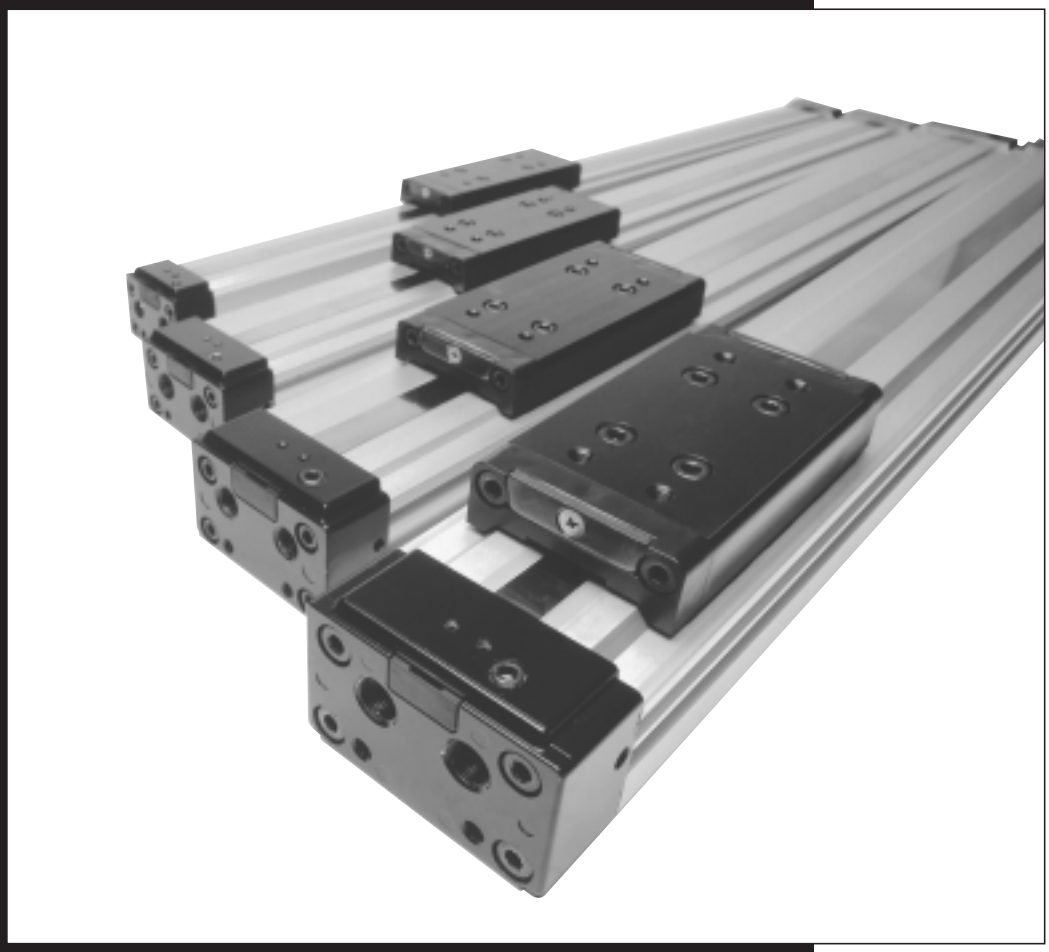
SRL2-M
Rodless Cylinders



Up to 100 PSI
Bore Sizes 5/8" through 2 1/2"
Strokes to 196"

Miller FLUID POWER

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Miller SRL2-M Series Rodless Cylinders

Table Of Contents

Miller One Year Warranty

Miller's Rodless cylinders are warranted for one (1) year to be free from defects in workmanship and material. Miller will replace, free of charge including lowest transportation costs, but not including installation or any other charges, any part that Miller's inspection shows to be defective. All defective parts must be returned to Miller's plant within warranty period after shipment by Miller. Written permission for such return must first be obtained.

A complete explanation is required of the defects and circumstances. This warranty applies only if goods fail to function properly under correct use, normal operating conditions, and proper application because of defects in material or workmanship, and if Miller is notified promptly in writing of such failure. If goods are in accordance with or in reference to an engineering drawing specified by or furnished to the customer, these specifications and information shall be applicable in determining such correct use, operation and application. MILLER MAKES NO WARRANTY THAT THE GOODS ARE DELIVERED FREE OF THE RIGHTFUL CLAIM OF ANY THIRD PERSON BY WAY OF INFRINGEMENT OR THE LIKE. THERE ARE NO WARRANTIES OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE OR ORDINARY PURPOSE NOT WITHSTANDING ANY DISCLOSURE TO MILLER OF THE USE TO WHICH THE PRODUCT IS TO BE PUT.

Miller shall never be liable for any consequential or incidental damages. The sale of Miller's products under any other representation, warranty or guarantee, express or implied, is not authorized by Miller.

Other Miller Air and Hydraulic Cylinders. Order Catalog by File No.

A Series Cylinders
Up to 250 PSI Permanently lubricated

Series A steel air cylinders are available in bore sizes from 1½" through 20" and up to 250 psi operating pressure. Standard NFPA dimensions and proven Miller design features. (File 7619)

AL Series Cylinders
Up to 200 PSI Permanently lubricated

Our new aluminum AL Series air cylinders are available in bore sizes from 1½" through 8". Operating pressures up to 200 PSI. Dimensions are NFPA Standard. (File 8564)

J Series Cylinders
500-2500 PSI

Our popularly-priced line of medium pressure hydraulic cylinders, with bore sizes from 1½" to 20". (File 7620)

H Series Cylinders
3000-5000 PSI

Miller's heavy-duty cylinder line for the most demanding hydraulic applications. Bore sizes from 1½" to 20". Heavy-duty construction. (File 7622)

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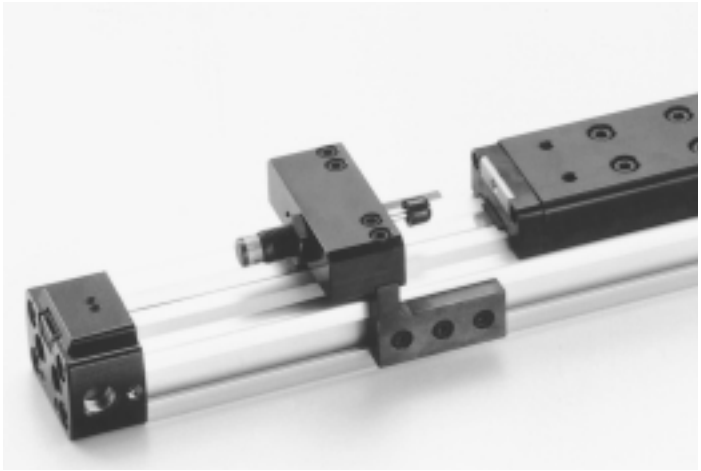
SRL2-M Rodless Cylinder Features and Benefits

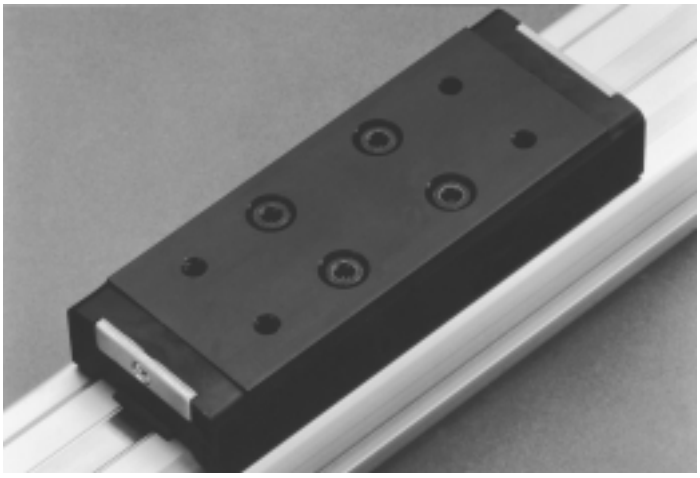
The SRL2-M Rodless Cylinder provides increased performance in addition to offering more options.



Adjustable stroke and shock absorber option available for full cylinder stroke.

Two sets of port locations standard. One side port at each end and both ports in one end cap.

A large variety of cylinder switches are available in reed or proximity type with 5 meter wire length.



Large table with 4 threaded mounting holes insures stable and firm mounting of tooling.

Miller SRL2-M Series
Rodless Cylinders

Space Saving/Low Profile

High speed operation. No lubrication required.

Bores: 16mm (⅝" nominal)
20mm (¾" nominal)
25mm (1" nominal)
32mm (1¼" nominal)
40mm (1½" nominal)
50mm (2" nominal)
63mm (2½" nominal)

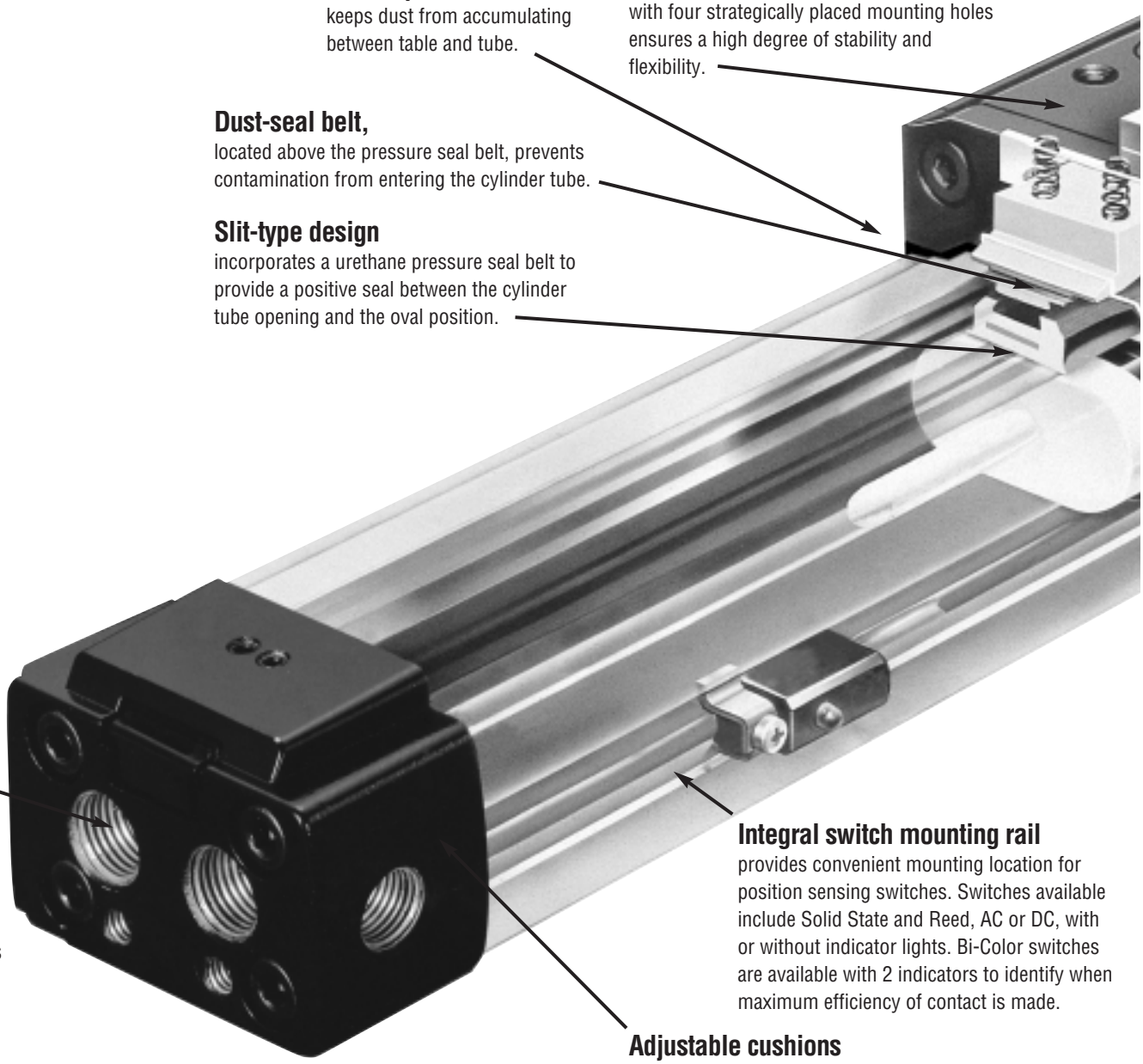
Strokes: To 196 inches

Dust wiper
keeps dust from accumulating between table and tube.

Large work table
with four strategically placed mounting holes ensures a high degree of stability and flexibility.

Dust-seal belt,
located above the pressure seal belt, prevents contamination from entering the cylinder tube.

Slit-type design
incorporates a urethane pressure seal belt to provide a positive seal between the cylinder tube opening and the oval position.



Additional ports in one end cap
for optional piping location.

NOTE: END CAP PORTS SHOWN ON THIS VIEW ARE FOR REPRESENTATION ONLY. ACTUAL END PORTS ARE AT OTHER END OF CYLINDER IN RELATION TO STANDARD SIDE PORTS AND END PORTS ARE NORMALLY FURNISHED PLUGGED.

Integral switch mounting rail
provides convenient mounting location for position sensing switches. Switches available include Solid State and Reed, AC or DC, with or without indicator lights. Bi-Color switches are available with 2 indicators to identify when maximum efficiency of contact is made.

Adjustable cushions
for deceleration at end of stroke are standard.

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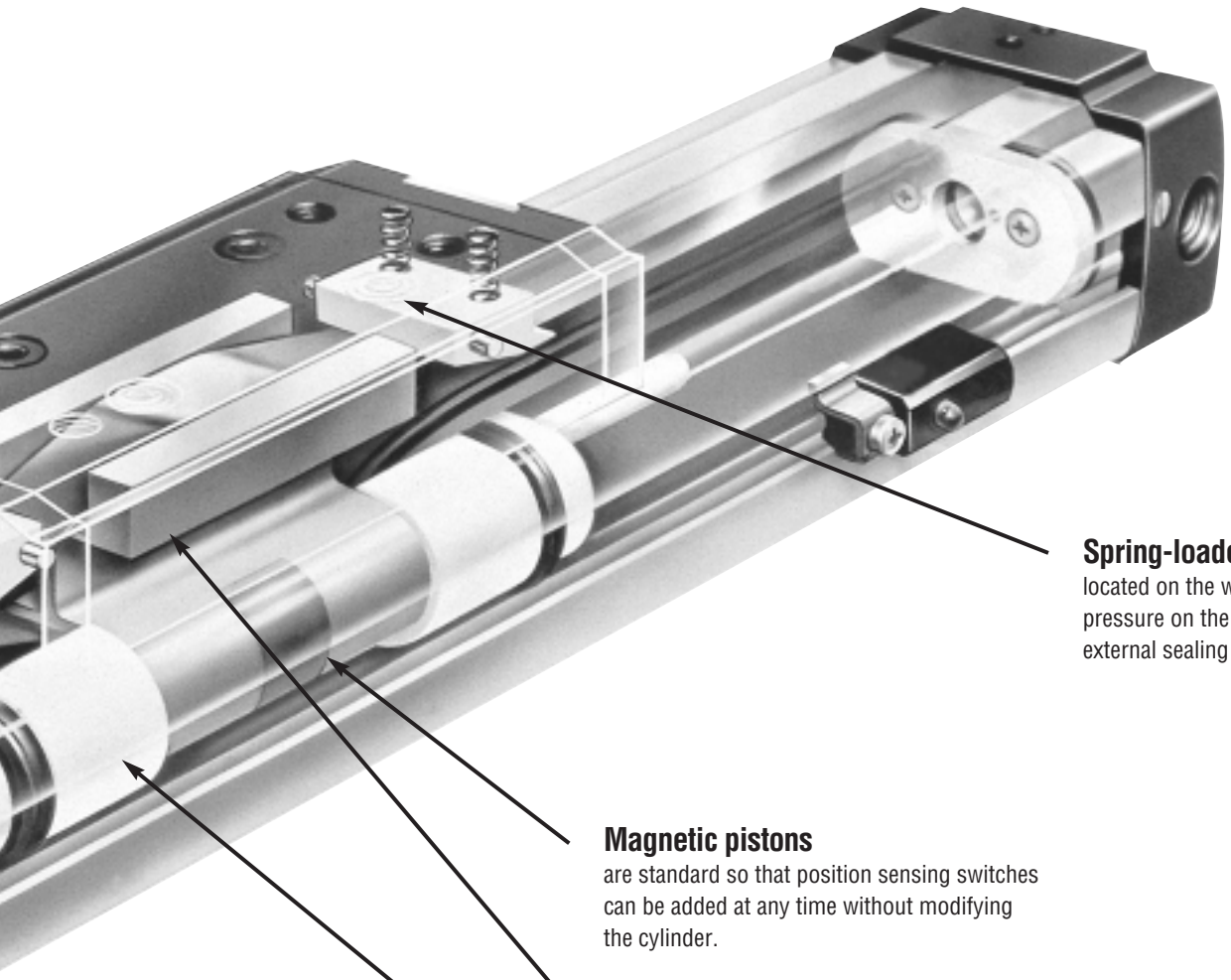
High Load Bearing Capacity



Spring-loaded tension arms
located on the work table maintain constant pressure on the dust seal belt to ensure external sealing protection.

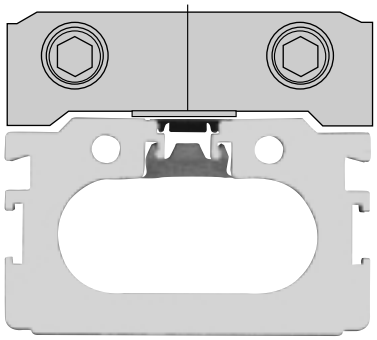
Magnetic pistons
are standard so that position sensing switches can be added at any time without modifying the cylinder.

Compact yoke
construction allows for reduced piston length resulting in reduced overall cylinder length.

Unique oval piston design
dramatically reduces overall cylinder height.

Oval Piston Design

Oval piston design provides greater load carrying capacity than typical rodless cylinders with round pistons.

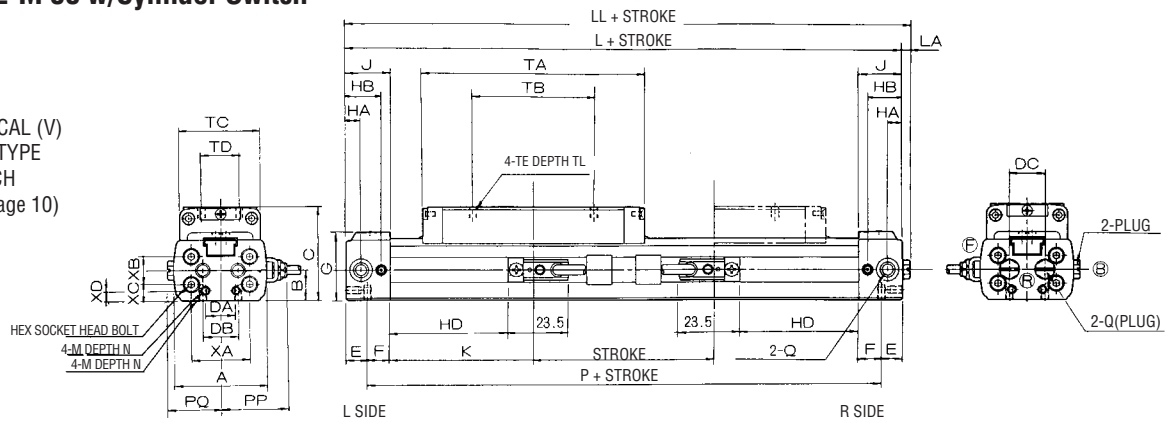


Miller SRL2-M Series
Rodless Cylinders

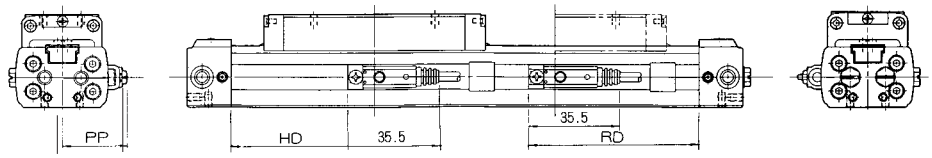
Dimensions (ø16~ø20)

SRL2-M 00 w/Cylinder Switch

VERTICAL (V)
LEAD TYPE
SWITCH
(see page 10)



HORIZONTAL (H)
LEAD TYPE
SWITCH
(see page 10)



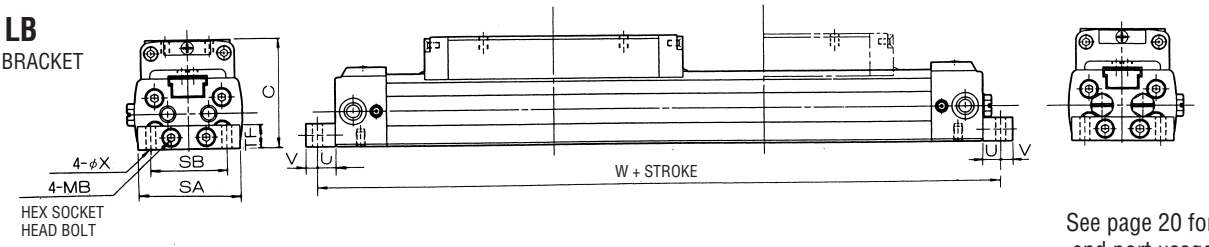
HD and RD Dimensions Indicate Maximum Sensitivity Mounting Position For End of Stroke

Bore	(mm)	A	B	C	DA	DB	DC	E	F	G	HA	HB	J	K	L	LL	LA	M	N	P	PQ	Q	TA	TB	TC	TD	TE	TL
16	inches	1.46	0.47	1.46	0.47	0.55	0.47	0.34	0.35	1.06	0.24	0.55	0.69	2.24	5.87	5.98	0.12	5-40	0.20	5.20	0.83		3.47	1.89	1.26	0.59	5-40	0.20
	mm	37	12	37	12	14	12	8.5	9	27	6	14	17.5	57	149	152	3	—	5	132	21	M5	88	48	32	15	—	5
20	inches	1.73	0.55	1.65	0.55	0.63	0.63	0.41	0.45	1.22	0.34	0.73	0.87	2.46	6.65	6.75	0.10	8-32	0.26	5.83	0.97	1/8NPT	3.94	2.36	1.50	0.71	8-32	0.24
	mm	44	14	42	14	16	16	10.5	11.5	31	8.5	18.5	22	62.5	169	171.5	2.5	—	6.5	148	24.5		100	60	38	18	—	6

Bore	(mm)	XA	XB	XC	XD	MA	Switch				LB. Mounting								LB 1 Mounting								
							HD	RD	PP		SA	SB	TF	U	V	W	X	MB	SA	SB	TG	TY	U	V	W	X	MC
									MgV	MgH																	
16	inches	0.91	0.43	0.26	0.16	—	1.85	2.64	1.04	1.10	1.38	1.02	0.32	0.24	0.16	6.34	0.14	—	1.38	1.02	0.24	1.69	0.24	0.16	6.34	0.13	5-40, 1/4" LG
	mm	23	11	6.5	4	M3x20	47	67	26.5	28	35	26	8	6	4	161	3.6	M3x10	35	26	6	43	6	4	161	3.4	
20	inches	1.10	0.63	0.24	0.20	—	2.07	2.85	1.16	1.22	1.69	1.30	0.39	0.24	0.24	7.13	0.19	—	1.69	1.30	0.32	1.97	0.24	0.24	7.13	0.18	8-32, 3/8" LG
	mm	28	16	6	5	M4x25	52.5	72.5	29.5	31	43	33	10	6	6	181	4.7	M4x12	43	33	8	50	6	6	181	4.5	

SRL2-M LB

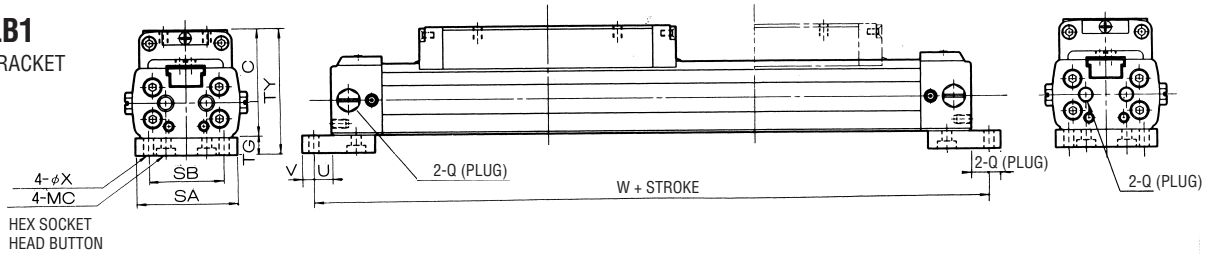
WITH FOOT BRACKET



See page 20 for
end port usage

SRL2-M LB1

WITH FOOT BRACKET



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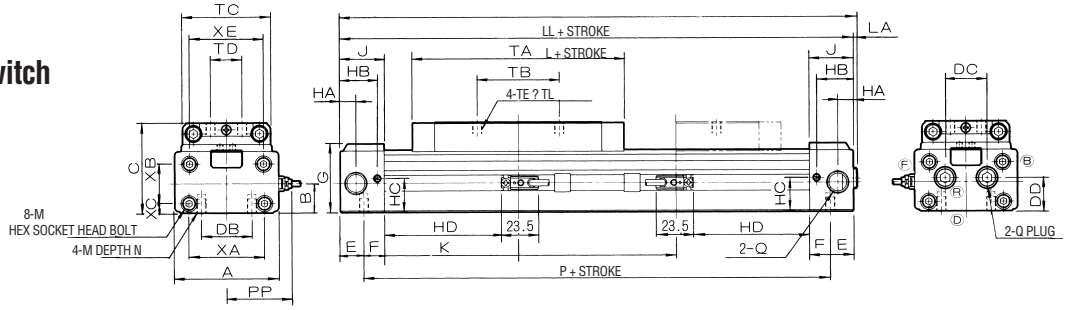
Miller SRL2-M Series
Rodless Cylinders

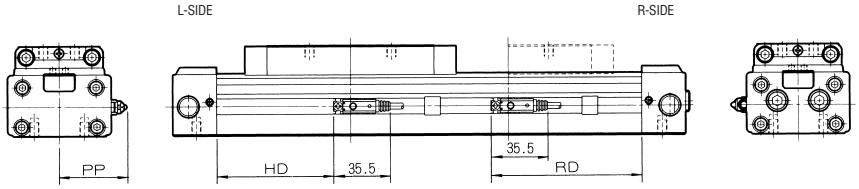
Dimensions (ø25~ø63)

SRL2-M 00 w/Cylinder Switch

VERTICAL (V)
LEAD TYPE
SWITCH
(see page 10)



HORIZONTAL (H)
LEAD TYPE
SWITCH
(see page 10)



HD and RD Dimensions Indicate Maximum Sensitivity Mounting Position For End of Stroke

Bore	(mm)	A	B	C	DB	DC	DD	E	F	G	HA	HB	HC	J	K	L	LL	LA	M	N	MA	P	Q	TA	TB	TC	TD	TE	TL
25	inches	2.09	0.67	2.09	0.79	1.02	0.75	0.55	0.39	1.59	0.30	0.79	0.74	0.95	2.80	7.48	7.56	0.08	1/4-20	0.35		6.38	1/8NPT	4.80	2.76	1.89	0.79	10-24	0.32
	mm	53	17	53	20	26	19	14	10	40.5	7.5	20	18.9	24	71	190	192	2		9	M5X30	162		122	70	48	20		8
32	inches	2.60	0.73	2.24	1.26	1.06	0.83	0.59	0.51	1.71	0.39	0.93	0.85	1.10	3.35	8.90	9.00	0.10	1/4-20	0.35		7.72	1/4NPT	5.28	3.15	2.21	0.79	1/4-20	0.35
	mm	66	18.5	57	32	27	21	15	13	43.5	10	23.5	21.5	28	85	226	228.5	2.5		9	M5X30	196		134	80	56	20		9
40	inches	3.15	0.87	2.64	1.42	1.38	1.10	0.67	0.55	2.03	0.51	1.02	1.06	1.22	3.58	9.61	9.71	0.10	5/16-18	0.47		8.27	1/4NPT	5.83	3.54	2.68	1.18	1/4-20	0.43
	mm	80	22	67	36	35	28	17	14	51.5	13	26	27	31	91	244	246.5	2.5		12	M6X35	210		148	90	68	30		11
50	inches	3.78	1.10	3.23	1.77	1.38	1.38	0.91	0.63	2.40	0.59	1.30	1.39	1.54	3.54	10.16	10.26	0.10	5/16-18	0.47		8.35	3/8NPT	5.98	3.94	3.15	1.18	5/16-18	0.51
	mm	96	28	82	45	35	35	23	16	61	15	33	35.3	39	90	258	260.5	2.5		12	M8X45	212		152	100	80	30		13
63	inches	4.65	1.38	3.74	1.97	1.54	1.65	0.75	0.79	2.91	0.59	1.26	1.69	1.54	4.29	11.65	11.75	0.10	3/8-16	0.59		10.16	3/8NPT	6.61	4.33	4.02	1.58	5/16-18	0.51
	mm	118	35	95	50	39	42	19	20	74	15	32	43	39	109	296	298.5	2.5		15	M8X45	258		168	110	102	40		13

Bore	(mm)	XA	XB	XC	XE	Switch				LB. Mounting										LB 1 Mounting								
						HD	RD	PP MgV	PP MgH	SA	SB	TF	U	V	W	X	XF	XG	MB	SA	SB	TG	TY	U	V	W	X	MC
25	inches	1.50	0.91	0.22	1.58	2.36	3.23	1.36	1.42	2.05	0.79	0.47	0.35	0.43	8.19	0.28				1.97	0.79	0.39	2.48	0.35	0.43	8.19	0.28	1/4-20x1/2 LG
	mm	38	23	5.5	40	60	82	34.5	36	52	20	12	9	11	208	7	—	—	M5x50	50	20	10	63	9	11	208	7	
32	inches	1.89	0.98	0.24	1.85	2.91	3.78	1.63	1.69	2.52	1.26	0.47	0.35	0.43	9.61	0.28				2.52	1.26	0.39	2.64	0.35	0.43	9.61	0.28	1/4-20x1/2 LG
	mm	48	25	6	47	74	96	41.5	43	64	32	12	9	11	244	7	—	—	M5x50	64	32	10	67	9	11	244	7	
40	inches	2.36	1.18	0.28	2.28	3.15	4.02	1.91	1.97	3.15	1.42	0.59	0.43	0.35	10.47	0.35	0.51	0.34		—	—	—	—	—	—	—	—	—
	mm	60	30	7	58	80	102	48.5	50	80	36	15	11	9	266	9	13	8.7	M6x55	—	—	—	—	—	—	—	—	—
50	inches	2.91	1.42	0.39	2.76	3.11	3.98	2.22	2.28	3.70	1.77	0.79	0.43	0.35	11.02	0.35	0.51	0.34		—	—	—	—	—	—	—	—	—
	mm	74	36	10	70	79	101	56.5	58	94	45	20	11	9	280	9	13	8.7	M8x65	—	—	—	—	—	—	—	—	—
63	inches	3.78	1.65	0.55	3.54	3.86	4.72	2.66	2.72	4.57	1.97	0.98	0.51	0.47	12.68	0.43	0.61	0.41		—	—	—	—	—	—	—	—	—
	mm	96	42	14	90	98	120	67.5	69	116	50	25	13	12	322	11	15.5	10.5	M8X70	—	—	—	—	—	—	—	—	—

SRL2-M LB

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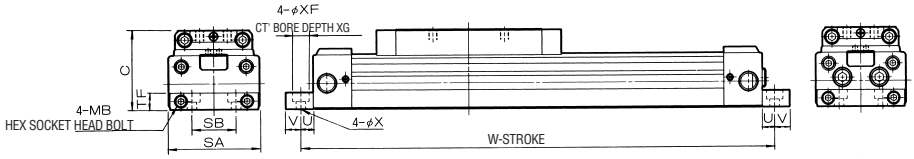

See page 20 for end port usage

SRL2-M LB1

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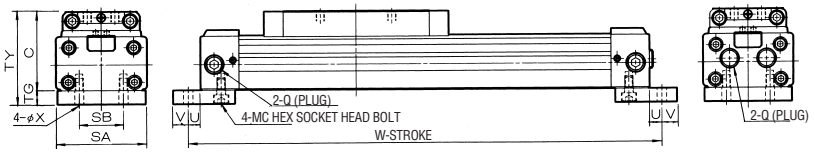

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Cylinder Switch

Large array of Position Sensing Switches can be easily mounted on standard SRL2-M rodless cylinder

1. Proximity Switch

- Highly reliable detection
- No internal moving parts
- Eliminates chattering
- Faster wiring time. M2V5, M2H5, and M2WV5, switches are 2-wire type same as reed switches.
- M2V5, M2H5, and M2WV5, switches can be connected in series.

2. Proximity Switch with 2-color indicator

- Easy mounting and adjustment
- Green light indicates the most effective mounting location
- Provides faster switch placement

3. Reed Switch

- Used for both AC and DC
- Same switch used for both AC/DC relay and for programmable controller

Switch Specifications Chart

	Contactless Switch			Reed Switch	
Model	M2V5, M2H5, M2WV5	M3V5, M3H5	M3WV5	M0V5, M0H5	M5V5, M5H5
Application	Programmable controller	Programmable controller, Relay IC circuit, low wattage solenoid valve		Prog. controller, Relay	Prog. controller, Relay, IC, w/out lamp
Supply Voltage	—	4.5-2.8VDC	10-28VDC	—	—
Load Voltage, Current	10-30VDC, 5-30mA	Below 30VDC, below 200mA	Below 30VDC, below 150mA	12/24VDC, 5-50mA 110 VAC, 7-15mA	24VDC, 50mA 110 VAC, 15mA
Power consumption	—	For 24VDC, 10mA with light on	For 24VDC, Below 15mA	—	—
Internal Voltage Drop	Below 4 Volts	Below 0.5 Volts		Below 2.4 Volts	0 Volts
Lamp	LED light				w/out lamp
Current Leakage	Below 1mA	Below 10µA		0	
Lead Wire Length	16' (5M) 2 wire oil resistant vinyl cable	16' (5M) 3 wire oil resistant vinyl cable		16' (5M) 2 wire oil resistant vinyl cable	
Shock Resistance	100 G			30 G	
Insulation Resistance	Greater than 100MΩ (with megger at 500VDC)				
Isolation V Resistance	No malfunction when 1000VAC is applied for 1 min.				
Ambient Temperature	15°F to 140°F (-10°C to 60°C)				
Protection	IEC code IP67, oil resistant				

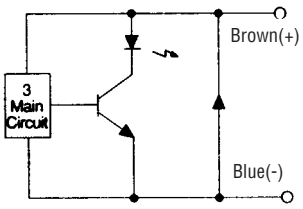
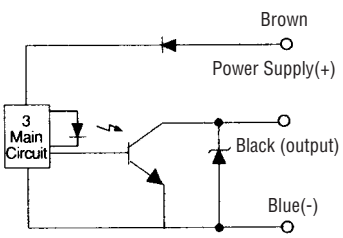
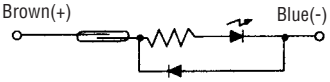
How To Order

Switches and brackets are available as complete assemblies. To order, specify quantity and switch model number.

Model	Switch Type	Lamp
715-SRL2-M2V5	Solid State	LED
715-SRL2-M2H5	Solid State	LED
715-SRL2-M3V5	Solid State	LED
715-SRL2-M3H5	Solid State	LED
715-SRL2-M2WV5	Solid State	Bi-Color
715-SRL2-M3WV5	Solid State	Bi-Color
715-SRL2-M0V5	Reed	LED
715-SRL2-M0H5	Reed	LED
715-SRL2-M5V5	Reed	not available
715-SRL2-M5H5	Reed	not available

Mounting lead wire holders (page 10) are sold in packages of 6 pieces and can be ordered by specifying Part No. 715-SRL2-LEAD-HLDR

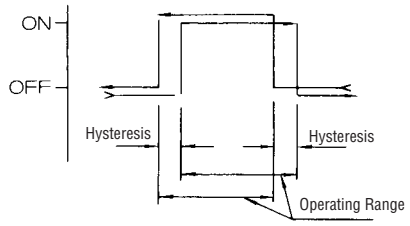
Switch Electrical Schematics

M2V5, M2H5, M2WV5	M3V5, M3H5, M3WV5	M0V5, M0H5	M5V5, M5H5
			

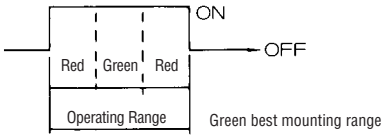
Miller SRL2-M Series
Rodless Cylinders

Operating Range

(1) M0V5, M0H5, M2V5, M2H5, M3V5, M3H5, M5V5, M5H5: The operating range is the distance, when the piston moves, between one position where the switch first turns on and the other position in the same direction where it turns off. The mid-point in the operating range is the most sensitive position and the switch should be mounted at that location.



(2) Proximity switches with two-color indicator, M2WV5, M3WV5: The operating range is within the red-green-red lights on. The green light shows the best mounting range.



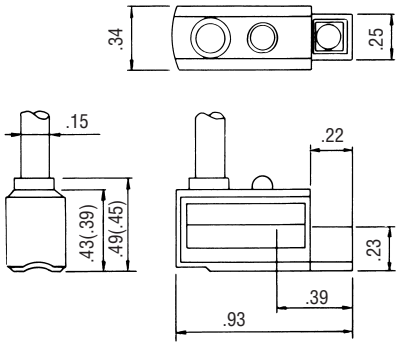
Hysteresis

Hysteresis is the distance, when the piston moves, between one position where the switch first turns on and the other position in the opposite direction where it turns off. Switches should not be located in this area.

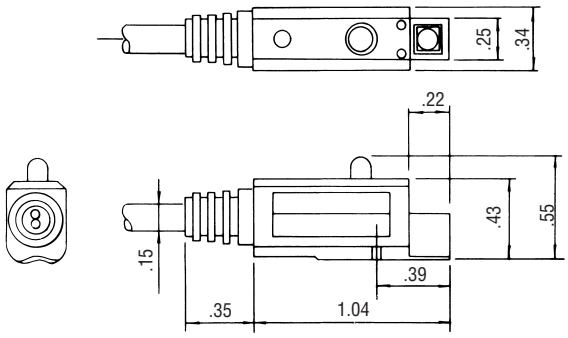
Operating Range, Hysteresis

Bore Size (mm)	Operating Range (in)			Hysteresis (in)		
	Proximity Switch		Reed Switch	Proximity Switch		Reed Switch
	M2V5, M2H5, M3V5, M3H5	M2WV5, M3WV5	M0V5, M0H5, M5V5, M5H5	M2V5, M2H5, M3V5, M3H5	M2WV5, M3WV5	M0V5, M0H5, M5V5, M5H5
16	.157 - .512	.157 - .472	.118 - .433	.060	.040	.120
20	.157 - .512	.157 - .472	.118 - .433			
25	.374 - .610	.354 - .551	.335 - .531	.080	.060	.140
32	.295 - .591	.315 - .551	.276 - .531			
40	.453 - .689	.394 - .650	.394 - .630			
50	.650 - .945	.551 - .827	.571 - .846			
63	.630 - .945	.551 - .827	.551 - .846			

Vertical (V) Switches

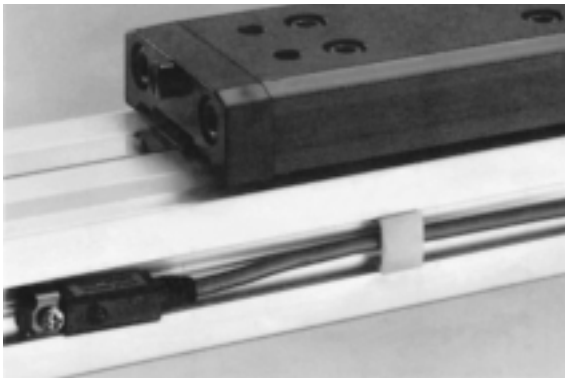


Horizontal (H) Switches



( ) Brackets indicate dimension for bi-color switch

Movement and Replacement of Switches, and Mounting and Removal of Lead Wire Holder



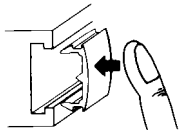
Moving Switches

Loosen the flat head screw on the switch fixture. Move the switch body and fixture along the cylinder tube to the desired location.Tighten the flat head screw.

Replacing Switches

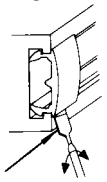
Loosen the flat head screw and slide the switch from under the fixture. Do not remove the fixture. Slide the new switch under the fixture in the desired location and tighten the flat head screw to a torque value of 4.5-6 in. lbs.

Mounting Lead Wire Holder



Push lead wire holder with your thumb and snap it into place.

Removing Lead Wire Holder



Insert a screw-driver between the cylinder tube and the lead wire holder and turn it to remove the holder.

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Notes on usage - Contactless Switch

M2V5, M2H5, M2WV5, M3V5, M3H5, M3WV5

Lead Wire Connection

Follow the color coding when connecting the wires. Ensure that the power supply is disconnected before you start.

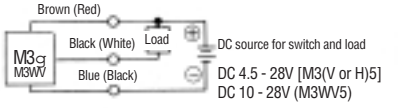


Fig. 1. Basic circuit example (Switch and load use same power source)

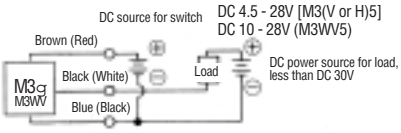


Fig. 2. Basic circuit example (Switch and load use different power sources)

Output Circuit Protection

- When connecting and using an inductive load (relays, solenoid valves), as surge voltage occurs with the switch off, be sure to wire a protection circuit as shown in Fig. 3.
- When connecting and using a capacitor load, as in-rush current occurs with the switch on, be sure to wire a protection circuit as shown in Fig. 4.
- When lead wire is more than 10m long, be sure to wire a protection circuit as shown in Fig. 5, 6 (for M2, M2WV) or Fig. 7 (for M3, M3WV).

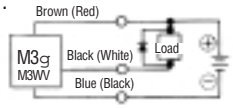


Fig. 3. Example where inductive load is used with diode. Use diode Hitaachi V06C or equivalent.

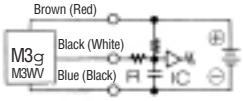


Fig. 4. Example where capacitor load is used with resistance (R). Resistance (R) should exceed the value from $\frac{V}{0.15}=R(\Omega)$ the formula.

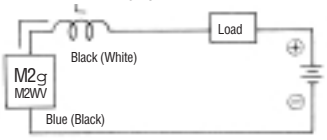


Fig. 5. Choke coil L= hundreds of H - several mH, with high-frequency characteristic. Connection should be within 2m of switch.

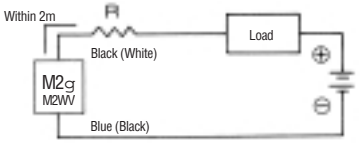


Fig. 6. In-rush current resistance R equals as much resistance as load circuit side permits. Connection should be within 2m of switch.

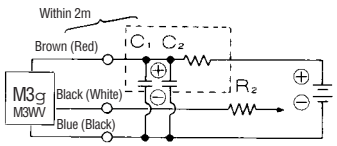


Fig. 7. Power source noise absorption circuit C1 = 20-50 µF electrolytic capacitor (more than 50V of allowable pressure).
C2 = 0.01-0.1 µF. Ceramic capacitor R1 = 20-30 Ohms. In-rush current resistance R2 equals as much resistance as load circuit side permits. Connection should be within 2m of switch.

Connection to Programmable Controller (Sequencer)

Connection depends on type of programmable controller. Conneciton should be as shown n Fig. 8-12.

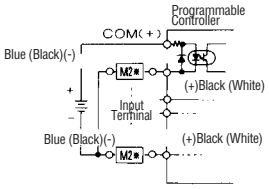


Fig. 8. Example of connecting M25 (M2WV5) to source input. (Outside power source).

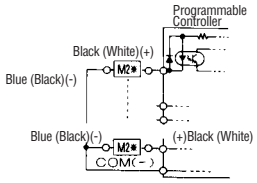


Fig. 9. Example of connecting M25 (M2WV5) to source input. (Built-in power source).

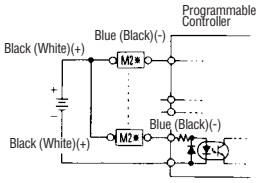


Fig. 10. Example of connecting M25 (M2WV5) to sink input.

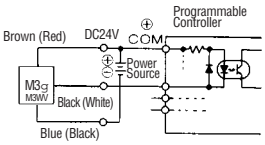
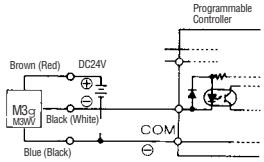


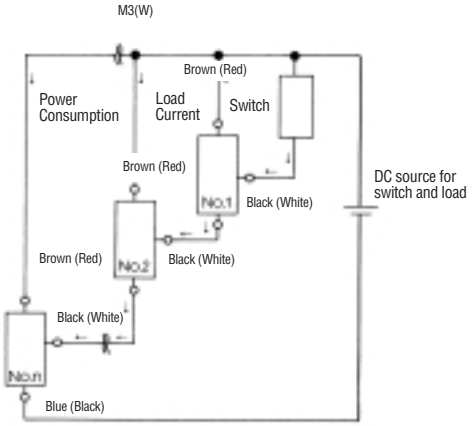
Fig. 11. Example of connecting M35 (M3WV5) to source input. (Outside power source).

Fig. 12. Example of connecting M35 (M3WV5) to source input. (Built-in power source). M35 switch cannot connect to sink input sequencer.



Series Connection

(1) If more than one M25 and/or M2WV5 switches are wired in series, the total amount of voltage drop is the sum of all the switches connected. As voltage at load side is power voltage minus the sum of voltage fall at switches, check your programmable controller, as being a load, with its specified input to determine maximum number of connections.
(2) If more than one proximity switch of the 3-wire type are wired in series, the value of the voltage drop at switches is the total sum of voltage fall of all the switches connected. As current flowing in the switches is the sum of the power consumption of all of the switches connected and load current, as shown below, check the specified load of switches so that it does not exceed the maximum load current of switches, and determine the mazimum number of connections.
(3) Lamp is on only when all the switches are on.



Parallel Connection

On M25 and/or M2WV5 switches, the leakage current increases based on the number of connections. When one switch turns on and off, as the voltage at both ends of the switch connected in parallel drops below the load voltage range down to internal voltage drop value when switch is turned on, other switches will not turn on. Therefore, check the specified input of the programmable controller regarding the connection load before use. M35 and M3WV5 switches have a small leakage current (under 10µA) so multiple connections will usually not present a problem or cause the lamp to fade or stay off.

Magnetic Environment

Avoid using switches near a strong magnetic field or strong current (large magnet, spot welding machine, etc.). When cylinders with switches are mounted close to each other in parallel, or when magnetic material moves near the cylinder, they could cause interference and affect switch operation.

Protection of Lead Wires

Minimum bending radius of lead wires should be 3/8". Ensure that no bending or tension stresses are continuous on the wires. For moving portion, use wiring similar to that used on robots.

Notes on usage - Reed Switches M0V5, M0H5, M5V5, M5H5

Lead Wire Connection

Connect the lead wire of the switch with load in series type connection. Do not connect it directly to a power source. In the case of the M05 switch the following will apply:

(1) When using for DC, connect the black (white) wire to positive, and blue (black) wire to negative. If the wires are reversed, the switch will work but the lamp will not light.

(2) When connecting to an AC relay or programmable controller input, using half wave rectification, the switch may not light. If this happens, it can be corrected by connecting the switch lead wires to the opposite polarity.

Contact Capacity

Avoid using a load that exceeds the maximum contact capacity of the switch. In the case of a lower current than the rated current value, the M0 switch lamp may not light.

Contact Protection

When using an inductive load, such as a relay, etc., be sure to set the protection circuit as shown in Fig. 1 and Fig. 2. Also, if lead wire is longer than that specified in Table 1, set protection circuit as shown in Fig. 3 and Fig. 4.

Table 1

Voltage	Lead Wire Length
DC	50m
AC	10m

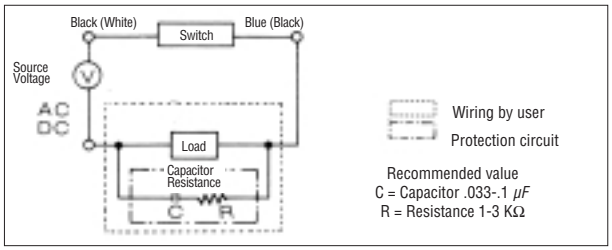


Fig. 1. When using capacitor resistance

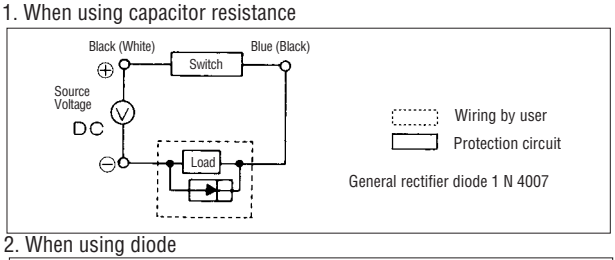


Fig. 2. When using diode

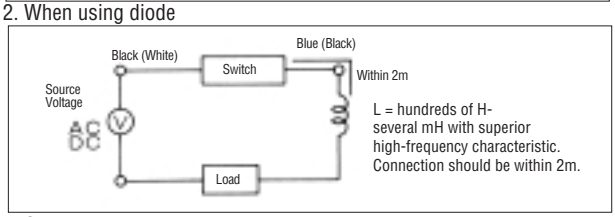


Fig. 3. Choke coil

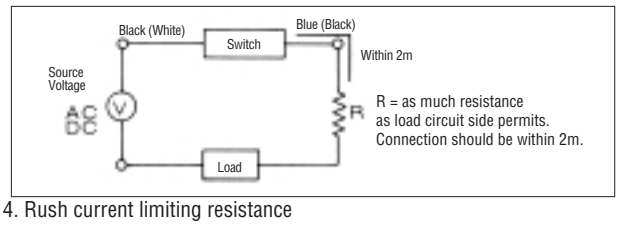


Fig. 4. Rush current limiting resistance

Relay

Use the following relays or equivalents:

Omron, MY or G type
Furnas 46 type
Potter & Brumfield KUP type
Allen Bradley HC type

Series Connection

If more than one M05 switch is wired in series, value of voltage drop at switches are the total of all the switches connected. In order to ensure its operation, use one M05 switch and use M55 for the others and the voltage drop will be limited to that of one M05 switch (about 2.4V). The lamps will light only when all the switches are on.

Parallel Connection

Any number of switches can be used in parallel connections, but in the case of the M0 switch, the lamp might be dimmer or not on at all.

Magnetic Environment

Avoid using switches near a strong magnetic field or strong current (large magnet, spot welding machine, etc.). When cylinders with switches are mounted close to each other in parallel, or when magnetic material moves near the cylinder, they could cause interference and affect switch operation.

Protection of Lead Wires

Minimum bending radius of lead wires should be R9 or more. Ensure that no bending or tension stresses are continuous on the wires. For moving portion, use wiring similar to that used on robots.

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Miller SRL2-M Series
Rodless Cylinders

Rodless Cylinder

Saves space, withstands high loads, moves at high speeds without lubrication

Specifications

Model	SRL2-M (Standard w/switch)			
Operating Medium	Compressed Air			
Maximum Pressure, PSI	100 PSI			
Minimum Pressure, PSI	ø16\ø20 Bores 29 ø25\ø32\ø40 Bores 14.5 ø50\ø63\ Bores 7			
Proof Pressure, PSI	152			
Bore Size mm (inch nominal)	16(⅝)	20(¾), 25(1)	32(1¼), 40(1½)	50(2), 63(2½)
Port Size	M5	⅛ NPT	¼ NPT	⅜ NPT
Ambient Temperature °F (°C)	40-140 (5-60)			
Stroke Tolerance in.	.080 to 39" .100 to 118" .120 to 196"			
Piston Speed, *in./sec.	2-80 IPS with side ports on each end (ø16\ø20 bores 2-40 IPS with one end ports with 39" stroke) (ø25\ø32\ø40\ø50\ø63 bores 2-40 IPS with one end ports with 78" stroke)			
Cushion	Air Cushion Standard			
Lubrication	Not Required (if you choose to lubricate your system, continuing lubrication will be required. Use Class 1, 150 VG 32 Turbine Oil.)			

* Note: Actual piston speed with one end ports will vary depending on stroke length.

How To Order

The following "How To Order" example is of a SRL Rodless Cylinder with Foot Mount Brackets, 1½" Bore, Cushions at both ends, and a 25¼" Stroke with 2/Switches.

SRL2-M LB – 40B – 02525 – A1 – M2H5 – 2

Cylinder	Mounting	Bore	Cushion Location	Stroke	Option	Switch	Switch Quantity
SRL2-M Rodless Cylinder	**00** Basic Mounting **LB** Foot Mount Brackets LB1 Foot Mount Brackets	**16** (16mm) ⅝" nominal **20** (20mm) ¾" nominal **25** (25mm) 1" nominal **32** (32mm) 1¼" nominal **40** (40mm) 1½" nominal **50** (50mm) 2" nominal **63** (63mm) 2½" nominal	**B** Both Ends (Standard) **R** Right end only* **L** Left end only* **N** No cushions * Facing port side of cylinder	(XXXNN) **XXX** = inches **NN** = .01" increments **Example:** 02525 = 25.25"	**A** Stroke adjustment with shock absorber both ends **A1** Stroke adjustment with shock absorber right side **A2** Stroke adjustment with shock absorber left side **C** C-Mount fixture	**M2V5** **M2H5** **M3V5** **M3H5** **M2WV5** **M3WV5** **M0V5** **M0H5** **M5V5** **M5H5**	

To order floating joint or tube center support brackets, use part numbers shown on page 15.

Weight & Theoretical Force Characteristics

Bore	Effective Area In²	Weights: Weight at zero stroke M00 lbs.	M00 kg.	MLB lbs.	MLB kg.	MLB1 lbs.	MLB1 kg.	Weight per 1" (25.4mm) Stroke lbs.	kg.	Theoretical Forces (Lbs.) Pressure (PSI) 30	40	60	80	100
16	0.31	0.70	0.3	0.73	0.3	0.77	0.4	.07	.03	9	12	19	25	31
20	0.49	1.15	0.5	1.19	0.5	1.28	0.6	.10	.04	15	20	29	39	49
25	0.84	2.21	1.0	2.43	1.1	2.43	1.1	.15	.07	23	30	46	61	76
32	1.26	3.31	1.5	3.53	1.6	3.75	1.7	.20	.09	38	50	69	100	125
40	1.96	5.29	2.4	5.51	2.5	—	—	.27	.12	59	78	117	156	195
50	3.08	7.94	3.6	8.16	3.7	—	—	.40	.18	91	122	182	243	304
63	4.86	13.67	6.2	14.33	6.5	—	—	.63	.28	145	193	290	386	483

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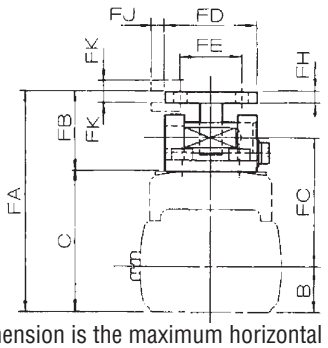
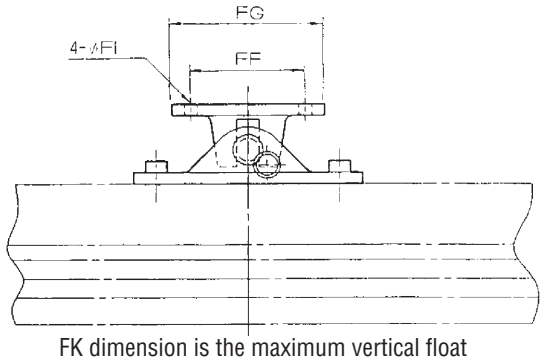
Accessories and Options

Floating Joint

Absorbs misalignment between cylinder and load



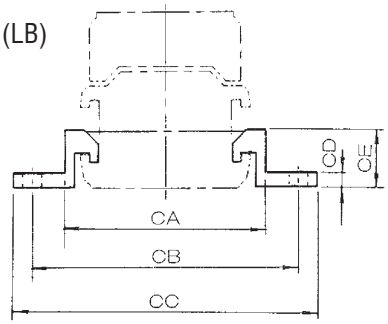
FJ dimension is the maximum horizontal float

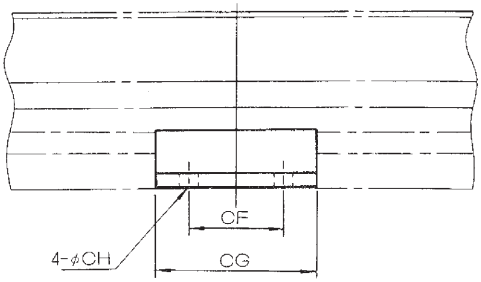


FK dimension is the maximum vertical float

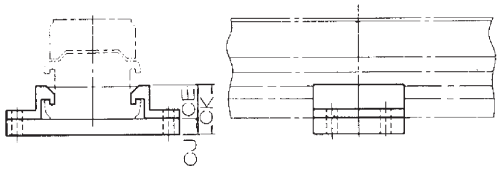
Tube Center Support Brackets

(LB)



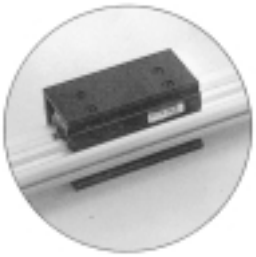


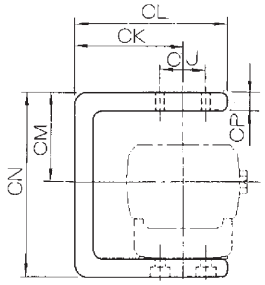
(LB1)

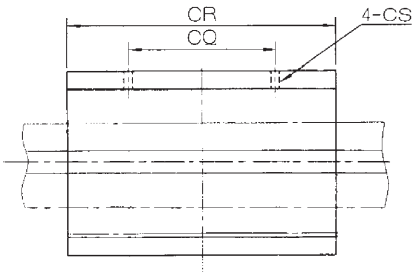


C Mounts

Provides mounting surface 180° from work table







See page 20 for additional information on using C-mounts

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Accessories and Options

Floating Joint

Bore		FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	B	C	Part Number
16	inches	2.238	0.827	1.339	0.945	0.673	1.181	1.575	0.118	0.134	0.118	0.118	0.472	1.457	715-SRL2-16-FLJNT
mm	mm	58	21	34	24	16	30	40	3	3.4	3	3	12	37	
20	inches	2.638	0.984	1.535	1.181	0.787	1.575	2.205	0.157	0.177	0.118	0.118	0.551	1.654	715-SRL2-20-FLJNT
mm	mm	67	25	39	30	20	40	56	4	4.5	3	3	14	42	
25	inches	3.071	0.984	1.85	1.181	0.787	1.575	2.205	0.157	0.236	0.118	0.118	0.669	2.087	715-SRL2-25-FLJNT
mm	mm	78	25	47	30	20	40	56	4	6	3	3	17	53	
32	inches	3.74	1.496	2.185	1.772	1.181	1.969	2.756	0.236	0.276	0.197	0.197	0.728	2.244	715-SRL2-32-FLJNT
mm	mm	95	38	55.5	45	30	50	70	6	7	5	5	18.5	57	
40	inches	4.134	1.496	2.441	1.772	1.181	1.969	2.756	0.236	0.276	0.197	0.197	0.866	2.638	715-SRL2-40-FLJNT
mm	mm	105	38	62	45	30	50	70	6	7	5	5	22	67	
50	inches	4.961	1.732	2.874	2.362	1.575	2.756	3.543	0.315	0.354	0.197	0.197	1.102	3.228	715-SRL2-50-FLJNT
mm	mm	126	44	73	60	40	70	90	8	9	5	5	28	82	
63	inches	5.472	1.732	3.11	2.362	1.575	2.756	3.543	0.315	0.354	0.197	0.197	1.378	3.74	715-SRL2-63-FLJNT
mm	mm	139	44	79	60	40	70	90	8	9	5	5	35	95	

Tube Center Support Brackets (2 per kit)

Bore		CA	CB	CC	CD	CE	CF	CG	CH	CJ	CK	Kit Part Number	
												00 & LB Mtg.	LB1 Mtg.
16	inches	1.654	2.205	2.52	0.118	0.472	0.787	1.378	0.157	0.236	0.709	715-SRL2-16-00-MDSPT	715-SRL2-16-LB1-MDSPT
mm	mm	42	56	64	3	12	20	35	4	6	18		
20	inches	1.929	2.52	2.953	0.157	0.551	0.787	1.496	0.197	0.315	0.866	715-SRL2-20-00-MDSPT	715-SRL2-20-LB1-MDSPT
mm	mm	49	64	75	4	14	20	38	5	8	22		
25	inches	2.362	2.992	3.465	0.236	0.768	0.787	1.575	0.276	0.394	1.161	715-SRL2-25-00-MDSPT	715-SRL2-25-LB1-MDSPT
mm	mm	60	76	88	6	19.5	20	40	7	10	29.5		
32	inches	2.913	3.465	3.937	0.236	0.846	0.787	1.575	0.276	0.394	1.24	715-SRL2-32-00-MDSPT	715-SRL2-32-LB1-MDSPT
mm	mm	74	88	100	6	21.5	20	40	7	10	31.5		
40	inches	3.543	4.252	4.882	0.236	0.965	1.181	2.362	0.354			715-SRL2-40-00-MDSPT	—
mm	mm	90	108	124	6	24.5	30	60	9				
50	inches	4.173	4.882	5.512	0.315	1.201	1.181	2.362	0.354			715-SRL2-50-00-MDSPT	—
mm	mm	106	124	140	8	30.5	30	60	9				
63	inches	5.118	5.984	6.772	0.394	1.516	1.969	3.543	0.433			715-SRL2-63-00-MDSPT	—
mm	mm	130	152	172	10	38.5	50	90	11				

C-Mounts*

Bore		CJ	CK	CL	CM	CN	CP	CQ	CR	CS	Part Number**
16	inches	0.591	1.398	1.969	1.142	2.362	0.236	1.89	3.465	5-40	715-SRL2-16-CBRKT
mm	mm	15	35.5	50	29	60	6	48	88		
20	inches	0.709	1.28	1.969	1.024	2.362	0.236	2.362	3.937	8-32	715-SRL2-20-CBRKT
mm	mm	18	32.5	50	26	60	6	60	100		
25	inches	0.787	1.772	2.717	1.102	2.795	0.197	2.756	4.567	10-24	715-SRL2-25-CBRKT
mm	mm	20	45	69	28	71	5	70	116		
32	inches	0.787	2.126	3.209	1.319	3.15	0.276	3.15	5.039	1/4-20	715-SRL2-32-CBRKT
mm	mm	20	54	81.5	33.5	80	7	80	128		
40	inches	1.181	2.48	3.76	1.496	3.602	0.315	3.543	5.433	1/4-20	715-SRL2-40-CBRKT
mm	mm	30	63	95.5	38	91.5	8	90	138		
50	inches	1.181	2.913	4.449	1.89	4.429	0.394	3.937	5.591	5/16-18	715-SRL2-50-CBRKT
mm	mm	30	74	113	48	112.5	10	100	142		
63	inches	1.575	3.465	5.433	2.283	5.157	0.512	4.331	6.22	5/16-18	715-SRL2-63-CBRKT
mm	mm	40	88	138	58	131	13	110	158		

* C-Mounts not available with adjustable stroke, shock absorber or tube center support bracket.

** Use this part number when ordering C-Mount as a separate part. When ordering with cylinder, use “C” option as part of cylinder part number.

How To Order Accessories:

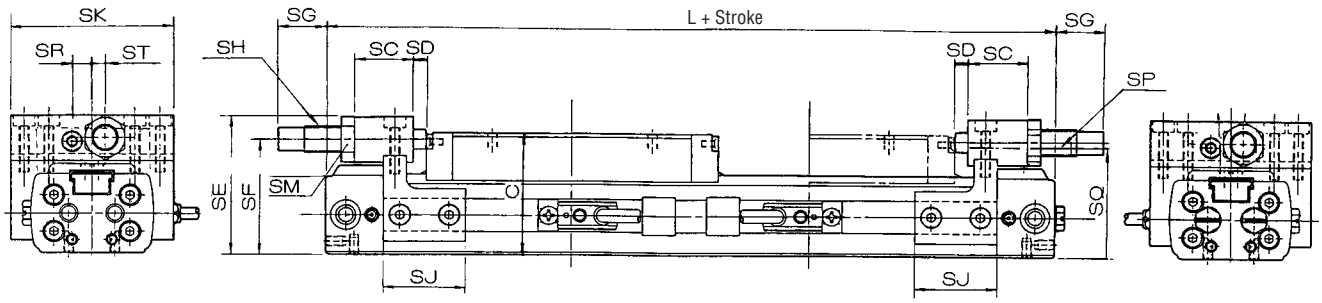
Example: To order a floating joint and tube center support brackets for a 40 mm SRL cylinder with LB mounting.

1-715-SRL2-40-FLJNT

1-715-SRL2-F4-222083

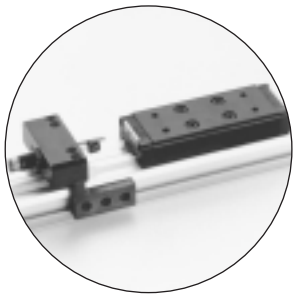
Accessories and Options

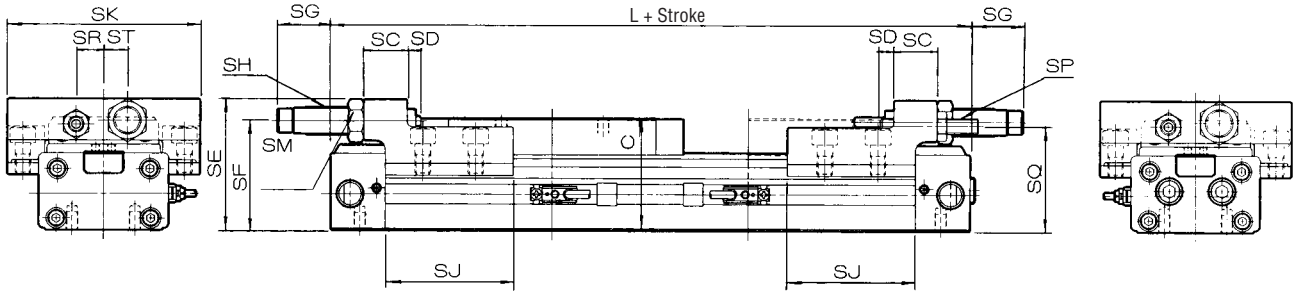
All Stroke Adjustment and Shock Absorber Dimensions



SH = max. energy absorption

Bore (mm)		SC	SD	SE	SF	SG		SH	SJ	SK	SP	SQ	SR	ST	C	L
						MAX	MIN	IN.-LBS.								
ø16	in.	0.71	0.16	1.65	1.38	0.57	0.18	26	0.98	1.93	M3	1.34	0.24	0.16	1.46	5.87
	mm	18	4	42	35	14.5	4.5		25	49		34	6	4	37	149
ø20	in.	0.89	0.14	1.89	1.57	0.57	0.18	61	1.54	2.24	M4	1.50	0.32	0.20	1.65	6.65
	mm	22.5	3.5	48	40	14.5	4.5		39	57		38	8	5	42	169
ø25	in.	0.79	0.10	2.46	2.03	0.57	0.18	104	1.97	3.03	M6	1.97	0.47	0.39	2.09	7.48
	mm	20	2.5	62.5	51.5	14.5	4.5		50	77		50	12	10	53	190



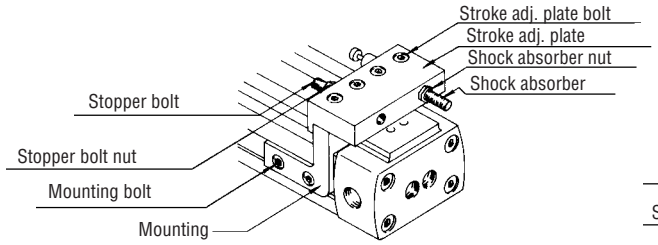


SH = max. energy absorption

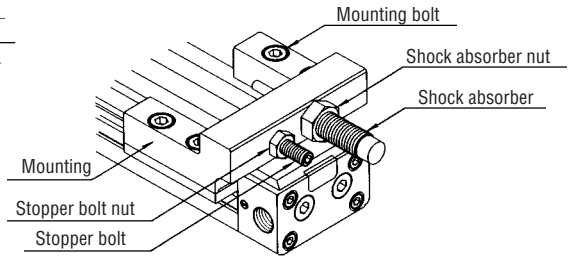
Bore (mm)		SC	SD	SE	SF	SG		SH	SJ	SK	SP	SQ	SR	ST	C	L
						MAX	MIN	IN.-LBS.								
ø32	in.	0.87	0.28	2.62	2.19	1.06	0.67	226	2.56	3.86	M8	2.11	0.55	0.47	2.24	8.90
	mm	22	7	66.5	55.5	27	17		65	98		53.5	14	12	57	226
ø40	in.	1.26	0.28	3.09	2.58	1.34	0.94	608	2.56	4.41	M10	2.50	0.67	0.47	2.64	9.61
	mm	32	7	78.5	65.5	34	24		65	112		63.5	17	12	67	244
ø50	in.	1.50	0.32	3.90	3.15	2.17	1.77	1042	2.76	5.35	M12	3.05	0.87	0.67	3.23	10.16
	mm	38	8	99	80	55	45		70	136		77.5	22	17	82	258
ø63	in.	1.50	0.32	4.41	3.68	1.73	1.34	1042	2.76	6.22	M16	3.50	0.98	0.79	3.74	11.65
	mm	38	8	112	93.5	44	34		70	158		89	25	20	95	296

Technical Information

Positioning of Stroke Adjustment Unit



ø16~ø25



ø32~ø63

(1) Moving the stroke adjustment unit.
The stroke adjustment unit can be moved by loosening the mounting bolts.

(2) Locking of stroke adjustment unit.
After moving the stroke adjustment unit to the appropriate position, lock it there by tightening the mounting bolts to the torque values shown in Figure 1. Insufficient torque may cause the stroke adjustment unit to slip out of position.

Figure 1. Torque values for tightening stroke adjustment unit.

Tightening Torque / Model	Mounting Bolt (In.-Lbs.)	Stroke Adj. Plate Bolt (In.-Lbs.)
SRL2-M-16	9-11	4-6
SRL2-M-20	22-24	
SRL2-M-25	46-50	22-24
SRL2-M-32	195-213	—
SRL2-M-40	390-415	—
SRL2-M-50-63	682-735	—

(3) Stroke adjustment using the stopper bolt.
Adjust the stroke by loosening the stopper bolt nut and turning the stopper bolt. After adjusting the stroke, tighten the stopper bolt nut to the torque values shown in Figure 2. When adjusting the 16-25 mm cylinders, due to the small amount of clearance between the table and the stroke adjustment plate, adjust the stroke by moving the complete stroke adjustment unit.

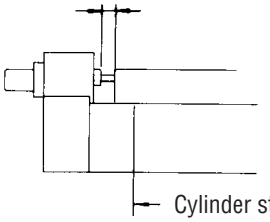
Figure 2. Torque values for tightning stopper bolt nut and shock absorber nut.

Tightening Torque / Model	Stopper Bolt Nut (In.-Lbs.)	Shock Absorber Nut (In.-Lbs.)
SRL2-M-16	10-11	12-16
SRL2-M-20	22-24	26-35
SRL2-M-25	73-84	40-53
SRL2-M-32	195-213	66-89
SRL2-M-40	390-425	195-266
SRL2-M-50	682-735	487-620
SRL2-M-63	1772-1914	487-620

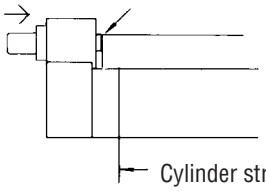
(4) Adjustment of shock absorber.
Adjust the absorption energy of the shock absorber by changing the operating stroke of the shock absorber. This is done by loosening the shock absorber nut and turning the unit. When adjustment is complete, tighten the shock absorber nut to the torque values shown in Figure 2.

(5) Notes on usage.
The shock absorber absorbs rated energy with rated stroke. The factory setting allows a small amount of shock absorber stroke before it bottoms out. Readjust the location of the shock absorber so that the complete stroke of the absorber is utilized.

Absorption energy as set at factory:
Small margin with stroke
of shock absorber.



Adjust the position of the shock absorber until the plunger of the shock absorber is fully depressed.



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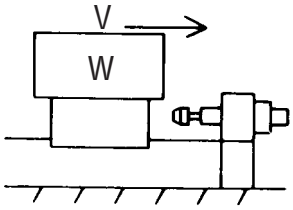
(6) Allowable collision energy of shock absorber.
By using the following formula, calculate collision equivalent effective weight (We) and collision energy (E), and ensure that both are below the allowable values shown in Figure 3. Also ensure that repeat frequency and collision speed are within specified allowable values in Figure 4.

To check the energy absorption capacity of the cylinder's shock absorber in the middle of the stroke, use the following formulae.

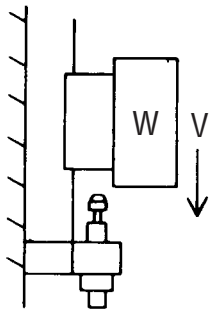
Horizontal Mounting



$$E = \frac{WV^2}{772} + FS$$

$$We = W + \frac{772\,FS}{V^2}$$

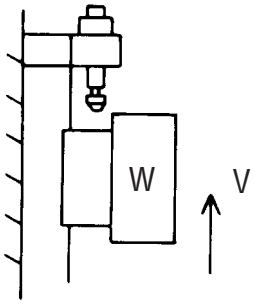
Vertical Mounting - Shock absorber at bottom



$$E = \frac{WV^2}{772} + (F+W) \cdot S$$

$$We = W + \frac{772\,(F+W)S}{V^2}$$

Vertical Mounting - Shock absorber at top

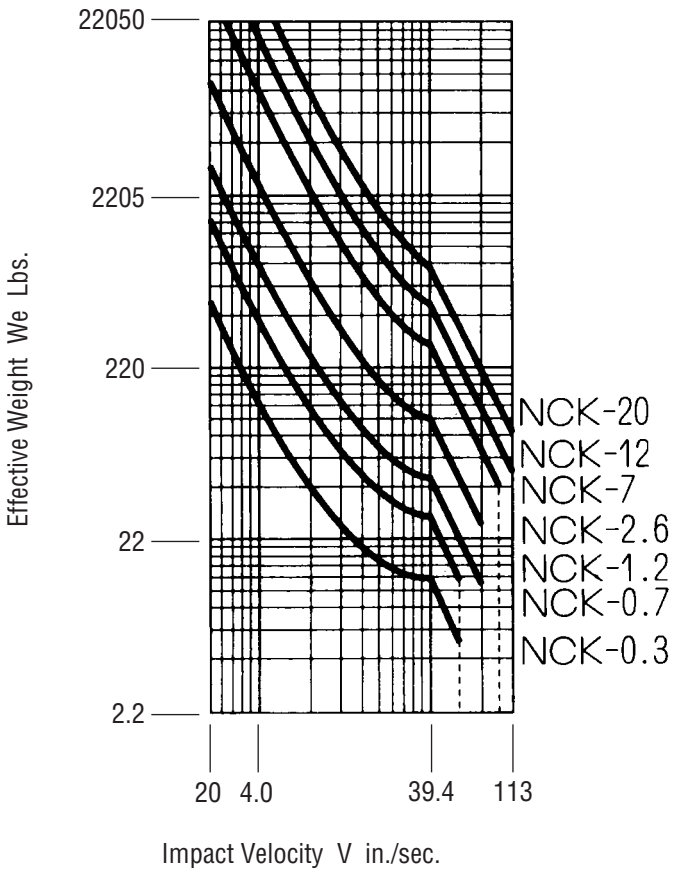


$$E = \frac{WV^2}{772} + (F-W)S$$

$$We = W + \frac{772\,(F-W)S}{V^2}$$

E = Energy to absorb (in. lbs.)
W = Weight attached to piston table (lbf)
F = Actual cylinder propelling force (lbf)
S = Stroke of shock absorber (in.)
V = Impact velocity (in./sec.)
We = Effective weight (lb.)

Figure 3. Effective Weight Versus Impact Velocity for Various Size Shock Absorbers.



Note: The following applies to the shock absorber being used with whole stroke adjustment.

The allowable absorption energy varies depending on impact velocity. When impact velocity is 78 in./sec., the maximum calculated absorption energy should not exceed 1/3 of the value shown in Figure 4. At an impact velocity of 39 in./sec., it should not exceed 1/2 the value shown in Figure 4.

Figure 4. Specifications

Cylinder	SRL2-M 16	SRL2-M 20	SRL2-M 25	SRL2-M 32	SRL2-M 40	SRL2-M 50, 63
Shock Absorber No.	NCK-00-0.3-C	NCK-00-0.7-C	NCK-00-1.2	NCK-00-2.6	NCK-00-7	NCK-00-12
Max. Energy Absorption - in.-lbs. (kgf · m)	26.0 (0.3)	60.8 (0.7)	104.2 (1.2)	226 (2.6)	608 (7.0)	1042 (12)
Stroke - inches	.236	.315	.394	.590	.787	.984
Energy Absorption/hour - in.-lbs/hour	54,700	109,380	187,510	338,560	729,200	750,000
Max. Impact Velocity - in./sec.	59	59	78.7	78.7	98.4	118.1
Max. Frequency Stroke per Minute	35	30	30	25	20	12
Ambient Temperature - F°, (C°)	41-140 (5-60)					
Spring Return Force - lb. Extended	.65	.45	.65	1.33	2.20	3.60
Compressed	1.01	.97	1.33	2.65	4.86	7.49
Return Time - Sec.	0.3	0.3	0.3	0.3	0.4	0.4

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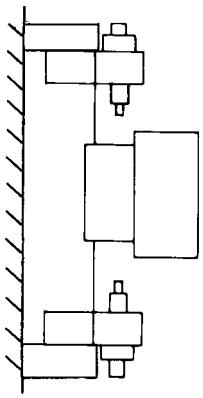
(7) Calculation examples for SRL2-M-20 with shock absorber NCK-00-0.7-C.

Example 1. Vertical Mounting



Weight attached to piston table - 6lb.
Impact velocity upward - 32 in./sec.
Impact velocity downward - 39 in./sec.
Working pressure - 70 psi
Actual propelling force - 28 lb.
(see Figure 13, page 26)

Upward kinetic energy:

$$Eup = \frac{6 \cdot 32^2}{772} + (28-6) \cdot 0.315 = 14.89 \text{ in.-lbs.}$$

Downward kinetic energy:

$$Edn = \frac{6 \cdot 39^2}{772} + (28+6) \cdot 0.315 = 22.53 \text{ in.-lbs.}$$

Effective weight, upward:

$$We\ up = 6 + \frac{772 \cdot (28-6) \cdot 0.315}{32^2} = 11.22 \text{ lb.}$$

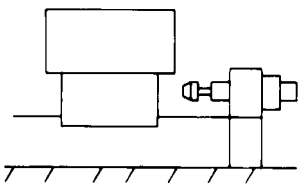
Effective weight, downward:

$$We\ dn = 6 + \frac{772 \cdot (28+6) \cdot 0.315}{39^2} = 11.43 \text{ lb.}$$

Eup = 14.89 is less than 1/2 times 60.8 (See Figure 4) - OK
Edn = 22.53 is less than 1/2 times 60.8 (See Figure 4) - OK
We up = 11.22 is less than 32 (See Figure 3) - OK
We dn = 11.43 is less than 31 (See Figure 3) - OK

Example 2. Horizontal Mounting

Weight attached to piston table - 6 lb.
Impact velocity - 36 in./sec.
Working Pressure - 50 psi
Actual propelling force - 20 lb.
(see Figure 13, page 26)



Kinetic energy:

$$E = \frac{6 \cdot 32^2}{772} + 20 \cdot 0.315 = 16.37$$

$$We = 6 + \frac{772 \cdot 20 \cdot 0.315}{36^2} = 11.25$$

E = 16.37 is less than 1/2 times 60.8 (See Figure 4) - OK
We = 11.25 is less than 32 (See Figure 3) - OK

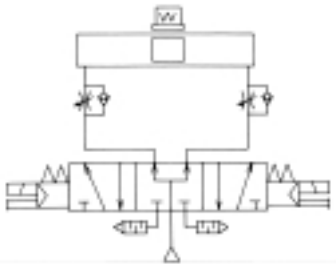
Intermediate Stroke Stop

Slit tube type rodless cylinders, by the nature of their design, will allow a very small amount of air to leak externally including the SRL2-M which has non-detectable, minimal leakage. To try to stop and hold a cylinder in an intermediate position will require a three position valve with both cylinder ports open to pressure in the circuit for more satisfactory results. See Figures 5 and 6.

Horizontal Weight

The circuit in Figure 5 shows that equal pressure is applied to both sides of the piston when it stops which prevents the table from jumping out of position at restart.

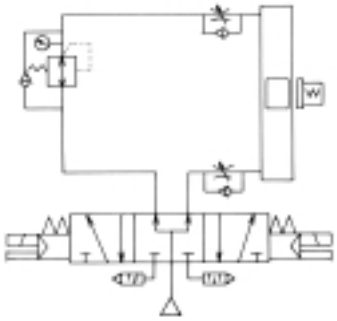
Figure 5



Vertical Weight

As shown in Fig. 6, the table moves in the same direction as the weight in a vertical application. Install a regulator with a check valve to reduce the cylinder thrust on the upper side to balance the weight and force on the lower side.

Figure 6



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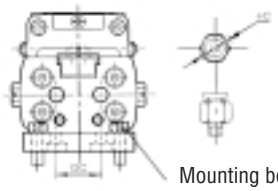
Piping

Piping should be of a rust resistant material and be of a sufficient internal area for piston speed required. Make sure that piping is clean and free from sealing compound before connecting to system.

End Port Piping

Refer to Figure 7 to determine when end port piping can be used with various types of mountings relative to fitting clearance.



Mounting bolt for axial foot mount

Figure 7

Bore Size (mm)	ø C [O.D. of fittings (in.)] Mounting		
	00	LB	LB1
ø 16	.472	End Port Piping Not Available	.472
ø 20	.630		.630
ø 25	1.024		1.024
ø 32	1.065		1.063
ø 40	1.378	1.024	
ø 50	1.378	1.181	
ø 63	1.535	1.339	

On all bore sizes with axial foot mounting (LB or LB1), the end port pipe fittings will obstruct the mounting holes. To avoid this problem, mount the cylinder first and tighten the mounting bolts and then attach the pipe fittings to the cylinder ports.

Cushion Adjustment

Cushion adjustment screws are located next to the ports on the side of the cylinder. The cushion effect can be reduced by loosening the cushion screw (turning counterclockwise). If the cylinder is subjected to high kinetic energy due to a heavy load or high speed, etc., an external cushion device should be considered to absorb the kinetic energy load. See stroke adjustment and shock absorption option.

Quality of Compressed Air

Use clean, dry compressed air to operate the cylinder. This can be accomplished by installing a filter with a proper filtration rating and flow rate ahead of the directional control valve and draining the filter regularly to ensure that no moisture or contaminants are allowed into the system.

Work Environment

System components should be mounted in areas free from corrosive atmosphere, rain, water and direct sunlight. If cutting oils, coolants, oil mists, etc. are present, the cylinder should be covered or protected to avoid damage to the seals. Also, avoid areas where cutting chips, dust, spatter, etc. will come in contact with the cylinder.

Under normal usage, the cylinder has an effective dust-seal belt which prevents contamination from entering the interior of the cylinder. However, under unusually dusty or contaminated operating conditions, it is recommended that the cylinder be mounted with the work table and dust-seal belt facing down. When mounted in this fashion, be sure to check the weight deflection chart to ensure that the unsupported tube is not overloaded. C-mounts are available for use in these circumstances. See pages 14 and 15 for C-mount dimensions.

External Guides

When external guides are employed, ensure that excessive forces are not transmitted to the cylinder due to friction, misalignment, or deflection of the external guides. Use of a floating joint is recommended. See pages 28-31 for application forms and pages 14 and 15 for floating joint dimensions.

Other Considerations

Avoid electric welding around the rodless cylinder as current could be conducted through the cylinder tube and destroy the dust belt.

Excessive inertia will cause the cylinder to malfunction. Ensure that inertia loads are within allowable range.

Deep scratches or dents on the cylinder tube from external means may have an effect on cylinder performance.

If negative pressure (vacuum) is caused in the cylinder by excessive external force or inertia force, the pressure seal belt may be drawn away from the slit tube causing external leakage. Ensure that no negative pressure or vacuum can be generated inside the cylinder.

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Sizing Guide for SRL Rodless Cylinder

Introduction

Unlike traditional cylinders with piston rods, where load forces are normally experienced on the cylinder centerline, the design of rodless cylinders dictates that *all* load forces are eccentric to some degree.

Depending on the application, these eccentric load forces can become quite substantial and create an adverse effect on cylinder performance and life expectancy. As a result, the use of rodless cylinders, and the manner in which they are designed into a system, requires careful consideration of a variety of engineering factors to ensure optimal performance. These factors include load moments, mounting method, total weight and resistive force, velocity and deceleration.

Note: Miller Fluid Power Application Engineers will be happy to assist you in evaluating your application. For your convenience, there are typical application loading diagram forms on pages 28-31 which show the three basic cylinder mounting conditions:

Condition 1 - Cylinder horizontal, Table horizontal
Condition 2 - Cylinder horizontal, Table vertical
Condition 3 - Cylinder vertical, Table vertical

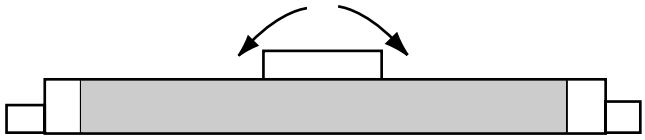
Select the application loading diagram that fits your application. Fill out the form and include any other pertinent data along with your name and your company name, address, phone and/or FAX number and FAX the form and information to Miller Fluid Power for review.

Load Moments

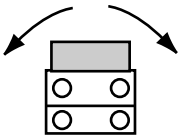
There are three load moments to be considered:
Bending Moment (M1), Radial Moment (M2), and Cross Moments (M3), as illustrated in Figure 8.

The preferred location of any load is in the center of the cylinder table. Some applications may require the load to be offset. To help in determining the load moments affecting your application, some of the typical loading diagrams, forces, and distances to consider are shown on page 22.

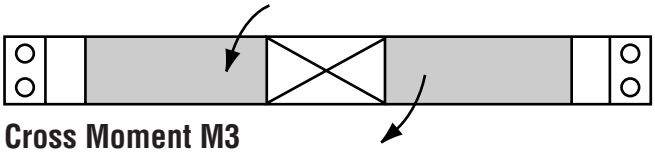
Figure 8



Bending Moment M1



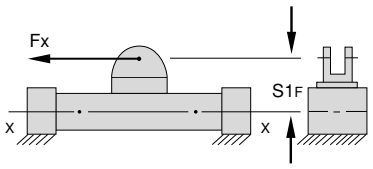
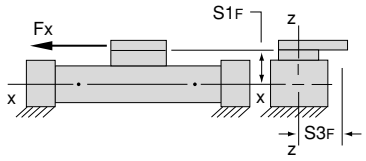
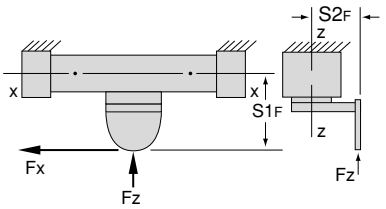
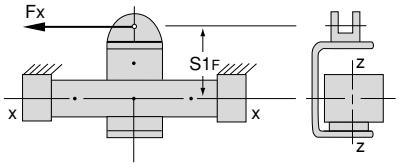
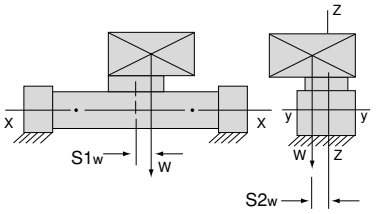
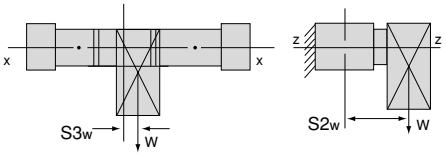
Radial Moment M2



Cross Moment M3

Typical Mounting Diagrams and Loading

A. Axis X–X Horizontal

Loading Type	Mtg Diag #	Mounting Diagram	M1	M2	M3
Resistive Force Only	A1		F_X x $S1_F$	—	—
	A2		F_X x $S1_F$	—	F_X x $S3_F$
	A3		F_X x $S1_F$	F_Z x $S2_F$	F_X x $S2_F$
	A4		F_X x $S1_F$	—	—
Weight Only	A5		W x $S1_W$	W x $S2_W$	—
	A6		—	W x $S2_W$	W x $S3_W$

B. Axis X–X Vertical

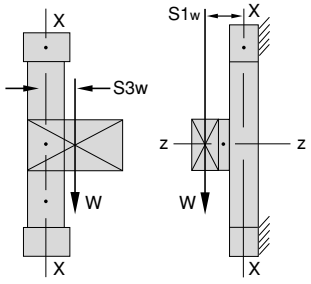
Loading Type	Mtg Diag #	Mounting Diagram	M1	M2	M3
Weight Only	B1		W x $S1_W$	—	W x $S3_W$

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Figure 9 shows the maximum allowable moments for each of the three types of loading: Bending, Radial, and Cross moments.

The sum total of each of these types of moments, divided by each of the maximums, determines a Weight-Moment Factor (WMF) equal to or less than 1.0. On horizontal mountings, the Total Weight (W_T) should also be divided by the maximum weight allowable (Figure 10) and factored into the equation.

Horizontal Mountings:

$$\frac{W_T}{[W]} + \frac{M1}{[M1]} + \frac{M2}{[M2]} + \frac{M3}{[M3]} = WMF \leq 1.0$$

Vertical Mountings:

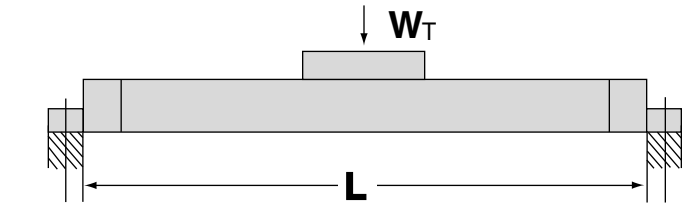
$$\frac{M1}{[M1]} + \frac{M2}{[M2]} + \frac{M3}{[M3]} = WMF \leq 1.0$$

Figure 9

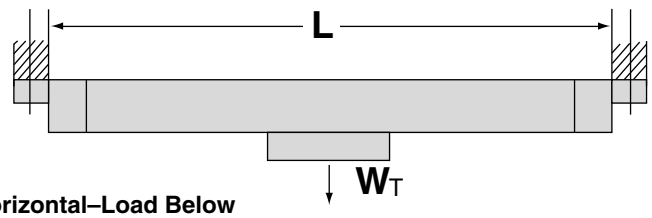
Maximum Allowable Moments (In.-Lbs.)						
	[M1]		[M2]		[M3]	
Bore	Bending Moment		Radial Moment		Cross Moment	
	Std. Mtg.	C-Mtg.	Std. Mtg.	C-Mtg.	Std. Mtg.	C-Mtg.
16	44	31	9	4	9	9
20	89	62	13	6	27	27
25	150	106	44	22	89	89
32	319	221	89	44	186	186
40	682	478	204	102	230	230
50	1363	956	283	142	372	372
63	2434	1708	460	230	673	673

Weight and Deflection

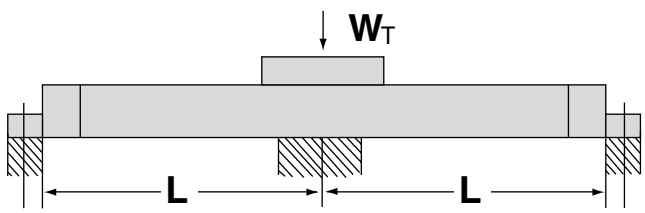
Figure 10 shows the maximum weight [W] in lbs. that the cylinder can accept as well as the maximum length [L] between supports at the maximum weight.



Horizontal–Load Above



Horizontal–Load Below



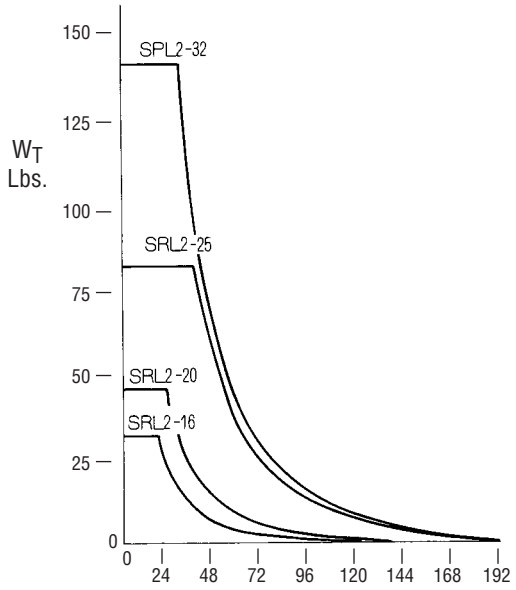
Horizontal–Tube Support

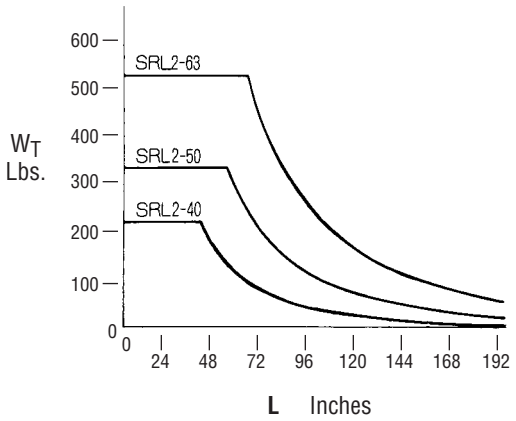
Figure 10

Bore	Max. Allowable Weight [W] Lbs.		Max. unsupported Length [L] in. at Max. Weight
	STD. MTG.	"C" MTG.	
16	32	16	17.7
20	45	23	21.7
25	81	41	35.4
32	140	70	29.5
40	218	109	39.4
50	331	165	51.2
63	522	261	63.0

Acceptable length and weight combinations for the various bore sizes can be determined from the charts in Figure 11.

Figure 11





To determine cylinder deflections under the weight (or resistive force perpendicular to the piston table) without mid-support, see the graphs on page 24.

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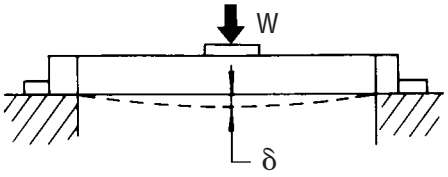
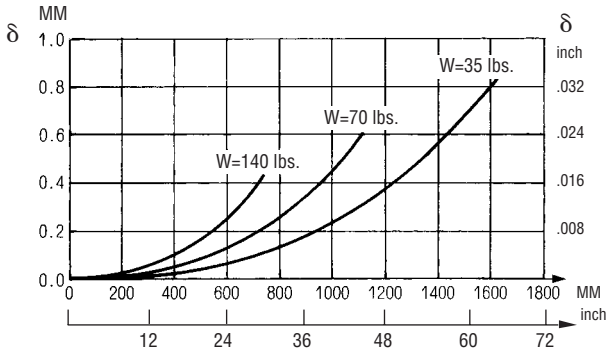
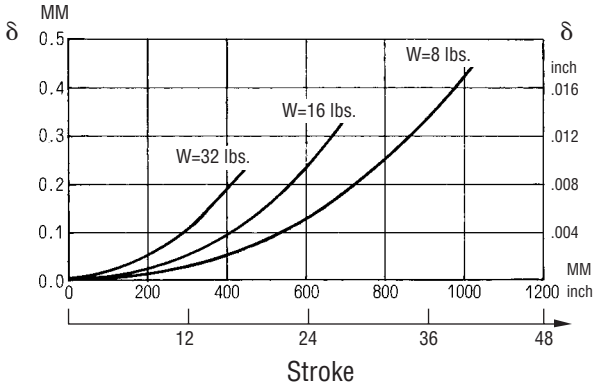
Tube Deflection Without Mid-Support



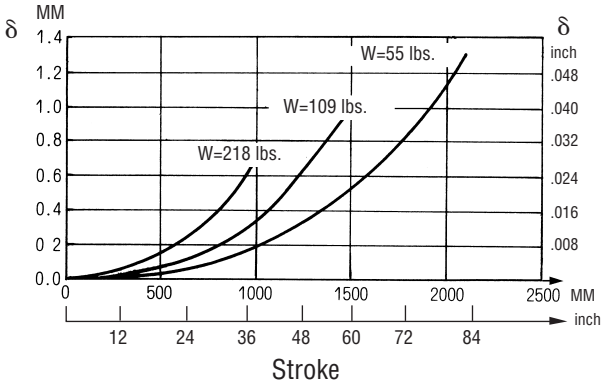
SRL2-M-32



SRL2-M-16



SRL2-M-40



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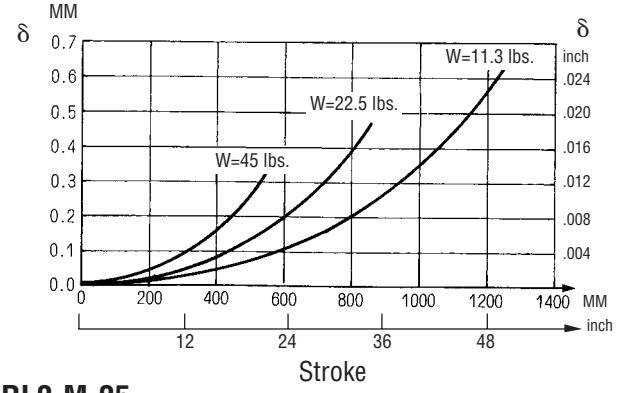
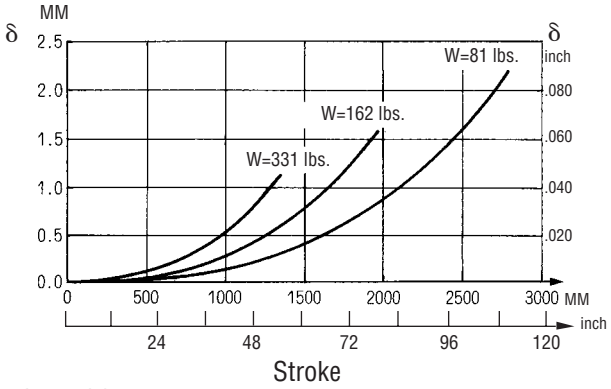
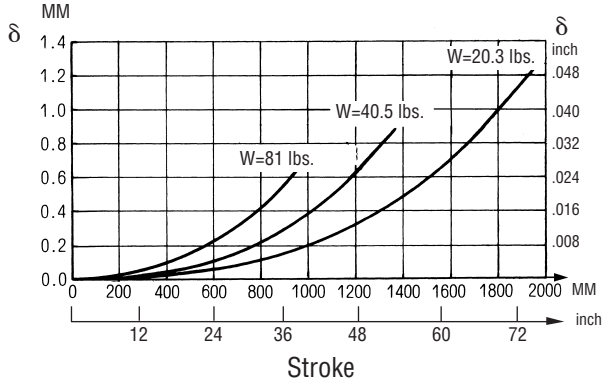


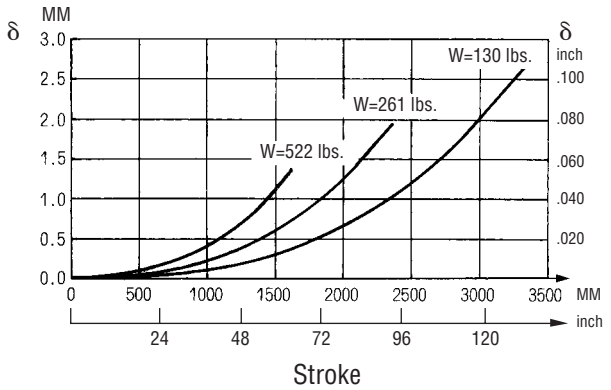
SRL2-M-50



SRL2-M-25

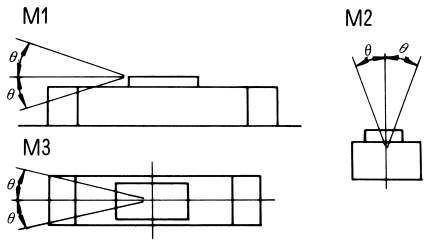


SRL2-M-63

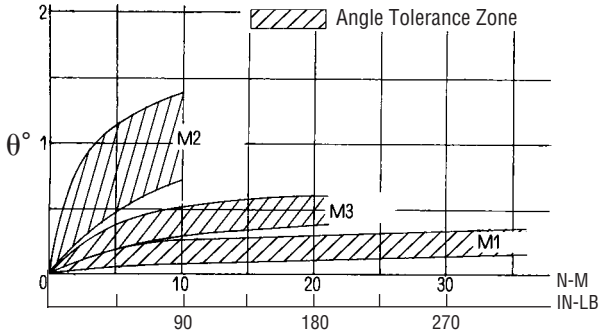


Moment and Deflection

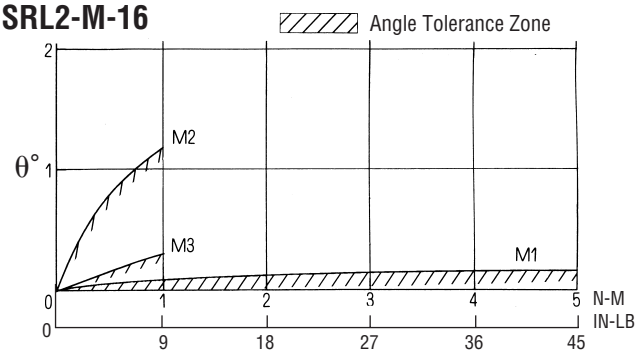
Piston Table Angular Deflection Due To Load Moments Applied



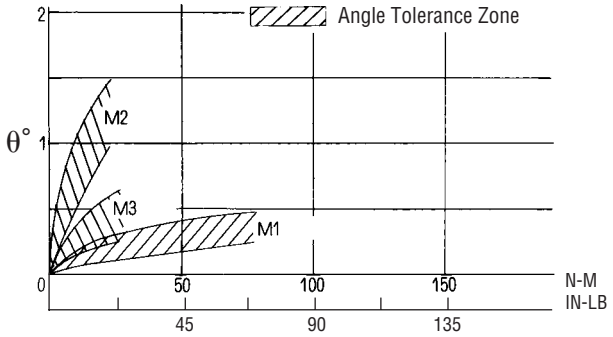
SRL2-M-32



SRL2-M-16



SRL2-M-40



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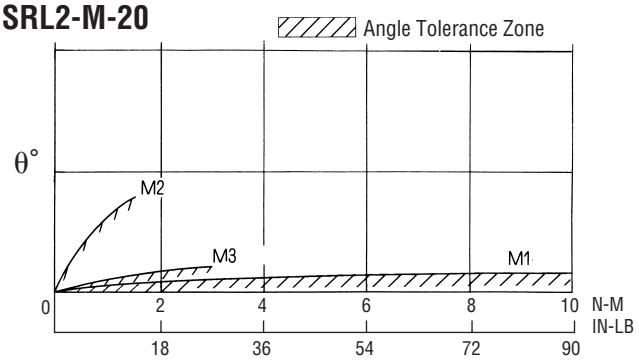
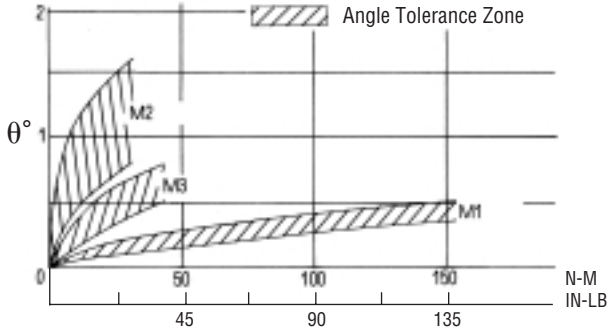
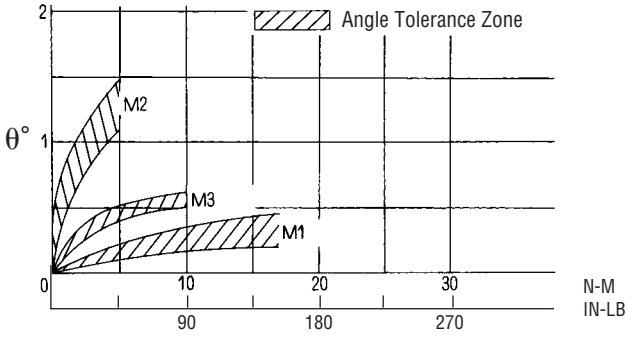


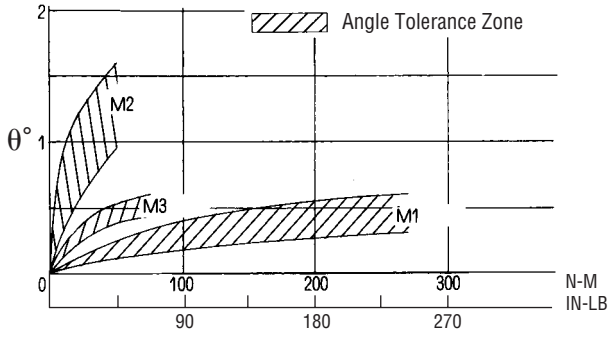
SRL2-M-50



SRL2-M-25



SRL2-M-63



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Load Factor and Forces

The Load Factor must be determined to ensure that the cylinder force available is adequate to overcome the total resistive force plus the additional friction caused by the load moments. This is done by calculating the frictional forces (Ff) created by the moments and the weight, using the formulas and the chart in Figure 12, and adding the resistive force (F_X), which is determined by the actual application.

Ff1 = M1 x C1 **Ff2** = M2 x C2 **Ff3** = M3 x C3
Fwf (Weight Frictional Force) = .2 x (W_T)
The sum of all resistive forces (F) including friction is determined as follows:

Horizontal Mountings:
$F = Ff1 + Ff2 + Ff3 + Fwf + F_X$
Vertical Mountings:
$F = Ff1 + Ff2 + Ff3 + W_T + F_X$

Actual Cylinder Force (Fa) available is shown in Figure 13.
Load Factor (LF) is determined as follows:
%LF = F/Fa x 100

Load Factor (LF) should never exceed 50%. If LF does exceed 50%, it will be necessary to select the next larger bore size and calculate its load factor.

Figure 12

Moment Friction Factor			
Bore mm	**C1**	**C2**	**C3**
16	.18	.61	.18
20	.15	.53	.15
25	.13	.41	.13
32	.10	.33	.10
40	.10	.28	.10
50	.10	.23	.10
63	.08	.20	.08

Figure 13

Actual Cylinder Force (Fa) in Lbs.											
	Effective Area	Pressure PSI									
Bore	**Sq.In.**	**15**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
16	0.33	—	—	6	10	13	16	19	22	25	28
20	0.48	—	7	11	15	20	24	28	33	37	41
25	0.84	—	11	19	26	34	41	49	56	64	71
32	1.26	—	17	28	39	50	62	73	84	95	107
40	1.96	—	27	44	61	78	97	114	131	148	166
50	3.08	35	42	69	96	123	152	179	206	233	260
63	4.86	55	66	109	152	194	239	283	325	368	411

Deceleration and Energy Absorption

The kinetic energy (E) to be absorbed during deceleration must be calculated to determine whether the cushion can absorb the load or an external shock absorber may be required. To calculate this, first determine the actual speed (V) at which the piston enters the cushion by multiplying the load factor coefficient (K), from Figure 14, times the average speed (V1) that the piston travels. V1 is derived from actual cycle time determined by the application requirement.

The formula is as follows:

V (In. per Sec.) = **KV1**

E (In.-Lbs.) $= \frac{W_T V^2}{772}$

Figure 14

Load Factor Coefficient					
Load Factor	10%	20%	30%	40%	50%
K	1.15	1.30	1.45	1.60	1.75

The following chart, Figure 15 shows the maximum energy absorption for each size cylinder, both with cushions and without cushions. If the requirements for your application fall below the number shown for the size of the cylinder you have selected, then no external shock absorber may be required, but inertia forces and moments should be considered.

Figure 15

Maximum Kinetic Energy [E] Absorption			
Bore	**Cushion length in.**	**With Cushion in.-lbs.**	**W/out Cushion in.-lbs.**
16	0.75	1.95	0.06
20	0.87	5.22	0.09
25	0.82	12.39	0.13
32	0.92	22.75	0.27
40	0.94	37.79	0.44
50	0.98	80.81	0.64
63	1.16	154.01	1.22

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Inertia Moment Consideration

When the weight is stopped at the end of the stroke by the cylinder cushion, inertial force is created. This inertial force (Fi) can be determined by using the formula:

Fi = WG

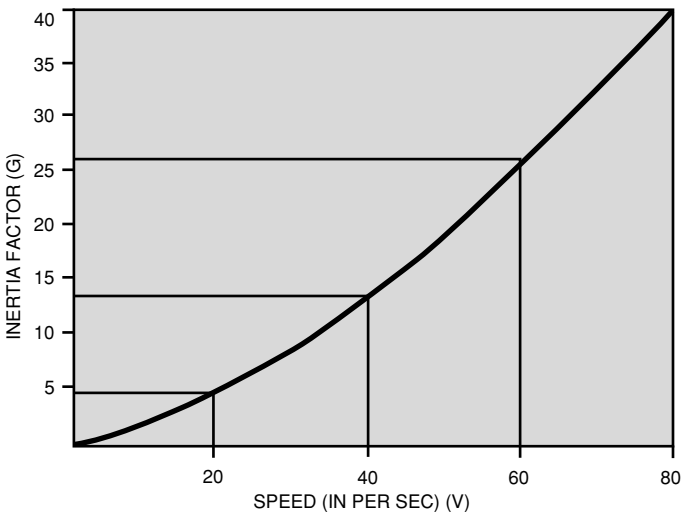
W = Weight attached to the piston table (lbs.)
G = Inertia factor (Figure 16)

Example:
A speed of 40 in./sec. corresponds to an inertia factor G of 13.

The inertial force calculated would then be multiplied by the distance from the center of gravity of the load to the centerline of the cylinder, and added to the previously calculated M1 and M3 moments. This will give an M1 Total and M3 Total. Ensure that the M1 Total and the M3 Total do not exceed the [M1] and [M3] values shown in Figure 9. If they exceed these values, an external shock absorber must be used.

See pages 16-19 for additional information on shock absorbers.

Figure 16

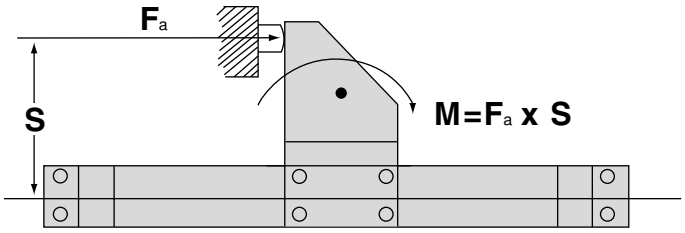


External Stops

When a cylinder piston is stopped externally, it creates an additional moment equal to the cylinder actual force (Fa) times the distance (S). This additional moment, plus the previously calculated Weight-Moment factor, should not exceed the allowable values. See page 23.

When reducing the stroke with external stops, remember that the cushion length and the energy absorption capacity are not directly proportional. Reducing the cushioning distance by 50% corresponds to a 30 to 40% cushion effectiveness.

Figure 17



SRL2-M Rodless Cylinder Sizing Forms

The following pages show the data that is required in order to size a rodless cylinder. They are typical load-mounting diagrams reflecting the three types of mounting conditions with either a resistive force or weight transfer application.

Condition 1: Cylinder mounted horizontal, table mounted horizontal

Condition 2: Cylinder mounted horizontal, table mounted vertical

Condition 3: Cylinder mounted vertical, table mounted vertical

The last page shows a cylinder mounted as in Condition 1, with the load guided and using a floating joint on the table.

If you wish Miller Fluid Power to size the rodless cylinder for you, please photocopy the form that fits your application, fill in the necessary data with any other information available about the application and FAX the data to Miller at Bensenville, Illinois using the FAX number shown on the back of the catalog.

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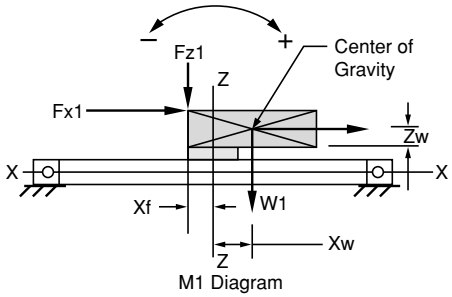
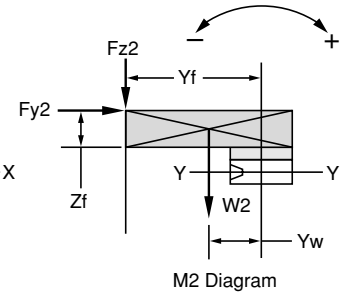
Sizing Forms

SRL2-M Resistive Forces

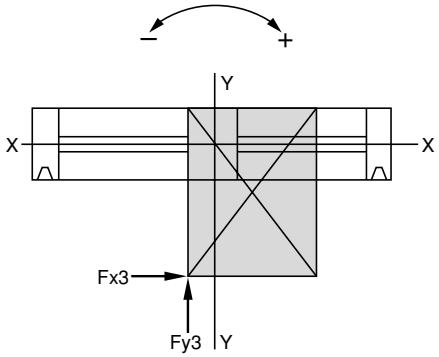
Horizontal Mount, Cond. 1



M1 Diagram



M2 Diagram



M3 Diagram
Top View

Notes:

$W1 = W2 = W$

$F_X1 = F_X3$

$F_y2 = F_y3$

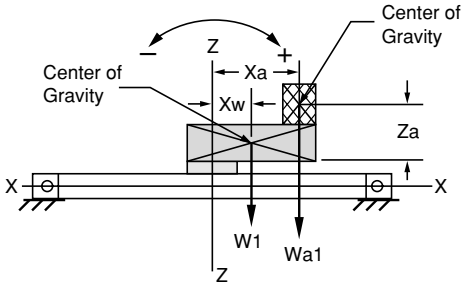
$F_Z1 = F_Z2$

	Required Data	
Diagram	**Force Lbs.**	**Distance In.**
M1	Fx1 = Fz1 = W1 =	Zf = Xf = Xw=
M2	Fy2 = Fz2 = W2 =	Zf = Yf = Yw=
M3	Fx3 = Fy3 =	Yf = Xf =
		Zw=

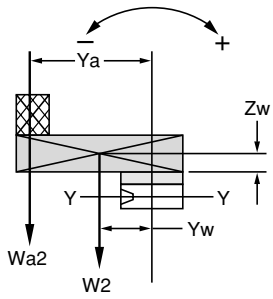
Required Data	
Operating Presssure (PSI)	
Stroke Length (In.)	
Unsupported Length (In.)	
Velocity (IPS) (In./sec.)	
Fixture Weight W (Lbs.)	

SRL2-M Weight Transfer

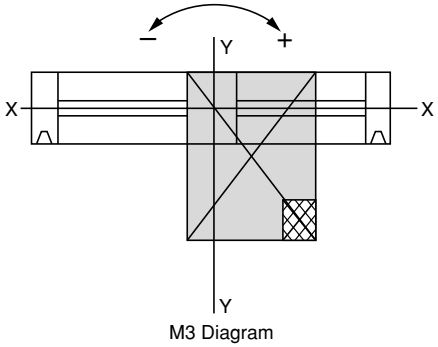
Horizontal Mount, Cond. 1



M1 Diagram



M2 Diagram



M3 Diagram
Top View

Notes:

$W1 = W2 = W$

$W_a1 = W_a2 = W_a$

	Required Data	
Diagram	**Weight Lbs.**	**Distance In.**
M1	W1 = *Wa1=	Xw= Xa =
M2	W2 = *Wa2=	Yw= Ya =
		Za = Zw =

*Specify if load Wa (product transferring) is attached or unfasten to the Fixture W.

Required Data	
Operating Presssure (PSI)	
Stroke Length (In.)	
Unsupported Length (In.)	
Velocity (IPS) (In./sec.)	
Fixture Weight W (Lbs.)	

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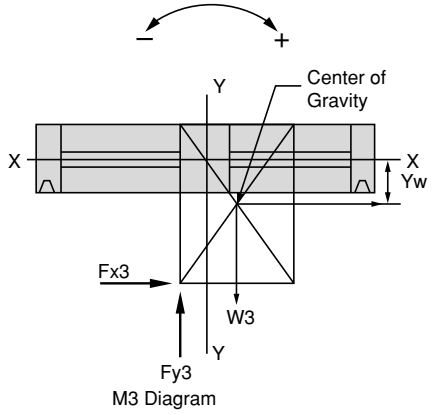
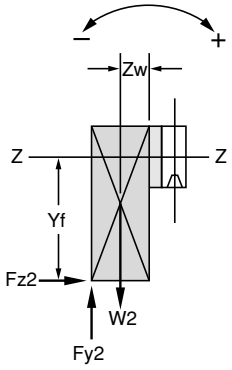
Sizing Forms

SRL2-M Resistive Forces

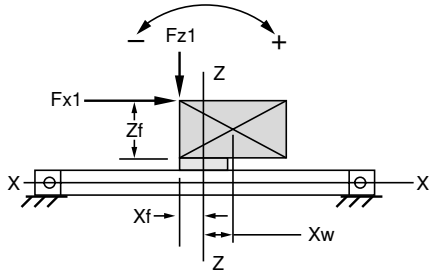
Horizontal Mount, Cond. 2



M3 Diagram



M2 Diagram



M1 Diagram
Bottom View

Notes:

$W2 = W3 = W$

$F_X1 = F_X3$

$F_Y2 = F_Y3$

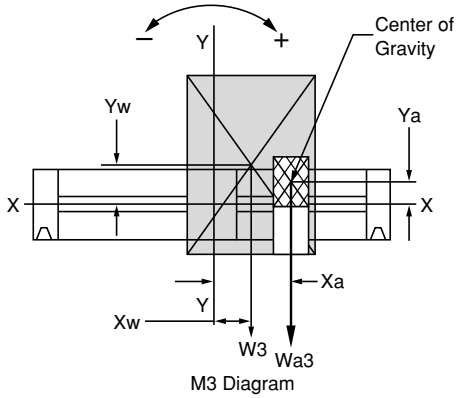
$F_Z1 = F_Z2$

	Required Data	
Diagram	**Force Lbs.**	**Distance In.**
M1	Fx1 = Fz1 =	Zf = Xf =
M2	Fy2 = Fz2 = W2 =	Zf = Yf = Zw =
M3	Fx3 = Fy3 = W3 =	Yf = Xf = Xw =
		Yw =

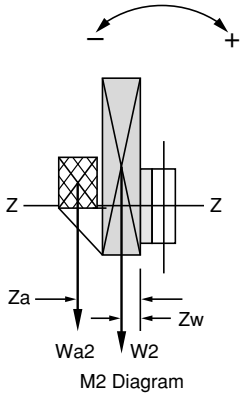
Required Data	
Operating Presssure (PSI)	
Stroke Length (In.)	
Unsupported Length (In.)	
Velocity (IPS) (In./sec.)	
Fixture Weight W (Lbs.)	

SRL2-M Weight Transfer

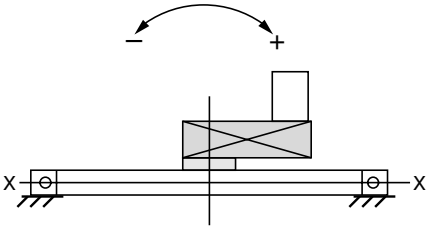
Horizontal Mount, Cond. 2



M3 Diagram



M2 Diagram



M1 Diagram
Bottom View

Notes:

$W2 = W3 = W$

$W_a2 = W_a3 = W_a$

	Required Data	
Diagram	**Weight Lbs.**	**Distance In.**
M2	*Wa2 = W2 =	Za = Zw =
M3	*Wa3 = W3 =	Xa = Xw =
		Ya = Yw =

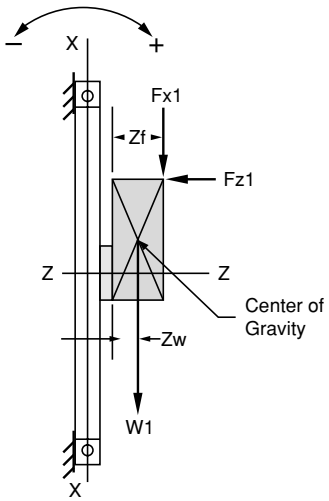
*Specify if load Wa (product transferring) is attached or unfasten to the Fixture W.

Required Data	
Operating Presssure (PSI)	
Stroke Length (In.)	
Unsupported Length (In.)	
Velocity (IPS) (In./sec.)	
Fixture Weight W (Lbs.)	

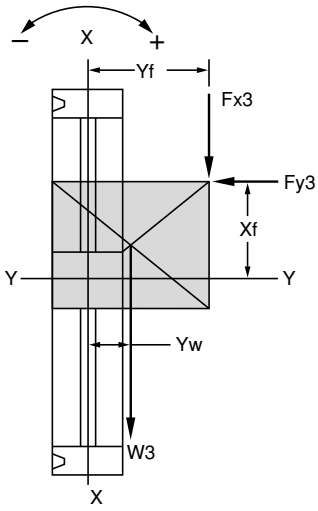
Sizing Forms

SRL2-M Resistive Forces

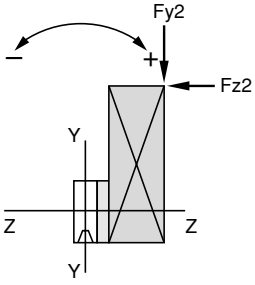
Vertical Mount, Cond. 3



M1 Diagram



M3 Diagram



M2 Diagram
Top View

Notes:

$W1 = W3 = W$

$F_X1 = F_X3$

$F_Y2 = F_Y3$

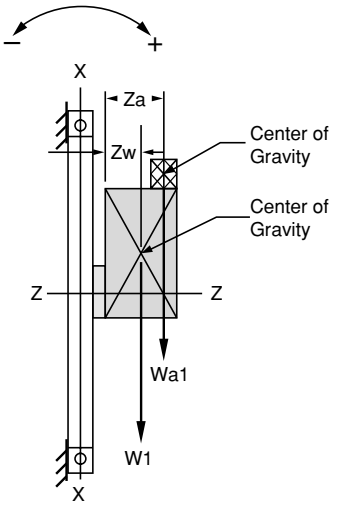
$F_Z1 = F_Z2$

	Required Data	
Diagram	**Force Lbs.**	**Distance In.**
M1	Fx1 = Fz1 = W1 =	Zf = Xf = Zw =
M2	Fy2 = Fz2 =	Zf = Yf =
M3	Fx3 = Fy3 = W3 =	Yf = Xf = Yw =

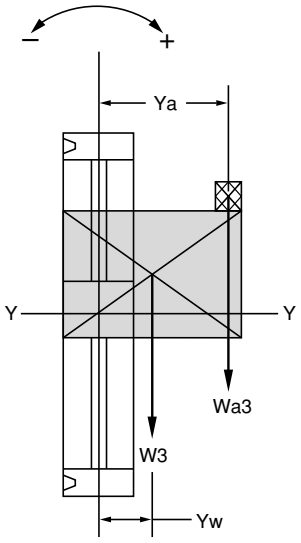
Required Data	
Operating Presssure (PSI)	
Stroke Length (In.)	
Unsupported Length (In.)	
Velocity (IPS) (In./sec.)	
Fixture Weight W (Lbs.)	

SRL2-M Weight Transfer

Vertical Mount, Cond. 3



M1 Diagram



M3 Diagram

Notes:

$W1 = W3 = W$

$W_a1 = W_a3 = W_a$

	Required Data	
Diagram	**Weight Lbs.**	**Distance In.**
M1	W1 = *Wa1 =	Zw = Za =
M3	W3 = *Wa3 =	Yw = Ya =

*Specify if load Wa (product transferring) is attached or unfasten to the Fixture W.

Required Data	
Operating Presssure (PSI)	
Stroke Length (In.)	
Unsupported Length (In.)	
Velocity (IPS) (In./sec.)	
Fixture Weight W (Lbs.)	

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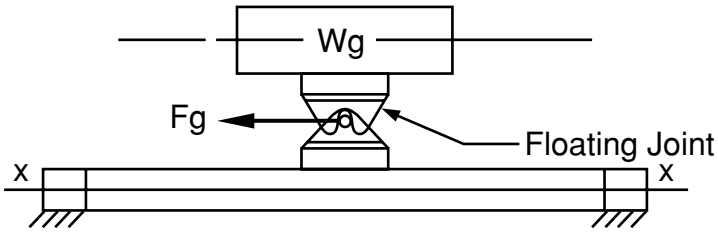
Sizing Forms

SRL2-M Resistive Force

Load Guided



Required Data		
Mounting Position:		
Operating Pressure (PSI)	**Circle One** Horizontal	Vertical
Weight W_G, (Lbs.)		
Friction (Resistive) Force F_G, (Lbs.)		
Stroke, (In.)		
Velocity, (In./Sec.)		

See pages 14, 15 and 20 for additional information on external guides and floating joint.

Air Consumption

Air consumption Q can be calculated using the following formula and table below.

$Q = 60 \times V_1 \times q$, SCFM

where V_1 – Average speed, in/sec.

q – unit air volume per 1" of stroke, SCFM.

Bore	Pressure Air Vol. Per 1" Stk Cu. Ft.	Standard Air Volume per 1" Stroke (SCFM) At Pressure (PSI)									
		10	20	30	40	50	60	70	80	90	100
16	.00194	—	—	.0006	.0007	.0009	.0010	.0011	.0012	.0014	.0015
20	.000282	—	—	.0009	.0010	.0012	.0014	.0016	.0018	.0020	.0022
25	.000486	—	.0011	.0015	.0018	.0021	.0025	.0028	.0031	.0035	.0038
32	.00729	—	.0017	.0022	.0027	.0032	.0037	.0042	.0047	.0052	.0057
40	.001134	—	.0027	.0034	.0042	.0050	.0058	.0065	.0073	.0081	.0088
50	.001782	.0030	.0042	.0054	.0066	.0078	.0091	.0103	.0115	.0127	.0139
63	.002812	.0047	.0066	.0086	.0105	.0124	.0143	.0162	.0181	.0200	.0220

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