

NON-MAGNETIC CONSTRUCTION

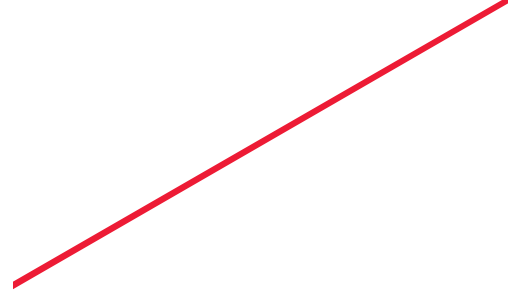
Special situations require the use of motor control equipment that presents a low “magnetic profile.” One example is a mine sweeper. Reducing the magnetic profile requires the use of non-ferrous (i.e. non-magnetic) materials where feasible. Additional steps may be necessary to counteract the impact of ferrous materials and magnetic structures that cannot be eliminated.

QUIET CONTROL (MIL-STD-740)

MIL-STD-740 defines acceptable levels for airborne and structure borne noise when “Quiet” operation is required. Airborne noise is undesired sound carried through the air. Structure borne noise is an undesired vibration carried through a solid medium such as the ship’s hull.

CUSTOMIZATION

Navy motor control equipment and components can be provided to meet custom requirements.



TESTING

AC Controllers, components and pilot devices are designed and built to meet the requirements of MIL-DTL-2212. Representative samples of controllers, components and pilot devices are periodically subjected to MIL-DTL-2212 Retention testing. The complete list of controller, component, and pilot devices approved by the Navy for general use in Naval applications, is found in the Qualified Products Database for MIL-DTL-2212.

<https://qpldocs.dla.mil/search/parts.aspx?qpl=1546>

DC Controllers and components were designed and qualified to the requirements of MIL-C-2212F. Representative samples of these devices are subjected to shock and other tests as part of internal quality assurance.

Leonardo DRS does not imply a full suite of QPL testing is completed for every configuration of controller, component and pilot device manufactured. If additional individual qualification testing is required, Leonardo DRS will provide a separate quote for those specifically requested tests. If qualification testing is required, Leonardo DRS must be notified prior to the placement of a Purchase Order.

Leonardo DRS Field Service can support special inspections, installation, and maintenance of equipment.

QUALITY ASSURANCE

The Leonardo DRS Naval Power Systems Milwaukee facility is ISO 9000 certified and quality programs exceed the requirements of MIL-I-45208A - "Inspection System Requirements". Leonardo DRS motor controllers, components, and accessories are designed and manufactured in conformance with MIL-DTL-2212 and applicable sub-tier Military Specifications, as indicated in this catalog. The Quality Assurance documentation normally requested includes Government Source Inspections, Certificate of Compliance, Certificate of Identity, and a copy of the final test report.

TECHNICAL MANUAL INSERTS

Standard Technical Manual Inserts are supplied when ordered. These existing product publications provide information for the installation, maintenance and repair of our standard motor control equipment.



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