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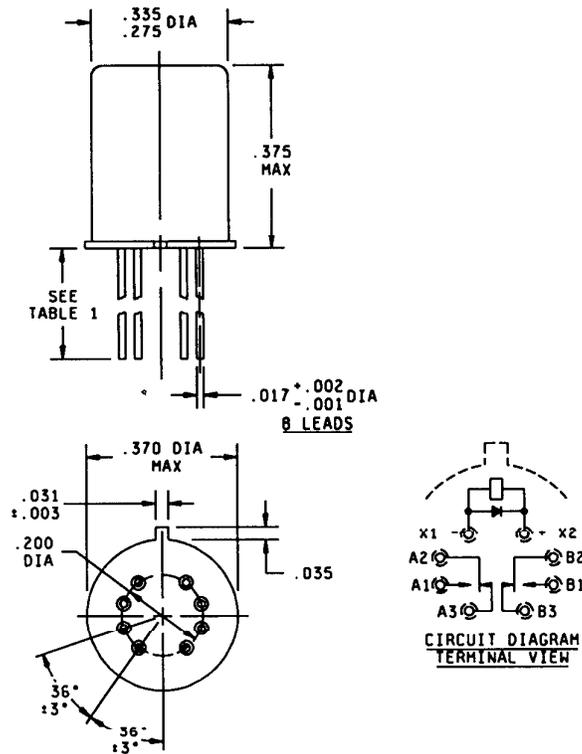
MIL-PRF-39016/21F  
20 JULY 1988  
 SUPERSEDING  
 MIL-R-39016/21E  
 10 February 1986

PERFORMANCE SPECIFICATION SHEET

RELAYS, ELECTROMAGNETIC, ESTABLISHED RELIABILITY, DPDT, LOW LEVEL TO 1.0 AMPERE (SENSITIVE 60 MILLIWATTS) WITH INTERNAL DIODES FOR COIL TRANSIENT SUPPRESSION AND POLARITY REVERSAL PROTECTION

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

The requirements for acquiring the product described herein shall consist of this specification and the latest issue of MIL-R-39016.



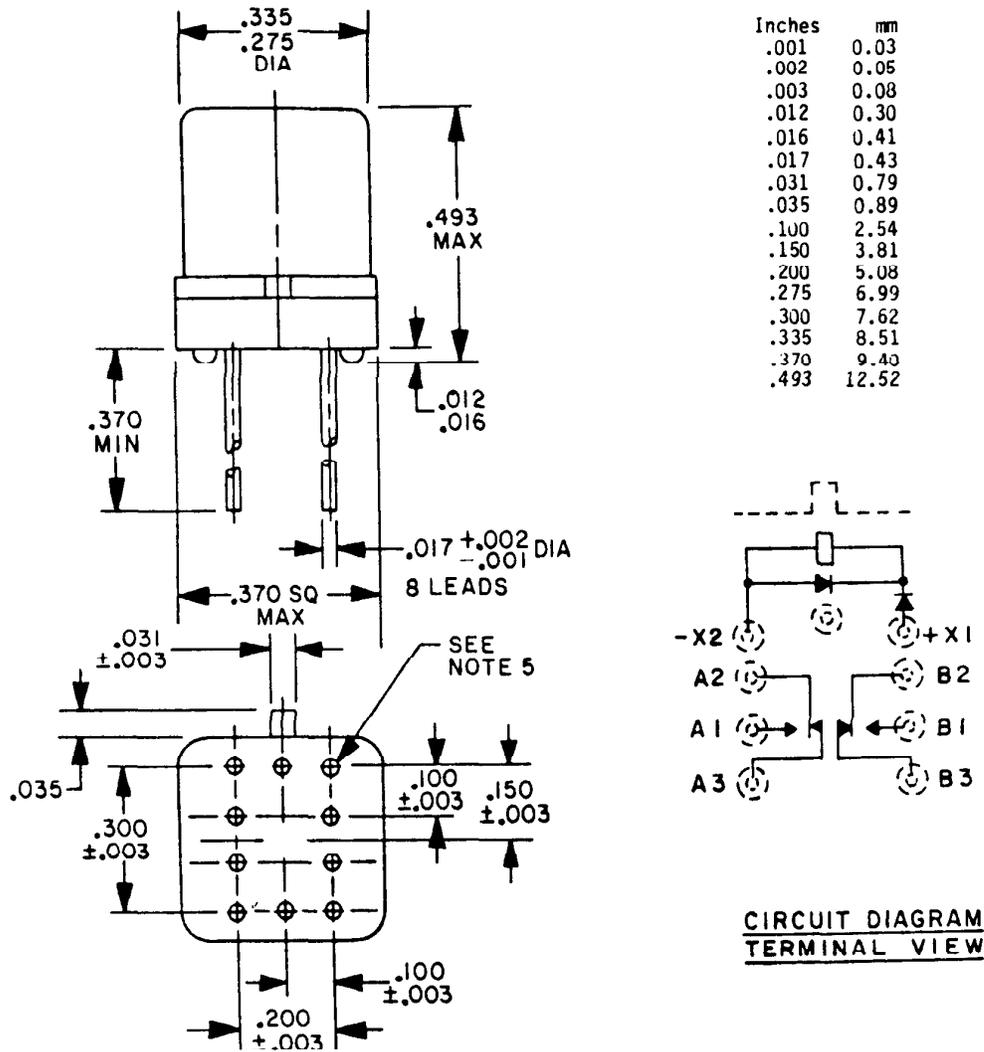
Inches	mm	Inches	mm	Inches	mm
.001	0.03	.031	0.79	.335	8.51
.002	0.05	.035	0.89	.370	9.40
.003	0.08	.200	5.09	.375	9.53
.017	0.43	.275	6.99		

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is  $\pm 0.010$  (0.25 mm).
4. Terminal numbers shown above are for reference only. Numbers do not appear on the relay.
5. Relays shall have a plus (+) sign placed on the circuit diagram as shown.
6. Coil symbol optional in accordance with MIL-STD-1285.
7. Circuit diagram shown on part is the terminal view.

FIGURE 1. Dimensions and configuration.

(F) denotes changes



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is  $\pm 0.010$  (0.25 mm).
4. Spreader pads shall be certified to MIL-M-38527/5-03.
5. Dimensions and tolerances shown for the bottom view of the spreader pad are for the center to center locations of the holes in the spreader pad.
6. Shape optional within the envelope dimension.
7. Terminal numbers shown above for reference only. Numbers do not appear on relay.
8. Relays shall have a (+) sign placed on circuit diagram as shown.
9. Coil symbol optional in accordance with MIL-STD-1285.
10. Circuit diagram shown on part is the terminal view.

FIGURE 2. Dimensions and configuration relay supplied with spreader pad attached.

REQUIREMENTS:

CONTACT DATA:

Load ratings:

High level (relay case grounded):

Resistive:

1.0 ampere at 28 V dc.

500 milliamperes at 115 V ac 400 Hz case not grounded.

250 milliamperes at 115 V ac 60 Hz case not grounded.

100 milliamperes at 115 V ac 60 and 400 Hz case grounded.

Inductive load: 0.2 ampere at 28 V dc with 0.32 henry inductance.

Lamp: 0.10 ampere at 28 V dc.

Low level: 10 to 50  $\mu$ A at 10 to 50 mV dc or peak ac.

Intermediate current: Applicable.

Contact resistance or voltage drop:

Initial: 0.10 ohm maximum (0.125 ohm maximum with spreader pad attached).

High level:

During life: Not more than 5 percent of open circuit voltage.

After life: 0.20 ohm maximum (0.225 ohm maximum with spreader pad attached).

Low level:

During life: 33 ohms maximum.

After life: 0.15 ohm maximum (0.175 ohm maximum with spreader pad attached).

Intermediate current:

During: 1 ohm maximum.

After: 0.20 ohm maximum (0.225 ohm maximum with spreader pad attached).

Contact bounce: 1.5 milliseconds maximum (applicable to failure rate level "L").

Contact stabilization time: 2.0 milliseconds maximum (applicable to failure rate levels "M", "P", and "R").

Overload (high level only): Two times rated current.

COIL DATA: See table I.

Operate time: 4.0 ms maximum over temperature range with rated coil voltage.

Release time: 7.5 ms maximum over temperature range.

ELECTRICAL DATA:

Insulation resistance: 1/ 10,000 megohms minimum at 500 V dc, except the resistance between coil and case at high temperature shall be 1,000 megohms minimum.

Dielectric withstanding voltage: 1/

	Sea level V rms (60 Hz)	Altitude V rms (60 Hz)
Between case, frame, or enclosure and all contacts both in the energized and deenergized positions - -	500	125 All terminals to case
Between case, frame, or enclosure and coil(s) - - -	500	
Between all contacts and coil(s) - - - - -	500	
Between open contacts in the energized and deenergized positions - - - - -	500	
Between contact poles - - - - -	500	
Between coils of dual coil relays - - - - -	---	

DIODE CHARACTERISTICS:

- (F) Coil transient suppression: Applicable.
- (F) Diode breakdown and block integrity (delete coil resistance and substitute this test in all inspection tables of MIL-R-39016):
- (F) With applicable voltage applied to the relay coil circuit in the reverse direction, monitor leakage current with dc microammeter or oscilloscope or qualifying activity approved test equipment. Leakage current shall not exceed the specified value.  
  
Maximum negative transient: 1.0 volt.
- (F) Breakdown voltage: 100 V dc minimum at 10 microamperes (µA).  
  
Maximum leakage current: 1 µA at 50 V dc.
- (F) Semiconductor in-process screening: Applicable, visual inspection of semiconductors shall be in accordance with MIL-STD-750, method 2073 or 2074.

ENVIRONMENTAL DATA:

- Temperature range: -65°C to +125°C.
- (F) Vibration (sinusoidal): MIL-STD-202, method 204. Contact chatter shall not exceed 10 microseconds maximum for closed contacts, and 1 microsecond maximum closure for open contacts.
- (F) Vibration (random): MIL-STD-202, method 214, test condition IG. Contact chatter shall not exceed 10 microseconds maximum for closed contacts, and 1 microsecond maximum closure for open contacts (applicable to qualification and group C testing only).
- (F) Shock (specified pulse): MIL-STD-202, method 213, test condition B (75 g's). Contact chatter shall not exceed 10 microseconds maximum for closed contacts, and 1 microsecond maximum closure for open contacts.
- Magnetic interference: Applicable.
- Resistance to soldering heat: Applicable.
- Acceleration: Applicable.
- Salt atmosphere (corrosion): In accordance with method 1041, MIL-STD-750.

1/ Insulation resistance and dielectric withstanding voltage tests must always precede all other specified electrical measurements. Connect all coil terminals together to avoid damage to diodes.

## PHYSICAL DATA:

Terminal strength (MIL-STD-202, method 211):

Pull test: Test condition A, 1 pound pull.

Bend test: Test condition C, 1/2 pound load.

Ⓕ Twist test: As specified in MIL-R-39016.

Solderability: Applicable.

Dimensions and configuration: See figures 1 and 2.

Weight: 4.25 grams (0.15 ounce) maximum, 4.50 grams (0.159 ounce) maximum with spreader pad attached.

Seal: Hermetic.

Ⓕ Minimum marking: Military part number, "J" with the date code (example J8530), circuit diagram, manufacturer's name or source code.

## LIFE TEST REQUIREMENTS:

High level: 100,000 cycles per relay.

Ⓕ Low level: 100,000 cycles plus 900,000 cycles mechanical life.

PART NUMBER: M39016/21- (dash number from table I and suffix letter designating failure rate level).

Ⓕ TABLE I. Dash numbers and characteristics. 1/

Dash numbers 2/				Coil voltage (V dc)		At 25°C						Over temperature range		
Lead length	Lead length	Lead length	Spreader pads (fig. 2)	5/	6/	Coil resistance (ref. only)	Coil current (mA)	Specified pickup value (V dc)	Specified hold value (V dc)	Specified drop-out value (V dc)	Specified pickup value (V dc)	Specified hold value (V dc)	Specified drop-out value (V dc)	
1.500 min	.187 +.010	.500 min	4/	Rated	Max	Ohms	Max	Min						
007	019	033	041	5.0	7.0	64	78.1	56.8	2.9	2.2	0.8	3.7	2.6	0.7
008	020	034	042	6.0	10.0	125	48.9	36.3	4.0	2.5	0.9	4.8	3.0	0.8
009	021	035	043	9.0	15.0	400	23.6	18.1	6.1	3.6	1.1	8.0	4.5	0.9
010	022	036	044	12.0	20.0	850	15.0	11.7	7.8	4.6	1.3	11.0	5.8	1.0
011	023	037	045	18.0	30.0	1,600	12.2	9.6	11.3	7.0	1.5	14.5	9.0	1.1
012	024	038	046	26.5	40.0	3,300	8.8	7.0	15.2	10.8	1.7	19.0	13.0	1.3
029	031	039	047	36.0	57.0	6,500	6.1	4.9	21.7	14.7	2.3	27.2	19.0	1.7
030	032	040	048	48.0	75.0	11,000	4.8	3.9	27.8	19.8	2.8	34.8	26.0	2.0

1/ Each relay possesses high level and low level capabilities. However, relays previously tested or used above 10 mA resistive at 6 V dc maximum or peak ac open circuits not recommended for subsequent use in low level applications.

2/ The suffix letter L, M, P, or R to designate the applicable failure rate level shall be added to the applicable listed dash number. Failure rate level (percent per 10,000 cycles): L, 3.0; M, 1.0; P, 0.1; R, 0.01. Example, 007L - - - - 048R.

3/ 1.500 inch leads are inactive for new design.

4/ Relays supplied with spreader pads (-041 through -048) shall have the pad rigidly attached.

5/ CAUTION: The use of any coil voltage less than the rated coil voltage will compromise the operation of the relay.

6/ Coil resistance not directly measurable at relay terminals. When rated voltage is applied to the coil terminals, the coil circuit current must be within the limits shown. Measure at 25°C at nominal voltage for 5 seconds, maximum.

QUALIFICATION INSPECTION:

Qualification inspection and sample size: See table II.

(F) TABLE II. Qualification inspection and sample size.

Single submission		Group submission
18 units plus 1 open unit for level L at C = 0 1/	M39016/21-038	18 units plus 1 open unit for level L at C = 0 1/
33 units plus 1 open unit for level M at C = 0 1/		33 units plus 1 open unit for level M at C = 0 1/
Qualification inspection as applicable		Qualification inspection as applicable
	M39016/21-033	2 units each part number
	M39016/21-034	Qualification inspection, group II
	M39016/21-035	
	M39016/21-036	
	M39016/21-037	
	M39016/21-039	
	M39016/21-040	

1/ The number of units required for qualification testing shall be increased as required in group V, table II, MIL-R-39016, if the relay manufacturer elects to test the number of units permitting one or more failures. Prior to performance of qualification inspection, the relay manufacturer shall preselect the sampling plan.

Initial qualification of relays supplied with spreader pads (-041 through -048), shall be tested as specified below:

Perform the following tests as specified in the qualification inspection table of MIL-R-39016, in the order shown below:

- (F) Before installation of pad, screening, visual and mechanical examination (internal), thermal shock, resistance to solvents, vibration (sinusoidal), vibration (random), shock (specified pulse), acceleration, terminal strength, magnetic interference (when specified), capacitance (when specified), coil life (applicable to continuous duty relays only), resistance to soldering heat, salt spray (corrosion), overload (applicable to high level relays only), life, terminal strength, and intermediate current.

After installation of pad perform the following tests as specified in the qualification inspection table of MIL-R-39016, in the order shown below:

- (F) Insulation resistance, dielectric withstanding voltage, static contact resistance, specified pickup, hold, and dropout values (voltages), coil resistance, operate and release time, contact dynamic characteristics, coil transient suppression (when specified), solderability, seal, visual and mechanical inspection (external).

Qualification inspection (reduced testing for previously qualified relays) for relays supplied with spreader pads (-041 through -048), two (2) units of the 26.5 volt rated coil voltage (-046) shall be tested as specified below:

Before installation of pad perform the following tests as specified in the qualification inspection table of MIL-R-39016 in the order shown below:

For failure rate level L only: Screening.

- (F) For failure rate levels M, P, and R: Vibration (sinusoidal) test duration shall be 10 minutes, vibration (random), particle impact noise detection (P.I.N.D., when specified), screening.

After installation of pad perform the following tests as specified in the qualification inspection table of MIL-R-39016 in the order shown below:

- (F) Insulation resistance, dielectric withstanding voltage, static contact resistance; specified pickup, hold, and dropout values (voltages), coil resistance, operate and release time, contact dynamic characteristics, coil transient suppression (when specified), solderability, seal, visual and mechanical inspection (external).

Group A testing for relays supplied with spread pads (-041 through -048), shall be tested as specified below:

- (F) Before installation of pad perform subgroup 2 of group A tests.
- (F) After installation of pad perform subgroups 3 and 4 of group A tests.

**SUPERSESION DATA:**

Supersession data: See table III.

TABLE III. Supersession data. 1/

Superseded part no. M39016/21-	New part no. M39016/21-	Superseded part no. M39016/21-	New part no. M39016/21-
001	007	015	021
002	008	016	022
003	009	017	023
004	010	018	024
005	011	025	029
006	012	026	030
013	019	027	031
014	020	028	032

1/ Dash numbers -007 through -012, -029, and -030 are inactive for new design and are for support of existing equipment designs only.

Cross reference for Government logistical support: See table IV.

(F) TABLE IV. Cross reference for Government logistical support.

Superseded part no. M39016/21-	New part no. M39016/21-	Support with part no. M39016/21-	Superseded part no. M39016/21-	New part no. M39016/21-	Support with part no. M39016/21-
001	007	007	---	033	033
002	008	008	---	034	034
003	009	009	---	035	035
004	010	010	---	036	036
005	011	011	---	037	037
006	012	012	---	038	038
013	019	033	---	039	039
014	020	034	---	040	040
015	021	035	---	041	041
016	022	036	---	042	042
017	023	037	---	043	043
018	024	038	---	044	044
025	029	029	---	045	045
026	030	030	---	046	046
027	031	039	---	047	047
028	032	040	---	048	048

CONCLUDING MATERIAL

Custodians:

Army - ER  
Navy - EC  
Ⓡ Air Force - 85

Review activities:

Army - AR  
Navy - AS, OS, SH  
Ⓡ Air Force - 99  
DLA - ES

User activities:

Navy - MC  
Ⓡ Air Force - 11

Preparing activity:  
Navy - EC

Agent:  
DLA - ES

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