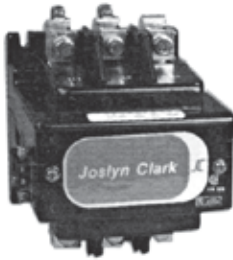
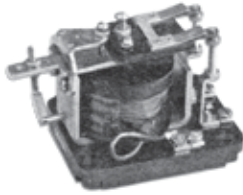
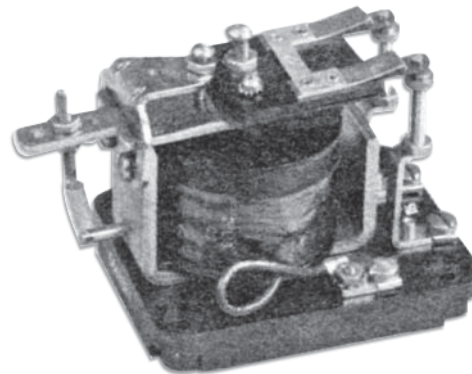
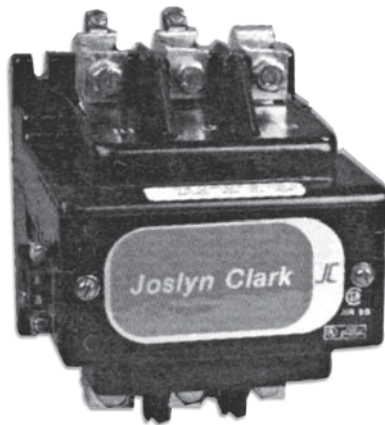


DC CONTROL

Index



Description	Page Number
Index.....	F1
146 Field Loss Relay.....	F2
5 DP Series - General Information.....	F3
Contactors - 1, 2, 3 Pole.....	F4
Accessories.....	F5
Coils & Contact Kits.....	F6
Dimensions Data.....	F7
7400 Contactors.....	F8
7400 Accessories & Dimensions Data.....	F9
RHEOSTATS.....	F10



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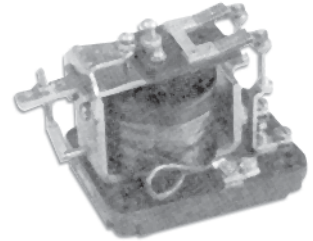
DC CONTROL

146 Field Loss Relay



Series 146 Relays provide excellent protection against over speeding on DC shunt or compound wound motors in the event of an open circuit in the field. The relay coil is connected in series with the shunt field while the re-lay motor contacts are in the motor control circuit. The relay coil is de-energized if the field opens and the relay contacts open to disconnect the motor from line. Where shunt or compound wound motors are operated at light loads or not rigidly connected to the load, field loss relays provide protection against motor and load damage from over speeding. The Series 146 Relay is a UL recognized component.

Coils are designed to carry maximum field current continuously. Relays are factory adjusted to pick-up at one tenth of the maximum field current amps. listed. Drop-out is approximately 62% of the pick-up value. Other pick-up values on special order.



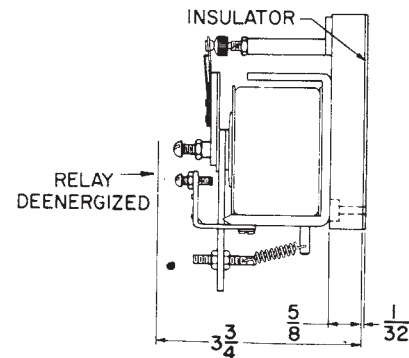
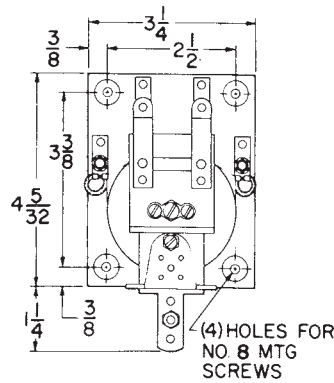
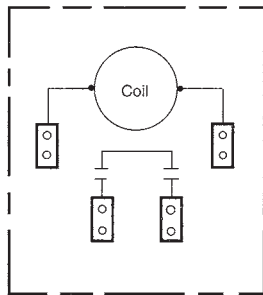
Field Loss Relays (DC) - 146 300V DC Max.

Max. Field Current Amps	Relay Pick-Up Amps	Relay Drop-Out Amps	Catalog No.	Max. Field Current Amps	Relay Pick-Up Amps	Relay Drop-Out Amps	Catalog No.
.25	.025	.0155	146-25	8.0	.800	.496	146-800
.5	.050	.031	146-50	9.0	.900	.559	146-900
1.0	.100	.062	146-100	10.5	1.050	.651	146-1050
1.5	.150	.093	146-150	12.0	1.200	.744	146-1200
2.0	.200	.124	146-200	13.5	1.350	.836	146-1350
2.5	.250	.155	146-250	15.0	1.500	.930	146-1500
3.0	.300	.186	146-300	22	2.200	1.320	146-2200
4.0	.400	.248	146-400	27	2.700	1.620	146-2700
5.0	.500	.310	146-500	35	3.500	2.100	146-3500
6.0	.600	.372	146-600	65	6.500	4.000	146-6500
7.0	.700	.434	146-700	80	8	4.96	146-8000

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Engineering Data:

Dimensions -Approximate



Ordering Information

- Use complete catalog number when ordering.
- Contact Rating: Single pole double break normally open contacts, rated at 0.7 amps., 250 V DC Max.

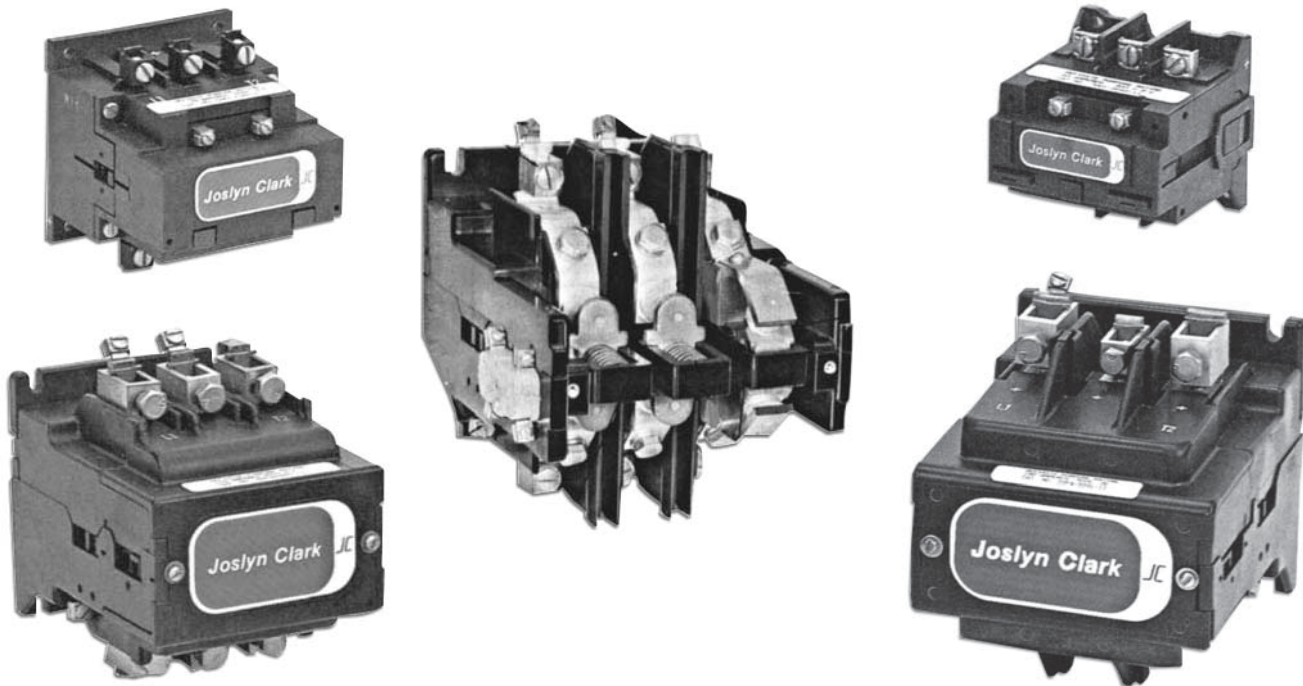


5DP Definite Purpose Contactors are designed for DC adjustable speed drive circuits using silicon controlled rectifier switching and other controls where a combination of normally open and normally closed power contacts are required. In all applications, reduced panel space for contactor mounting is made possible through a compact design and the built-in N.C. dynamic brake power contact feature.

In silicon controlled rectifier switching circuits, the SCR is normally phased back prior to contactor opening. Therefore, the N.O. contacts are not required to interrupt any appreciable current. Under abnormal conditions such as failure of the SCR or the control circuit, the contactor may be required to interrupt up to 200% current. The N.O. contacts are equipped with permanent magnet blowouts to meet this requirement.

The dynamic brake N.C. contact is required to insert the dynamic brake resistor and therefore must make up to 200% of rated current each time the contactor is de energized.

Jogging is accomplished at low voltage and current. Therefore, the dynamic brake contact is rated at 1/3 of rated voltage and dynamic brake current. The permanent magnet blowouts provide this interrupting ability.

**F**

- 1. Normally Closed Double Break Power Contacts** - made of silver cadmium oxide furnish "anti-weld" protection under overload conditions. Generous size contacts are long lasting, and maintenance-free. All N.C. power contacts supplied with permanent magnet blowouts to lengthen contact life.
- 2. Normally Open Double Break Power Contacts** - incorporate the same design features as the normally closed power poles. Permanent magnet blowouts are also furnished on d.c. load applications.
- 3. Permanent Magnet Blowouts** - mounted to surround the power contacts, function to quickly quench the arc when breaking loads, thereby increasing contact life and assuring positive load circuit interruption. All normally closed poles are furnished with permanent magnet blowouts. Normally open poles can be supplied with or without blowouts as indicated in the circuit symbols shown on page J6.
- 4. Stainless Steel Springs** - maintain exact contact pressure and assure fast contact break (N.O.) and make (N.C.).
- 5. Molded Housing** - constructed of hot-molded, high impact, high arc resistant insulating material. This design totally encloses the contacts and operating magnet in separate compartments and functions to eliminate internal phase-to-phase short circuits.
- 6. Molded Coil** - is layer wound, designed for continuous duty service. Coil construction resists moisture; thermal and mechanical stress. Coil connections are made to pressure type terminals.
- 7. Free-Floating Armature-Magnet Frame** - provide quiet, low vibration, low friction operation. Precision ground pole faces achieve an absolute air gap which prevents "hanging-up". Magnet frame is sized for fast, powerful operation and self-seating extends operational life.
- 8. Auxiliary Contacts** - for 10/40 amp. contactors are available with either the front mounted snap action type with quick connect terminals or the side mounted type with pressure terminals. Contacts for larger sizes in standard or special make-before-break contact combinations feature either standard double break silver-to-silver contacts or low power gold alloy contacts.
- 9. Pressure Type Terminals** - accessible, up-front location permits modern straight-thru wiring. Terminals accept stripped, un-lugged wires.

DC CONTROL

5DP Contactors

SCR Drive Contactors - N.O. or N.C. Power Poles

Drive Contactors Preferred Style 500 VDC Max

Type & Rating	Poles			Open Type Catalog No.
	N.O.	N.C.	Fig.No.	
7001 40 amp.	0	1	7A	7001-5150- **
	0	2	9	7001-5230- **
	1	0	1	7001-6050- **
	2	0	3	7001-7030- **
	2	1	10	7001-7140- **
5DP7 75 amp.	0	1	7A	5DP7-5150- **
	0	2	9	5DP7-5230- **
	1	0	1	5DP7-6050- **
	2	0	3	5DP7-7030- **
	2	1	10	5DP7-7140- **
5DP3A 110 amp.	0	1	8	5DP3A4001- **
	0	2	9	5DP3A3071- **
	1	0	1	5DP3A4011- **
	2	0	3	5DP3A5021- **
	2	1	15	5DP3A5091- **
5DP4 180 amp.	0	1	8	5DP4-4001- **
	0	2	9	5DP4-3071- **
	1	0	1	5DP4-4011- **
	2	0	3	5DP4-5021- **
	2	1	15	5DP4-5091- **
5DP9 260 amp.	0	1	8	5DP9-4001- **
	0	2	9	5DP9-3071- **
	1	0	1	5DP9-4011- **
	2	0	3	5DP9-5021- **
	2	1	15	5DP9-5091- **
5DP5 360 amp.	0	1	8	5DP5-4001- **
	0	2	9	5DP5-3071- **
	1	0	1	5DP5-4011- **
	2	0	3	5DP5-5021- **
	2	1	15	5DP5-5091- **
5DP8 535 amp.	0	1	8	5DP8-4001- **
	0	2	9	5DP8-3071- **
	1	0	1	5DP8-4011- **
	2	0	3	5DP8-5021- **
	2	1	15	5DP8-5091- **

* Coil Table #1 Replace * with appropriate coil voltage digit.

60 Hz/Voltage	(*)	DC/Voltage	(*)
120	1	115	8
240	2	230	9

** Coil Table #2 Replace ** with appropriate coil voltage suffix

60 Hz/Voltage	Suffix	DC/Voltage	Suffix
120	11	12	72
208/240	21	24	82
208	90	48	32
240	21	120	12
480	41	240	22
600	51		

Drive Contactors - Old Style

For New Installations Use Preferred Style

Type & Rating	Poles			Open Type Catalog No.
	N.O.	N.C.	Fig.No.	
7000 10/40 amp.	0	1	7A	7000-5150- **
	2	0	3	7000-7030- **
	2	1	10	7000-7140- **
5DP1 30 amp.	0	1	8	5DP1-01()00 *
	0	2	9	5DP1-02()00 *
	1	0	1	5DP1-10()00 *
	1	1	5	5DP1-11()00 *
	2	0	2	5DP1-20()00 *
	2	1	6	5DP1-21()00 *
	2	0	3	5DP1-5021- **
5DP2 56 amp.	2	1	7	5DP1-5051- **
	0	1	8	5DP2-01()00 *
	0	2	9	5DP2-02()00 *
	1	0	1	5DP2-10()00 *
	1	1	5	5DP2-11()00 *
	2	0	2	5DP2-20()00 *
	2	1	6	5DP2-21()00 *
5DP3 110 amp.	2	0	3	5DP2-5021- **
	2	1	7	5DP2-5051- **
	0	1	8	5DP3-01()00 *
	0	2	9	5DP3-02()00 *
	1	0	1	5DP3-10()00 *
	1	1	5	5DP3-11()00 *
	2	0	2	5DP3-20()00 *
5DP4 180 amp.	2	1	6	5DP3-21()00 *
	2	0	3	5DP3-5021- **
	2	1	7	5DP3-5051- **
	0	1	8	5DP4-01()00 *
	0	2	9	5DP4-02()00 *
	1	0	1	5DP4-10()00 *
	1	1	5	5DP4-11()00 *
5DP9 260 amp.	2	0	2	5DP4-20()00 *
	2	1	6	5DP4-21()00 *
	2	1	7	5DP4-5051- **
	0	1	8	5DP9-01()00 *
	0	2	9	5DP9-02()00 *
	1	0	1	5DP9-10()00 *
	1	1	5	5DP9-11()00 *
5DP5 360 amp.	2	0	2	5DP9-20()00 *
	2	1	6	5DP9-21()00 *
	2	1	7	5DP9-5051- **
	0	1	8	5DP5-01()00 *
	0	2	9	5DP5-02()00 *
	1	0	1	5DP5-10()00 *
	1	1	5	5DP5-11()00 *
5DP8 535 amp.	2	0	2	5DP5-20()00 *
	2	1	6	5DP5-21()00 *
	2	1	7	5DP5-5051- **
	0	1	8	5DP8-01()00 *
	0	2	9	5DP8-02()00 *
	1	1	5	5DP8-11()00 *
	2	0	2	5DP8-20()00 *
5DP8 535 amp.	2	1	6	5DP8-21()00 *
	2	1	7	5DP8-5051- **

The N.C. contact is short time rated for Dynamic Braking applications. Refer to table on page J7 for N.C. contact ratings.

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Auxiliary Contact Blocks

Field Installation Kit	Kit No.
Front mtd. aux. 10/40 amp. Old Style & 40A.	
N.O. - N.C. right hand front mtg.	5999-3504
N.O. - N.C. left hand front mtg.	5999-3604
N.O. - N.C. for multiple front mtg.	5999-3704 ¹
For 10/40 amp. Old Style & 40-535 Amp.	
N.O.	5M63
N.C.	5M64
N.O. & N.C.	5M65
N.O. low power.	5M63L
N.C. low power.	5M64L
N.O. & N.C. low power.	5M65L
N.O. Standard & N.C. low power.	5M66
N.O. low power & N.C. standard.	5M65L0
N.C. late break.	5M64E
N.O. & N.C. late break.	5M68 ⁴
N.C. lower power late break.	5M64LE
N.O. & N.C. low power late break.	5M67 ⁴
N.O. low power & N.C. low power late break.	5M69 ⁴
Tandem mounting auxiliary. **	5M60DA

**** NOT for 10/40A or 40A**

Reversing Kits

Description	Kit No
Mechanical interlock 30-260 amps. contactors except 75 amp.	5999-4737
Mechanical interlock 75 amp. contactors	5999-4717
Mechanical interlock 360 & 535 amp.	5999-4757
Mechanical interlock for two 3-pole 700 amp. contactors	5999-4767
Mechanical interlock for two 700 amp. contactors (1 Pole & 2-Pole)	5M96
Reversing baseplate for 30, 56 & 75 amp.	5999-8569
Reversing baseplate for 110, 180 & 260 amp. contactors	5999-8570
Reversing baseplate for 360 & 535 amp. contactors	5999-8571
Reversing baseplate for two 3-Pole 700 amp. contactors	5999-8572
Reversing baseplate for one 2-Pole 700 amp. & one 3-Pole 700 amp. contactors	5999-8573
For 2, 2 Pole 700 Amp	5999-8580

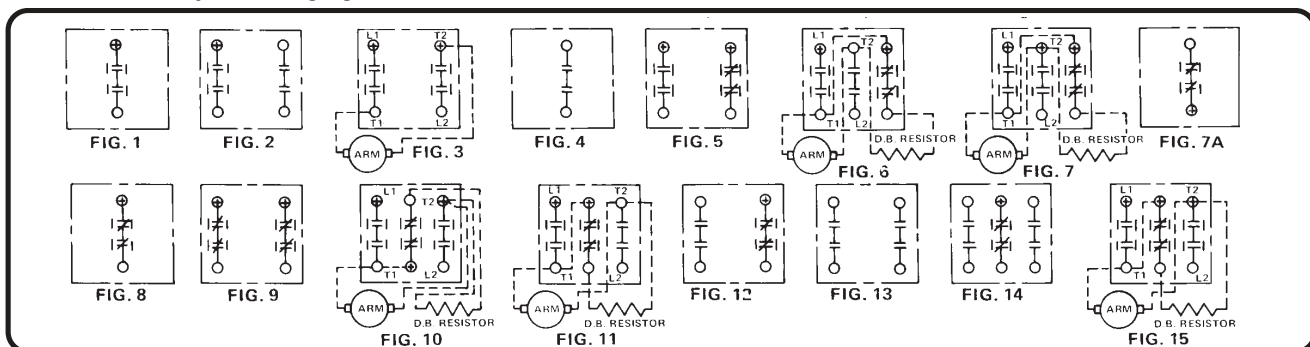
Notes:

- Kit includes one N.O. - N.C. auxiliary plus mounting hardware for installing 3rd and 4th auxiliary.
- Contains mounting hardware only. Order auxiliary separately.
- Without mounting bracket. Bracket required for mounting more than one extra auxiliary interlock.
- Not for use on 10/40, 40 & 75 Amp.
- If DC coil required then front Mtd Auxiliaries not available & contact blocks restricted to 2 & max. aux. contacts 4. 1 contact listed also used to economise coil when DC operated.

Auxiliary Contact Blocks contain 1 or 2 contacts depending on the type ordered, the table below lists max. # of contact blocks for each contactor rating.

Amps	Front Mtd		Side Mtd		Maximum Aux. Contacts	N.O.	N.C.	Amps	Front Mtd		Side Mtd		Maximum Aux. Contacts	N.O.	N.C.	
	LHS	RHS	LHS	RHS					LHS	RHS	LHS	RHS				
10/40 A	1 ⁵	1 ⁵	or	1	1	4=	2	2	180 A	0	0	2	2	8=	4	4
30 A	0	0		1	1	4=	2	2	260 A	0	0	2	2	8=	4	4
40 A	1 ⁵	1 ⁵	or	1	1	4=	2	2	360 A	0	0	2	2	8=	4	4
56 A	0	0		2	2	8=	4	4	535 A	0	0	2	2	8=	4	4
75 A	0	0		2	2	8=	4	4								
110 A	0	0		2	2	8=	4	4								

Terminal Polarity and Wiring Figures:



Symbols: ⏏ N.O. Contact ⏏| Contact with Blowout ⏏/ N.C. Contact ⊕ Positive Polarity

Contacts without blowouts do not have any interrupting rating. Contactors with 2 N.O. contacts and blowouts will interrupt 200% current under abnormal conditions.

DC CONTROL

5DP Contactors

Contact Kits¹ - 5DP

Contactor Type	Rating	N.O. Contact Kit No.	N.C. Contact Kit No.
7000, 7001	10/40A 40A	5M19	5M20
5DP1	30A	5M55	5M57
5DP2	56A	5M52	5M58
5DP7	75A	5999-2521	5M48
5DP3A	110A	5M80A	5M58
5DP3	110A	5M53	5M49
5DP4	180A	5M54	5M49
5DP9	260A	5M56	5M49
5DP5	360A	5M-045	5999-2461
5DP8	535A	5999-2371	5999-2461
5DP6	700A	² 5999-2381	5999-2481

Coil Kits - 5DP (AC)

Rating	Volts 50/60Hz	V.A.-60Hz(Approx)		Kit No. ³
		Inrush	Sealed	
7000	120	120	28	5ML25
10/40A	208	120	28	5ML26
7001	240	120	28	5ML29
40A	480	120	28	5ML27
	600	120	28	5ML28
5DP1 30A	120	234	36	5ML21
5DP2 56A	240	264	41	5ML22
5DP3A	480	245	37	5ML23
110A	600	246	36.6	5ML24
5DP7 75A	120	290	48	5999-1801
	208	290	48	5999-1805
	240	290	48	5999-1802
	480	290	48	5999-1803
	600	290	48	5999-1804
5DP3 110A	120	672	62.4	5ML41
5DP4 180A	208/240	672	69.6	5ML42
5DP9 260A	480	672	67.2	5ML43
	600	683	72	5ML44
5DP5 360A	120	1725	151	5ML51
	208/240	1750	138	5ML52
5DP8 535A	480	1776	144	5ML53
	600	1782	145	5ML54

Auxiliary Contact Rating

AC Volts	10/40 Thru 100A Amperes	
	Continuous	Inrush
120	6	60
280	3	30
480	1.5	15
600	1.2	12

DC Power Pack Kits⁵ - AC Coils

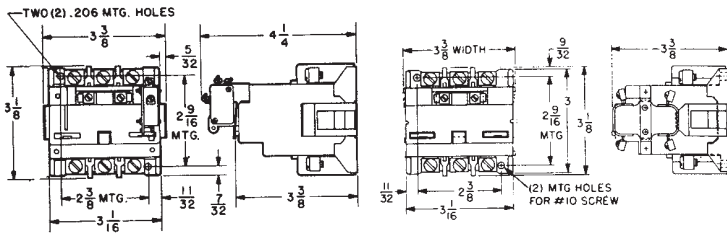
Rating	Volts 60Hz	Kit No.
5DP6	120	5999-8061
700 amp.	240	5999-8062
	480	5999-8063

Contact Ratings

DC Contact Rating - Amperes											
Type & Rating	Poles	N.O. Contacts		N.C. Contacts (intermittent duty)		Type & Rating	Poles	N.O. Contacts		N.C. Contacts (intermittent duty)	
		240V	500V	Dynamic Brake Make Only- 500V Max.	Jogging Break Only 160V Max.			240V	500V	Dynamic Brake Make Only- 500V Max.	Jogging Break Only 160V Max.
7000	2	110	----	20	7	5DP4	1	----	10	315	105
10/40 amp.	2	110	110	80(240V)	27(80V)	180 amp.	2	40	----	----	----
7001	2	180	----	70	23	5DP9	1	40	40	387	135
40 amp.	2	180	180	----	----	260 amp.	2	----	----	----	----
5DP1	1	----	----	54	20	5DP5	1	30	30	720	240
30 amp.	2	260	260	----	----	360 amp.	2	30	30	----	----
5DP2	1	360	360	105	35	5DP8	1	56	56	1070	356
56 amp.	2	360	360	----	----	535 amp.	2	56	56	----	----
5DP7	2	----	----	150	50						
75 amp.		535	535								
5DP3	1	700	700	315	105						
5DP3A	2	700	700	----	----						
110 amp.											

Notes:

- Contact Kits for 1-pole include stationary contacts, movable contacts and contact spring except as noted for 700 amp. size.
- Assembled kit for 1-pole including yoke with movable contacts and springs; stationary contacts.
- For all pole combinations except 2-pole N.C.
- These coils are for exact replacement at operating voltage and frequency listed.
- Power pack assembly kit includes rectifier, economizing resistor and terminal block.
- Values measured at rectifier power pack input.
- It is necessary to phase back the SCR's so that contactor normally does not interrupt appreciable current. Contactors with blowouts and 2 N.O. contacts will interrupt 200% current under abnormal conditions.

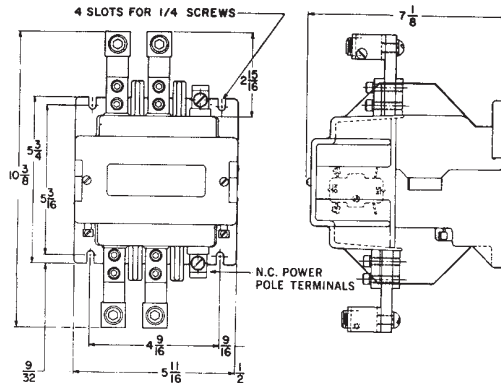


10/40 amp. contactor - 7000
40 amp. contactor - 7001
with front mounted auxiliary

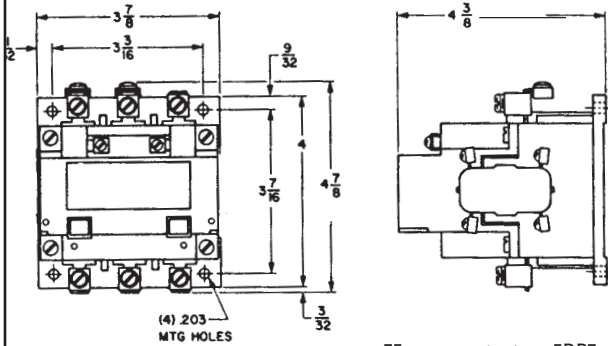
10/40 amp. contactor - 7000
40 amp. contactor - 7001
with side mounted auxiliary

Dimensions - Approximate
(Contactor base mounted vertically)

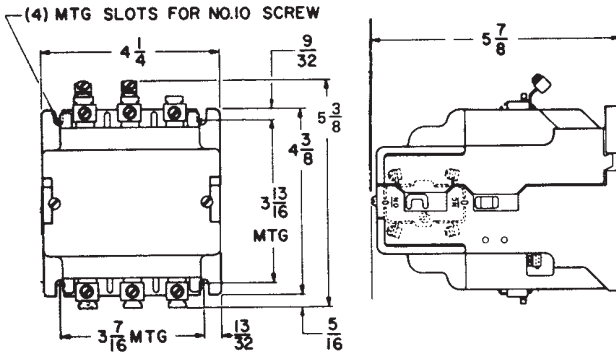
For side mounted auxiliary contact blocks add 1/2" per side to width dimension for all contactor sizes.



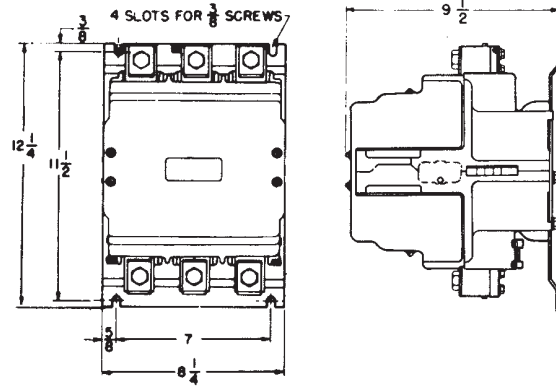
260 amp. contactor - 5DP9



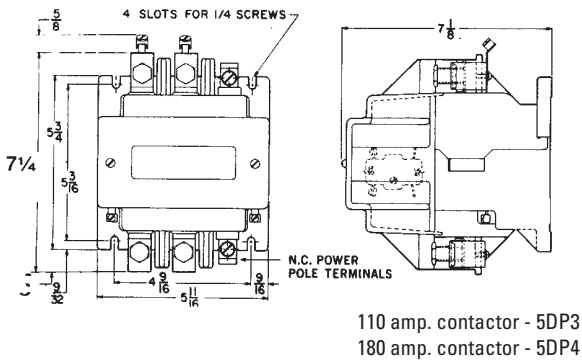
75 amp. contactor - 5DP7



110 amp. contactor - 5DP3A
30 & 56 amp. contactor - 5DP1 & 5DP2



360 & 535 amp. contactor - 5DP5 & 5DP8



110 amp. contactor - 5DP3
180 amp. contactor - 5DP4

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DC CONTROL - 7400

General Information

DC Contactors in sizes 1 Thru 5 are for use as main line, reversing or accelerating contactors in DC motor starters and controllers. Other applications include switching resistive heating and battery loads.

Description

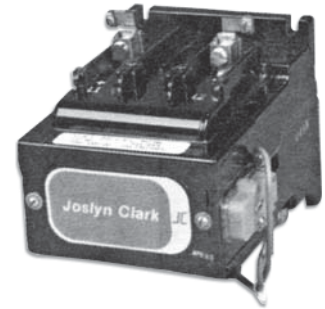
All DC Contactors are solenoid operated for fast, constant, long-life performance. Generous size double break silver cadmium oxide contacts in combination with built-in permanent magnet blowouts assure long contact life and positive circuit interruption. Terminal location makes the contactors ideal for straight-through wiring and for wire channel layouts. Accessible up-front pressure-type terminals are furnished as standard.

Auxiliary Contacts

All contactors can be furnished with N.O., N.C. or N.O. & N.C. auxiliary contact blocks. Each contactor can be supplied with a maximum of four auxiliary contact blocks. Kits are also available for field installation.

Operating Coils

Standard coils for DC operation are molded and equipped with pressure type terminals. The DC coils are furnished with late break auxiliary and economizing resistors as standard. AC coils can be furnished for applications requiring an AC control circuit.



250 Volts DC Max

Size	8-Hour Rating in Amps.		Open Type DC Coil 1 Pole N.O.	Open Type DC Coil 2 Pole N.O.	Open Type DC Coil 2 Pole N.O. & 1 Pole N.C.
	Open	Enclosed	Catalog No. ²	Catalog No. ²	Catalog No. ²
1	25	22.5	74014010- *	7401-1020- *	7401-3050- *
2	50	45	74024010- *	7402-1020- *	7402-3050- *
3	100	90	-----	7403-1020- *	7403-3050- *
4	150	135	-----	7404-1020- *	7404-3050- *
5	300	270	7405-4010- *	7405-1020- *	7405-3050- *
Size	Open	Enclosed	1 Pole N.O. - AC Coil	2 Pole N.O. - AC Coil	2 Pole N.O. - 1 N.C. - AC Coil
1	25	22.5	7441-4010- *	7441-1020- *	7441-3050- *
2	50	45	7442-4010- *	7442-1020- *	7442-3050- *
3	100	90	-----	7443-1020- *	7443-3050- *
4	150	135	-----	7444-1020- *	7444-3050- *
5	300	270	7445-4010- *	7445-1020- *	7445-3050- *

Auxiliary Contact Ratings

DC Volts	Amperes Normal	AC Volts	Amperes	
			Normal	nrush
125	1.1	120	6.0	60
250	0.55	240	3.0	30
		480	1.5	15
		600	1.2	12

Notes:

1. On Sizes 3 & 4 only for single pole applications use two poles in series and for two pole applications use one pole in each line.
2. Contactor furnished without auxiliary contact. See Modifications & Accessories.

Ordering Information

Coil Table

Use complete catalog number. Replace the (*) with the suffix from the coil table.	AC 60Hz/Voltage	Suffix	DC Voltage	Suffix
	120	11	24	82
	208/240	21	48	32
	480	41	120	12
	600	51	240	22

RHEOSTATS



Vitrohm plate type

100-2000 WATTS 600 VOLT SERVICE



Fig. 1. Vitrohm pressed steel rheostat for front-of-board mounting.

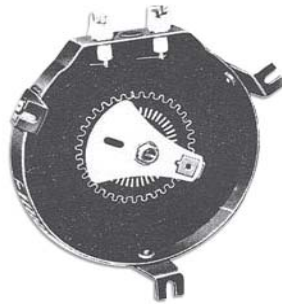


Fig. 2. 8" Vitrohm rheostat, Type S standard contacts, front-of-board mounting.



Fig. 3. 8" Vitrohm rheostat, Type M multi-step contacts, front-of-board mounting.

STANDARD SIZE RHEOSTATS - 6", 8", 13" TYPES S and M

APPLICATION

Vitrohm pressed steel rheostats furnish a simple, accurate and economical method of field control. They are universally applied for adjusting generator, alternator and exciter field currents to obtain variations in output voltage and for field control of adjustable speed D.C. and synchronous motors. Other typical applications include heater, furnace, battery charging and other controls.

4" RHEOSTATS-300 Volt Max. Service

APPLICATION

Vitrohm 4" rheostats for 300 volt max. service are specially designed for field and other control applications.

DANCER ROLL RHEOSTATS- 6, 8, 13 inch Types S and M

APPLICATION

Series 60DR rheostats are for dancer roll service on multi-motor drives where relative speeds between the motors must be maintained within specified limits. Typical applications of these field control rheostats include textile, paper, steel mills and others in the process machinery field.

**Consult Factory for all
Requirements**

MOTOR DRIVE ACCESSORIES-Type SMD

APPLICATION

Type SMD Accessories are for use with 8" or 13" rheostats where motor driven operation is required. Standard assemblies can be applied to drive up to four plates simultaneously. For larger 15 1/2" and 18" rheostats as well as the 13" size, a Type LMD large motor drive is available on order.

TO ORDER RHEOSTATS

- * Consult Factory for price and availability
- * If replacing and existing unit have the "K" number or serial number available.

FOR GENERATOR FIELD CONTROL SPECIFY:

1. Whether self-or separately-excited. If separately excited give voltage, field resistance (hot or cold) and minimum field current. If self-excited state maximum field current and field resistance (cold) under no load conditions, or peak generator voltage and field current at peak voltage and minimum generator voltage with field current at minimum voltage. For special control requirements supply saturation curve.
2. Open or enclosed
3. Type contacts
4. Type accessory.
5. Manual or motor drive
6. Optional or special

FOR OTHER APPLICATIONS SPECIFY:

1. Maximum and minimum current
2. Rheostat resistance.
3. Open or enclosed
4. Type contacts
5. Type accessory. If back-of-board mounting, state panel thickness
6. Manual or motor drive.
7. Optional or special features required.

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