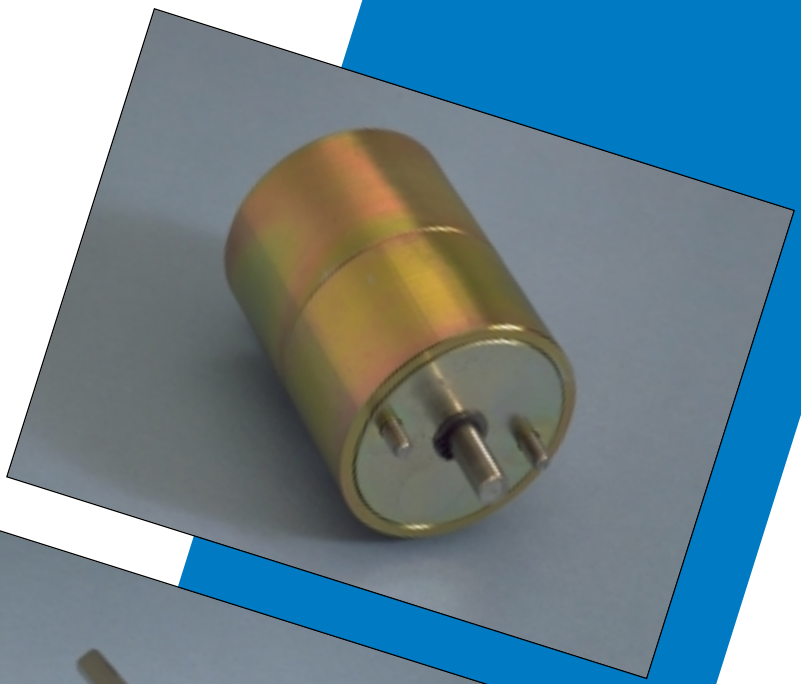
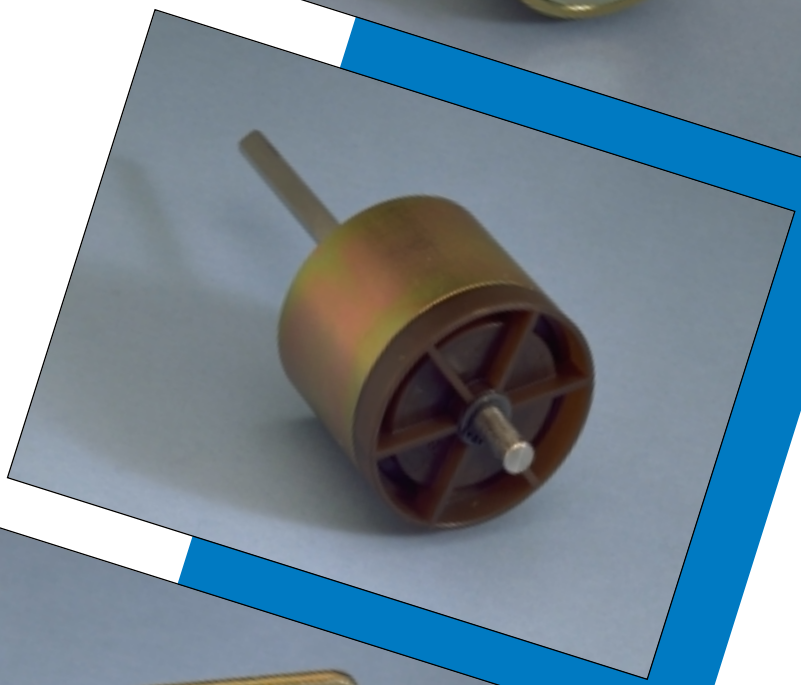
Series 50L Stepping Solenoids





- ❑ **Uni or Bi-Directional**
- ❑ **Maintenance free**
- ❑ **12, 18, 24 or 36 positions**
- ❑ **10,000,000 actuations**
- ❑ **Positive action**
- ❑ **High torque output**
- ❑ **Foot or flange mount**

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Series 50-L Stepping Solenoids

Stepping Solenoids are available in 12, 18, 24 and 36 position designs, with uni-directional and bi-directional options.

Known for their high torque-to-size ratio, the key to their superior performance is the exclusive tooth clutch drive. It has a positive action, self-locking drive that contributes to a greater usable torque output.

For friction loads the clutch provides a positive grip (no slip) when driving intertia loads. The drive also acts as a built-in electro-mechanical clutch brake to eliminate the natural tendency of overdriving at the end of step.

Torque is further increased by the incorporation of a spring loaded ball detent, accurate to ±1°, non-accumulative. This accuracy provides near perfect alignment of the internal inclined ball race assuring consistently high starting torque.

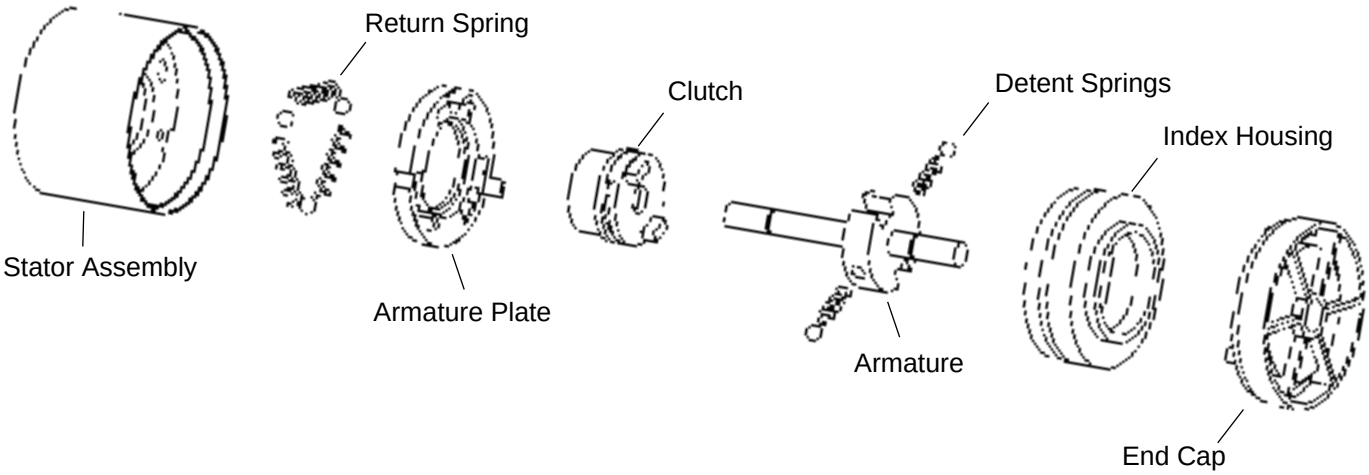
10,000,000 Actuations

All models have a minimum life expectancy of 10,000,000 steps. For bi-directional models this means 10,000,000 steps in each direction.

Maintenance-Free Operation

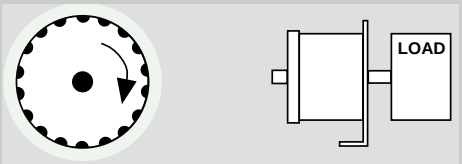
All internal parts are permanently lubricated and enclosed for environmental protection and maintenance-free operation.

Foot or flange mounts are available to make mounting to your equipment an easy operation. If flange mounting is used for bi-directional models, special consideration should be given to securing both sections of the stepping solenoid if high intertia loads are to be positioned.

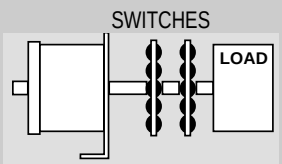


With a Uni-directional Series 50-L you can…

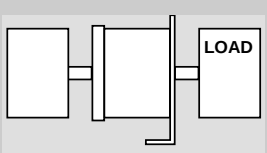
…drive your load remotely through a series of short steps and stop at any position



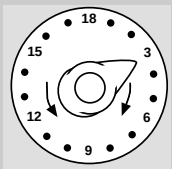
…or add rotary switches for a combination power positioning drive and a step or programme switch…



…or use the shaft extensions on each end to direct couple two loads and drive them in the same direction at the same time.



INDICATOR



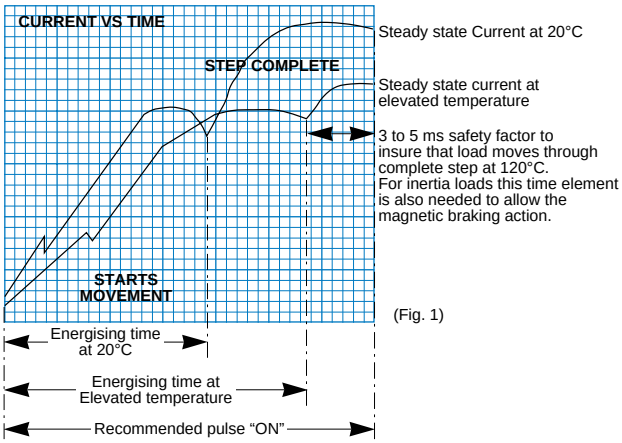
MANUAL KNOB

…or add a knob for manual reset in either direction

Engineering Considerations

PERFORMANCE DATA AND DEFINITIONS

A rise in coil temperature causes a decrease in torque output. Heat rise affects permissible operating speed (Fig. 1). Performance data in the table was derived from actual test, but allowances were made to compensate for losses due to heat rise.



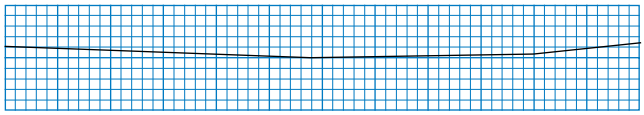
(Fig. 1)

Performance under "extended period of operation" is defined as operating for an indefinite period, allowing a minimum 'OFF' pulse interval sufficient to prevent coil thermal damage during sustained or continued operation Under "short period of operation" the shortest possible 'OFF' interval is used to obtain maximum speed. Under this condition operation is limited to one minute and a 30 minute rest period is allowed for cooling.

FRICTION VS INTERTIA LOADS

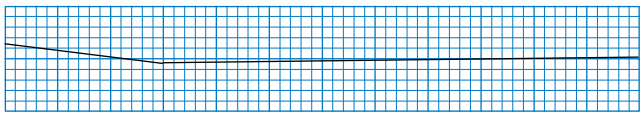
The performance information was developed from tests with friction loads, which represent the most severe condition because a constant torque throughout the stroke is required. An inertia load requires a high initial starting torque and a braking action at the end - a task which the Series 50-L Stepping Solenoid is designed to handle. In addition to the clutch brake, it also has built-in compensation to reduce velocity toward the end of each step. Some typical load characteristics are illustrated:

Pure friction loads are constant throughout the stroke. Therefore, a torque output consistently higher than load is required throughout the stroke (Fig. 2).



(Fig. 2) Time/Distance

Inertia loads characteristically require high starting or breakaway torque but once started, continue to drive without the high torque originally required to start the load moving (Fig. 3).

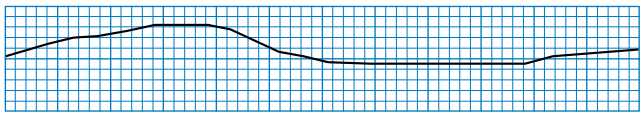


(Fig. 3) Time/Distance

Most loads combine components of friction and inertia. Figure 4 illustrates a load with a high initial friction component, some inertia, then a decline of the friction component toward the end of the step.

DETENT TORQUE

12 position models:	100mNm
18 position models:	140mNm
24 position models:	180mNm
36 position models:	240mNm

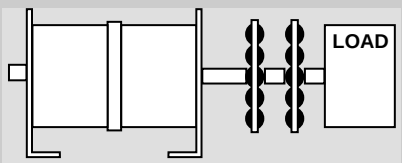


(Fig. 4) Time/Distance

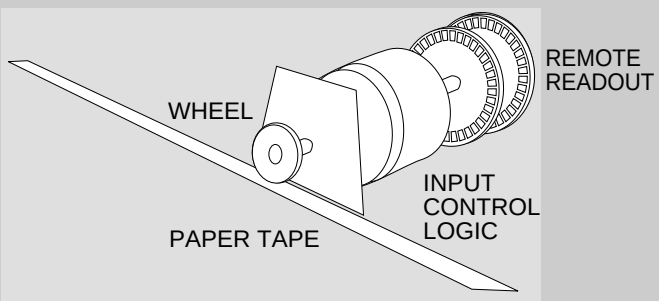
The above values have already been taken into consideration in the performance tables. Detent torque need only be considered when there is a load against the shaft with no power applied.

With a Bi-directional Series 50-L you can also…

…remotely position loads clockwise or anti-clockwise



Here's one of many ways you can use the Series 50-L



Performance

12 POSITION 30° STEPS

		NORMAL SPEED EXTENDED PERIOD OF OPERATION (1 MIN OR MORE)						MAXIMUM SPEED SHORT PERIOD OF OPERATION (1 MIN OR LESS)					
		25% ED			10% ED			1720 AT			2730 AT		
CONSTANT FRICTION TORQUE mNm	COIL TEMPERATURE	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC
55	20°C	35	105	7	24	216	4	35	26	16	24	26	20
115	20°C	40	120	6	27	243	3	40	26	15	27	26	18
170	20°C	45	135	5	30	270	3	45	26	14	30	26	17
230	20°C				32	288	3				32	26	17
285	20°C				35	315	2				35	26	16
340	20°C				38	342	2				38	26	15
400	20°C				42	398	2				42	26	14

18 POSITION 20° STEPS

		CONTINUOUS DUTY NORMAL SPEED 1 MINUTE PLUS OPERATION						INTERMITTENT DUTY MAXIMUM SPEED 1 MINUTE MAX. DURATION					
		25% ED			10% ED			1720 AT			2730 AT		
CONSTANT FRICTION TORQUE mNm	COIL TEMPERATURE	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC
55	20°C	30	90	8	22	198	4	30	18	20	22	18	26
115	20°C	35	105	7	25	225	4	35	18	18	25	18	23
170	20°C	40	120	6	28	252	3	40	18	17	28	18	21
230	20°C	45	135	5	30	270	3	45	18	15	30	18	20
285	20°C				33	297	3				33	18	19
340	20°C				35	315	2				35	18	18
400	20°C				40	360	2				40	18	17
450	20°C				42	398	2				42	18	16

24 POSITION 15° STEPS

		CONTINUOUS DUTY NORMAL SPEED 1 MINUTE PLUS OPERATION						INTERMITTENT DUTY MAXIMUM SPEED 1 MINUTE MAX. DURATION					
		25% ED			10% ED			1720 AT			2730 AT		
CONSTANT FRICTION TORQUE mNm	COIL TEMPERATURE	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC
55	20°C	26	78	9	20	180	5	26	16	23	20	16	27
115	20°C	32	96	7	23	207	4	32	16	20	23	16	25
170	20°C	38	114	6	26	234	3	38	16	18	26	16	23
230	20°C	42	126	5	28	252	3	42	16	17	28	16	22
260	20°C	45	135	5	30	270	3	45	16	16	30	16	21
285	20°C				32	288	3				32	16	20
340	20°C				34	306	3				34	16	20
400	20°C				38	342	3				38	16	18
450	20°C				40	360	2				40	16	17
520	20°C				42	378	2				42	16	17

36 POSITION 10° STEPS

		CONTINUOUS DUTY NORMAL SPEED 1 MINUTE PLUS OPERATION						INTERMITTENT DUTY MAXIMUM SPEED 1 MINUTE MAX. DURATION					
		25% ED			10% ED			1720 AT			2730 AT		
CONSTANT FRICTION TORQUE mNm	COIL TEMPERATURE	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC	PULSE ON TIME MILLISECS	OFF TIME MILLSECS	STEPS/SEC
55	20°C	20	60	12	17	144	6	20	20	25	16	24	25
115	20°C	24	72	10	18	162	5	24	20	22	18	24	23
170	20°C	28	84	8	19	171	5	28	20	20	19	24	23
230	20°C	36	108	8	20	189	4	36	20	17	21	24	22
285	20°C	40	120	6	23	207	4	40	20	18	23	24	21
340	20°C	45	135	5	25	225	4	45	20	15	25	24	20
400	20°C				27	243	3				27	24	19
450	20°C				30	270	3				30	24	18
520	20°C				32	288	3				32	24	17
580	20°C				35	315	2				35	24	16
630	20°C				38	342	2				38	24	16
690	20°C				42	398	2				42	24	15

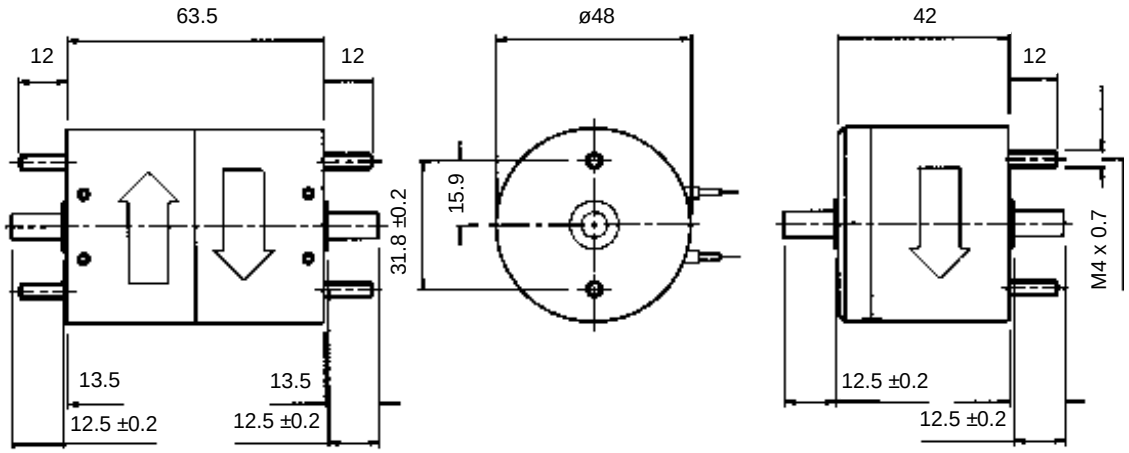
Coil Data

			NORMAL SPEED		MAXIMUM SPEED	
Coil Data			25% Duty	10% Duty	1720 ATS	2730 ATS
Coil AWG Number	OHMS @ 20°C	Number of Turns	Voltage DC	Voltage DC	Voltage DC	Voltage DC
19	0.31	110	4.9	7.8	4.9	7.8
20	0.43	125	6.0	9.5	6.0	9.5
21	0.74	168	7.6	12.1	7.6	12.1
22	1.26	224	9.7	15.4	9.7	15.4
23	2.03	288	12.1	19.2	12.1	19.2
24	3.20	360	15.3	24.0	15.3	24.0
25	4.91	440	19.2	31.0	19.2	31.0
26	7.72	550	24.0	38.0	24.0	38.0
27	11.10	636	30.0	48.0	30.0	48.0
28	18.80	840	39.0	61.0	39.0	61.0
29	30.50	1088	48.0	77.0	48.0	77.0
30	44.90	1275	61.0	96.0	61.0	96.0
31	70.90	1596	76.0	120.0	76.0	120.0
32	109.00	1974	95.0	150.0	95.0	150.0
33	175.00	2496	120.0	192.0	120.0	192.0
34	270.00	3042	152.0	242.0	152.0	242.0
35	414.00	3600	198.0	314.0	198.0	314.0
36	600.00	4200	250.0	397.0	250.0	397.0

Specifications

Vibration		10g 2000 Hz	Weight	Uni-directional	400g
Shock		50g 8.5 ms		Bi-directional	680g
Temperature shock		-55°C…+85°C	Mechanism torque	T=12	100mNm
Temperature range		-55°C…+80C		T=18	140mNm
Maximum coil temperature		+120°C		T=24	180mNm
Humidity		95% @ 50°C, 48 hours		T=36	240mNm
Minimum life		10 million steps	Angular Tolerance non accumulative		±1°
Proof voltage:	AWG 19-23	1000 Vrms			
	AWG 24-34	1200 Vrms			
	AWG 35-36	1500 Vrms			

Dimensions



Bi-directional **Uni-directional**

How to use performance data

The tables show four columns of typical operating conditions for a given unit. The first two, “normal speed, extended period of operation”, presume the stepping solenoids will be pulsed on a continuous basis (round the clock under normal ambient temperature of 20°C with no provision to cool the coil). Here the pulse ‘OFF’ interval is calculated to allow sufficient cooling time (between pulses) to prevent thermal damage.

Most applications, however, call for the stepping solenoid to operate on an intermittent basis, allowing time for the coil to cool while the stepping solenoid is not working. This permits a decrease of the pulse ‘OFF’ interval and a subsequent increase in stepping speed.

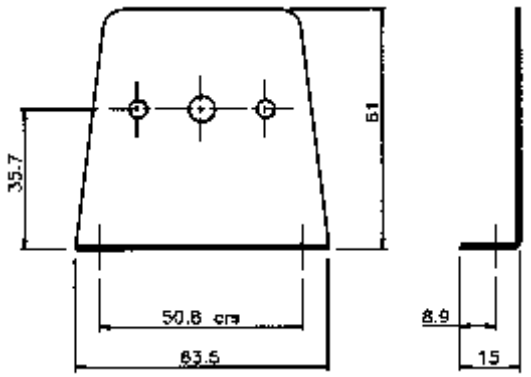
Examples shown below are for 18-position models:

EXAMPLE 1: Load is consistent friction of 230mNm. The stepping solenoid must step as rapidly as possible for a minute or less, then is allowed to rest for a minimum of 30 minutes. Input is 24 Vdc.

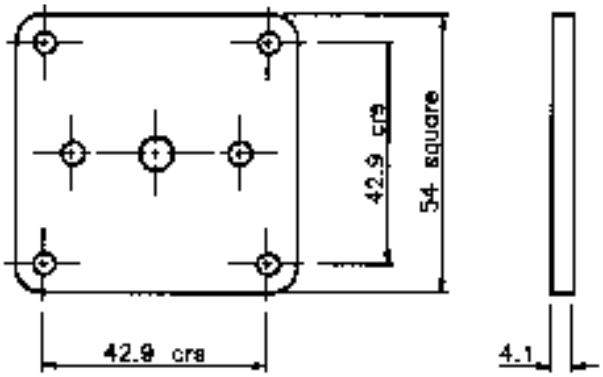
From the performance chart (short period of operation-maximum speed), 2730 ampere turns are required to obtain 20 steps per second. The ‘ON’ pulse at this speed would be 30 ms, ‘OFF’ interval 18 ms. Referring to coil data and the lower section of the chart, the coil for a 24 Vdc stepping solenoid to operate under these conditions is 24 awg.
Uni-directional model part number is
288550-118-001-024.

EXAMPLE 2: Load is a consistent friction of 450mNm. The stepping solenoid must step for an extended period (continuously or for more than one minute). Input is 12 Vdc. From the chart under 1/10 duty cycle 2730 ampere turns are required to move the 450mNm load. The ‘ON’ pulse is 42 ms and the ‘OFF’ interval is 398 ms for a stepping rate of 2 steps per second. Referring to the coil data and the lower section of the performance chart, the closest operating voltage 12.1 Vdc. Coil awg is 21.
Bi-directional model part number is
288550-218-001-021.

How To Order



Mounting hole Ø = 0.69mm
FOOT MOUNTING



Mounting hole Ø = 4.2mm
FLANGE MOUNTING

Ordering Codes

288 ☐ 50 - ☐ ☐ ☐ -001 - 0 ☐ ☐

Mounting Method	Direction	Number of Steps	Coil AWG
5 - Mounting Studs 6 - Flange Mounting 7 - Foot Mounting	1 - Uni-directional 2 - Bi-directional	12 - 12 Steps 18 - 18 Steps 24 - 24 Steps 36 - 36 Steps	

Example

Bi-directional, 24 Steps, 24 AWG Coil, Flange Mounting

Order Code: 288650 - 224 - 001 - 024

In light of continued product development we reserve the right to amend specifications without notice

FM 36870

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