Switches
Strokemaster®
Balluff Transducers

95% OF OUR CYLINDERS SHIP IN 2-3 DAYS!
ONE DAY RUSH SERVICE AVAILABLE ON ALL CATALOGED CYLINDER MODELS!

ACCESSORIES: SWITCHES

- Miniature AC/DC Reed
- High Power AC Reed
- Miniature DC Solid State
- RoHS
- Miniature AC/DC Reed with built-in circuit protection
- Extended Temperature Range Reed

TRD offers Reed, High Power AC Reed, DC Solid State and Reed Switches with built-in circuit protection to meet a wide variety of customer needs.

Advantages:

- Compact, low profile Switch/Bracket Assembly
- Switches and Brackets are Nylon and Stainless Steel Hardware construction – suitable for wash down or corrosive environments (IP67)
- Quick, Simple Set-up: Requires Standard (slotted) Screwdriver
- High visibility LED can be seen up to 20 feet
- Suitable for all bore sizes (1.50" to 12.00")
- Magnetically operated, can be located anywhere in the actuator stroke range
- **One magnet type (MPR) for both Reed AND Solid State TRD Switches.**
- Can be used with all TRD Aluminum Series Actuators (TA, TD, TRA, FM, MSE, MSR), Electroless Nickel (EN) Plated Series and Stainless Steel (SS) Series.

Benefits of REED Switch

- Internal Circuit Protection Option
- Lower Cost
- Low or High Current Models available, AC or DC and TRIAC type switch for inductive loads
- High Visibility Red LED (on Low Current Models)
- Choice of lead lengths available on all models
- Optional 8mm Quick Connect on Low Current Model

R10 Miniature REED Switch

- 120 Volts Max. (AC or DC)
- Cable options include 24 inch or 120 inch plain cable leads and 8mm Threaded Quick Connect
- High Visibility LED

RAC High Power AC REED Switch

- 12-240 Volts AC, 800 mA current rating, TRIAC output
- Cable options include 24 inch or 120 inch plain cable leads

MSS Miniature Solid State Switch

- 10-30 Volts DC, 4-300 mA current rating
- Can be wired Current Sinking (NPN) or Current Sourcing (PNP)

Benefits of SOLID STATE Switch

- Shock Proof
- GMR Technology - Giant Magneto Resistive Design
- Reverse Polarity and Over Voltage Protection
- High Visibility Red LED (All Models)
- Choice of lead lengths available or 8mm Quick Connect
- Cable options include 24 inch or 120 inch plain cable leads and 8mm Threaded Quick Connect
- High Visibility LED

R10P Miniature AC/DC REED Switch with built-in circuit protection

- 120 Volts Max. (AC or DC), 150 mA current rating (MAX).
- Cable options include 24 inch or 120 inch plain cable leads
- High Visibility LED

RHT Miniature Extended Temperature Range Reed Switch

- -40°F to 260°F (-40°C to 125°C)
- Cable options include 24 inch or 120 inch plain cable leads

Switch Application Selection Guide *(selecting the right switch for your application)*

SWITCH MODEL	PROGRAMMABLE CONTROLLERS	RELAYS	SOLENOIDS	INDICATOR LIGHTS		MOTORS	TIME COUNTERS
				BULBS	SOLID STATE		
R10 or RHT REED SWITCH	YES	<10VA*	<10VA*	<10VA*	YES	<10VA*	<10VA*
RAC HIGH POWERED REED SWITCHES**	NO	YES	YES	YES	NO	YES	YES
MSS SOLID STATE SWITCH	YES	<300mA	<300mA	<300mA	YES	<300mA	<300mA
R10P REED SWITCH	YES	<10VA	<10VA	<10VA	YES	<10VA	<10VA

*Use resistor-capacitor protection

**Minimum current = 80mA

Specify 'MPR' Option for ALL switch models when ordering actuators.

Electrical Specifications

R10 **Miniature Reed Switch, 24" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)**

R10X **Miniature Reed Switch, 120" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)**

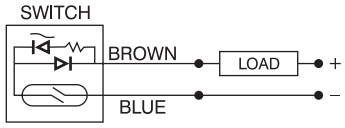
R10Q **Miniature Reed Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)**

Contacts	SPST Form A (Normally Open)
Contact Rating	10 Watts Max.
Input Voltage	120 Volts Max. (AC or DC)
Maximum Load Current	500 mA Max. (Resistive)
Actuating Time Average	1.0 millisecond
LED Indicator	High Luminescence Housing
Temperature Range	-20°C to 70°C (-4°F to 158°F)
Protection Rating	IP67

Schematics

R10 / R10X

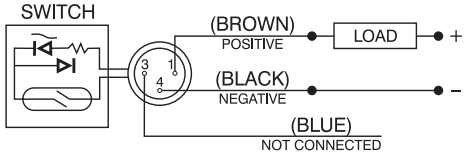
Miniature Reed Switch, Cable Type, (2 Wire Switch)



Input Voltage 120 Volts Max. AC/DC
Maximum Load Current 500 mA Max. (Resistive)

R10Q

Miniature Reed Switch, 8mm Male Quick Connect, (2 Wire Switch)



Input Voltage 120 Volts Max. AC/DC
Maximum Load Current 500 mA Max. (Resistive)

R10P **Miniature Reed Switch, 24" (24 AWG Wire, PVC Jacket) Plain Cable Lead, Circuit Protection (2 wire Switch)**

R10PX **Miniature Reed Switch, 120" (24 AWG Wire, PVC Jacket) Plain Cable Lead, Circuit Protection (2 wire Switch)**

R10PQ **Miniature Reed Switch, 8mm Male Quick Connect, (24 AWG Wire, PVC Jacket) Circuit Protection (2 wire Switch)**

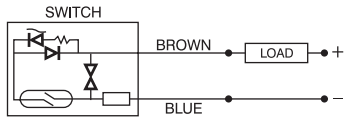
Contacts	SPST Form A (Normally Open)
Contact Rating	10 Watts Max.
Input Voltage	120 Volts Max. (AC or DC)
Maximum Load Current	150 mA Max.
Actuating Time Average	1.0 millisecond
LED Indicator	High Luminescence Housing
Temperature Range	-20°C to 70°C (-4°F to 158°F)
Protection Rating	IP67

Circuit Protection

Varistor	138 Volts
Choke	680 μH

R10P / R10PX

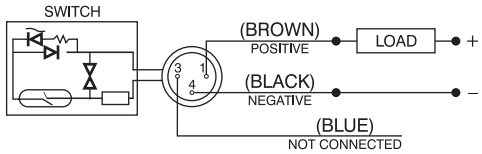
Miniature Reed Switch, Cable Type, (2 Wire Switch)



Input Voltage 120 Volts Max. AC/DC
Maximum Load Current 150 mA Max.

R10PQ

Miniature Reed Switch, 8mm Male Quick Connect, (2 Wire Switch)



Input Voltage 120 Volts Max. AC/DC
Maximum Load Current 150 mA Max.

Note: The circuit protection consists of a Varistor and Choke arrangement. The Varistor will take transient & voltage spikes out of the line and is mounted in parallel with the switch. The Choke will disperse inrush currents (normally caused by long cable runs) and is mounted in series with the switch.

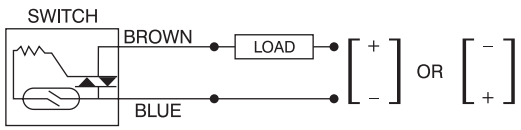
RAC **High Power AC Reed Switch, 24" (20 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)**

RACX **High Power AC Reed Switch, 120" (20 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)**

Contacts	TRIAC Output
Contact Rating	200 Watts Max.
Input Voltage	12 to 240 Volts (AC only)
Minimum Load Current	80 mA
Maximum Load Current	800 mA
Actuating Time Average	2.0 milliseconds
LED Indicator	Not Available
Temperature Range	-20°C to 70°C (-4°F to 158°F)
Protection Rating	IP67

RAC / RACX

High Power AC Reed Switch, Cable Type, (2 Wire Switch)



Contact Rating 200 Watts Max.
Input Voltage 12 to 240 Volts (AC only)
Minimum Load Current 80 mA
Maximum Load Current 800 mA

Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCHES — REED

Electrical Specifications

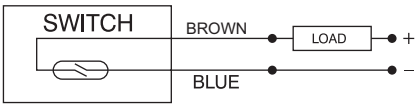
RHT **Extended Temperature Range Miniature Reed Switch, 24" (24 AWG Wire, Silicone rubber insulation with gray outer sheath, 4.5mm O.D.) Plain Cable Lead, (2 wire Switch)**

RHTX **Extended Temperature Range Miniature Reed Switch, 120" (24 AWG Wire, Silicone rubber insulation with gray outer sheath, 4.5mm O.D.) Plain Cable Lead, (2 wire Switch)**

Contacts	SPST Form A (Normally Open)
Contact Rating	10 Watts Max.
Input Voltage	120 Volts Max. (AC or DC)
Maximum Load Current	500 mA Max. (Resistive)
Actuating Time Average	1.0 millisecond
LED Indicator	Not Available
Temperature Range	-40°C to 125°C (-40°F to 260°F)
Protection Rating	IP67

Schematics

RHT / RHTX
Miniature Reed Switch, Cable Type, Extended Temperature Range
(2 Wire Switch)



Input Voltage	120 Volts Max. AC/DC
Maximum Load Current	500 mA Max. (Resistive)

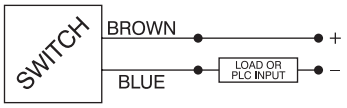
SWITCHES — SOLID STATE

MSS **Miniature Solid State Switch, 24" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)**

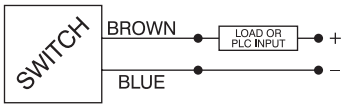
MSSX **Miniature Solid State Switch, 120" (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)**

*Output Type	Current Sinking or Current Sourcing
Input Voltage	10 to 30 Volts DC
Current Consumption (not sensing)	1mA
Minimum Load Current	4 mA
Maximum Load Current	300 mA
"ON" Voltage Drop	2.5 Volts @ 4 mA 3.5 Volts @ 300 mA
LED Indicator	High Luminescence Housing
Temperature Range	-20°C to 70°C (-4°F to 158°F)
Actuating Time Average	2.0 microseconds
Protection Rating	IP67
Reverse Polarity Protected	yes
Transient (over voltage) Protected	yes

MSS / MSSX
Miniature Solid State Switch, Cable Type,
(2 Wire Switch)



Typical Current Sourcing (PNP) Configuration



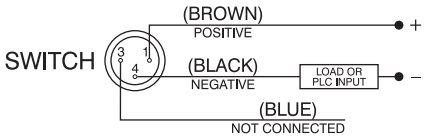
Typical Current Sinking (NPN) Configuration

***NOTE:** This is a two (2) wire switch used in series with the load. Therefore, this switch can be used with devices requiring either a current sinking (NPN) output or a current sourcing (PNP) output from the solid state switch.

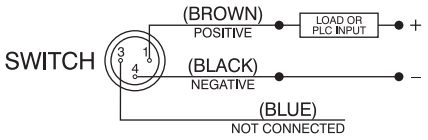
MSSQ **Miniature Solid State Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)**

*Output Type	Current Sinking or Current Sourcing
Input Voltage	10 to 30 Volts DC
Current Consumption (not sensing)	1mA
Minimum Load Current	4 mA
Maximum Load Current	300 mA
"ON" Voltage Drop	2.5 Volts @ 4 mA 3.5 Volts @ 300 mA
LED Indicator	High Luminescence Housing
Temperature Range	-20°C to 70°C (-4°F to 158°F)
Actuating Time Average	2.0 microseconds
Protection Rating	IP67
Reverse Polarity Protected	yes
Transient (over voltage) Protected	yes

MSSQ
Miniature Solid State Switch, 8mm Male Quick Connect,
(2 Wire Switch)



Typical Current Sourcing (PNP) Configuration



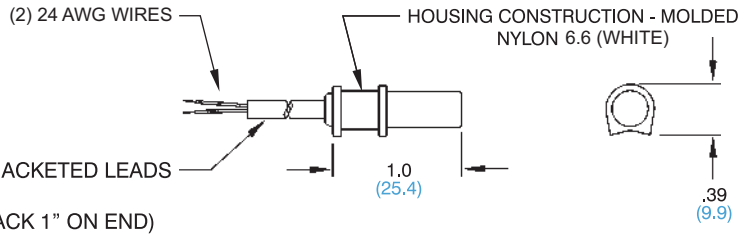
Typical Current Sinking (NPN) Configuration

***NOTE:** This is a two (2) wire switch used in series with the load. Therefore, this switch can be used with devices requiring either a current sinking (NPN) output or a current sourcing (PNP) output from the solid state switch.

Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCHES AND BRACKET DIMENSIONS

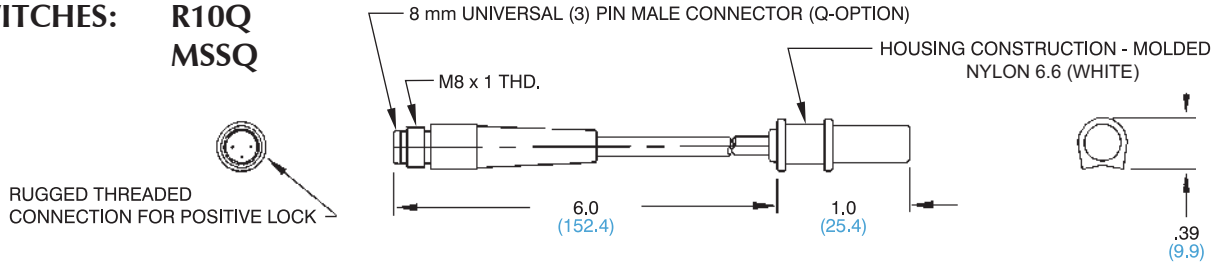
FOR SWITCHES: R10 / R10X RHT / RHTX MSS / MSSX



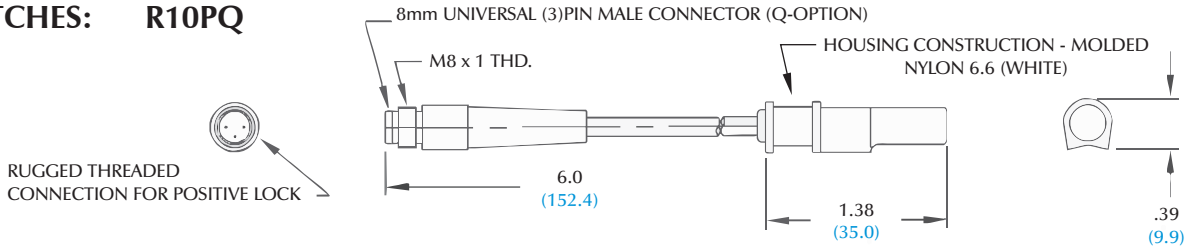
PLAIN CABLE LEADS

R10 / RHT / MSS = 24" (0.6m) PVC JACKETED LEADS
R10X / RHTX / MSSX = 120" (3.0m)
(JACKET CUT BACK 1" ON END)
(25.4)

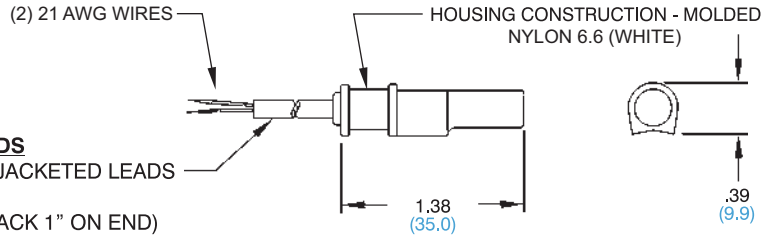
FOR SWITCHES: R10Q MSSQ



FOR SWITCHES: R10PQ



FOR SWITCHES: RAC / RACX R10P / R10PX

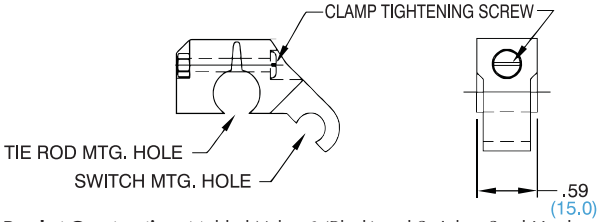


PLAIN CABLE LEADS

R10P / RAC = 24" (0.6m) PVC JACKETED LEADS
R10PX / RACX = 120" (3.0m)
(JACKET CUT BACK 1" ON END)
(25.4)

SWITCH BRACKET: SB15

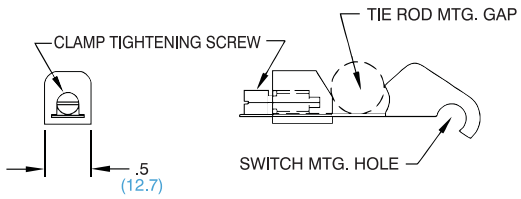
(For 1.50" Through 2.50" Bore Cylinders)



Bracket Construction: Molded Nylon 6 (Black) and Stainless Steel Hardware

SWITCH BRACKET: SB32

(For 3.25" Through 12.00" Bore Cylinders)



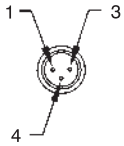
Bracket Construction: Molded Nylon 6 (Black) and Stainless Steel Hardware

QUICK CONNECT CORD SETS

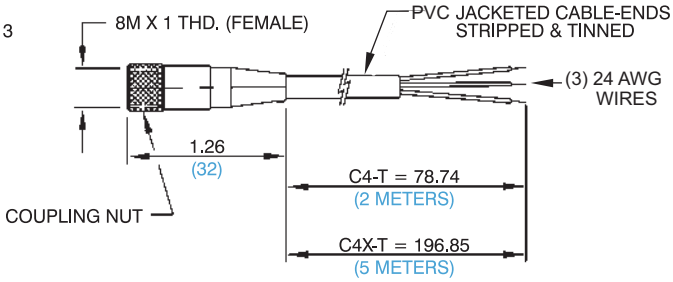
(Used with "Q" Type Switch Leads)

FOR CABLES:
C4-T (2 METER CABLE LENGTH)
C4X-T (5 METER CABLE LENGTH)

All Dimensions are in INCHES
(mm in parentheses)

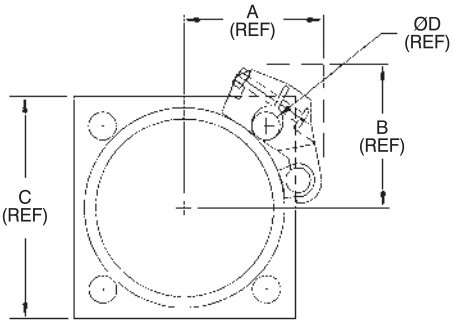


CONDUCTOR COLORS:
1. BROWN
3. BLUE
4. BLACK

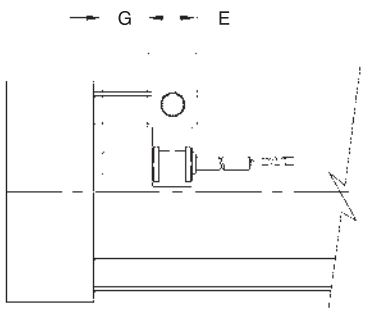


Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: *SWITCH MOUNTING DIMENSIONS*



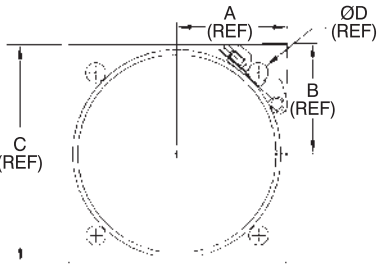
SB15



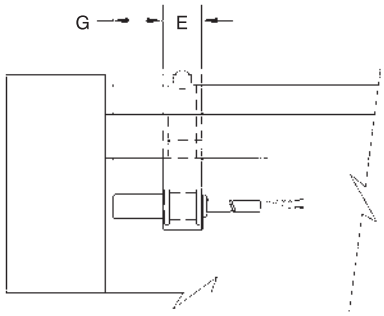
SB15

SWITCH BRACKET LETTER DIMENSIONS							
PART NO.	BORE	A	B	C	D	E	G
SB15	1.50	1.375	1.406	2.000	0.250	0.625	0.500
	2.00	1.625	1.656	2.500	0.313	0.625	0.500
	2.50	1.875	1.875	3.000	0.313	0.625	0.500
SB32	3.25	2.125	2.125	3.750	0.375	0.500	0.563
	4.00	2.438	2.375	4.500	0.375	0.500	0.563
	5.00	2.875	2.750*	5.500	0.500	0.500	0.563
	6.00	3.250*	3.250*	6.500	0.500	0.500	0.563
	8.00	4.250*	4.250*	8.500	0.625	0.500	0.563
	10.00	5.313*	5.313*	10.625	0.750	0.500	0.563
	12.00	6.375*	6.375*	12.750	0.750	0.500	0.563

*THESE DIMENSIONS ARE 0.500" OF THE 'C' DIMENSION. THE SWITCH BRACKET **DOES NOT** PROTRUDE BEYOND STANDARD HEAD/CAP.



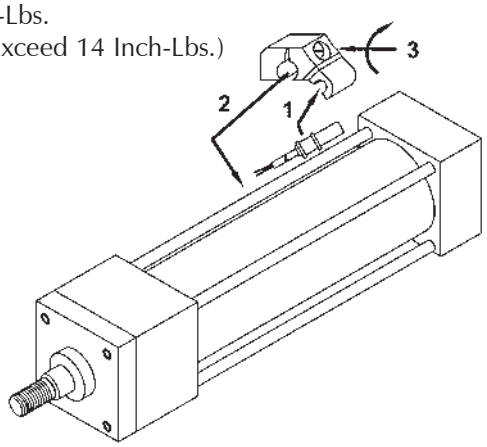
SB32



SB32

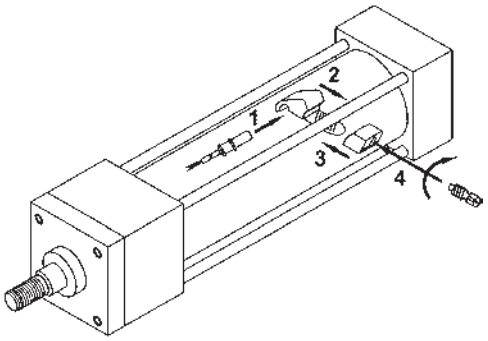
How To Assemble Switch and Brackets

Recommended Torque:
6-10 Inch-Lbs.
(Do Not Exceed 14 Inch-Lbs.)



SB15 SWITCH BRACKET (MOUNTING ILLUSTRATION)

Recommended Torque:
8-12 Inch-Lbs.
(Do Not Exceed 14 Inch-Lbs.)



SB32 SWITCH BRACKET (MOUNTING ILLUSTRATION)

Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCHES HYSTERESIS & BAND WIDTH

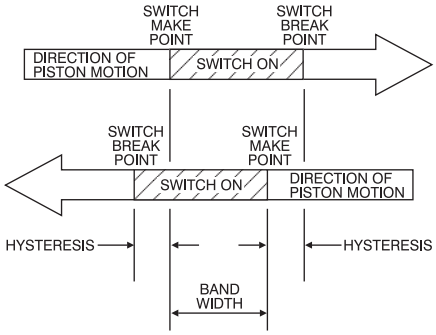
HYSTERESIS:

THE DISTANCE BETWEEN THE SWITCH BREAK POINT MOVING IN ONE DIRECTION AND THE SWITCH MAKE POINT MOVING IN THE OPPOSITE DIRECTION.

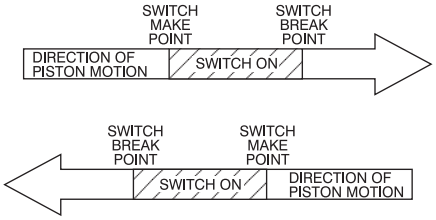
BAND WIDTH:

THE DISTANCE THE PISTON MOVES WHILE THE SWITCH IS MADE (IN EITHER DIRECTION), LESS THE HYSTERESIS.

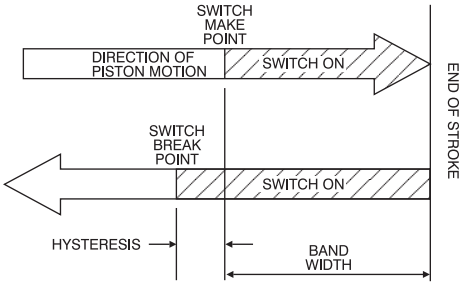
MID STROKE OPERATION

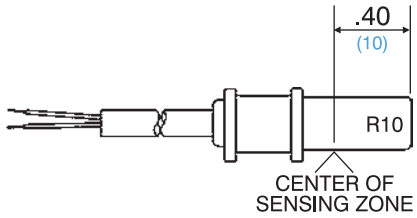


TERMINOLOGY ILLUSTRATION

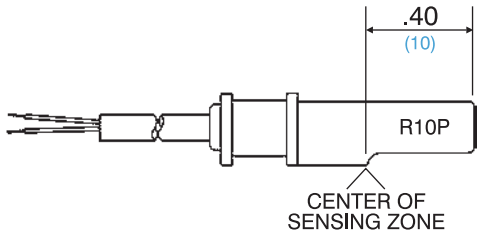


END OF STROKE OPERATION

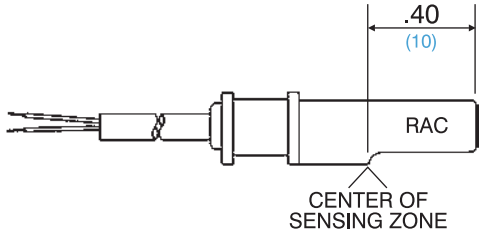




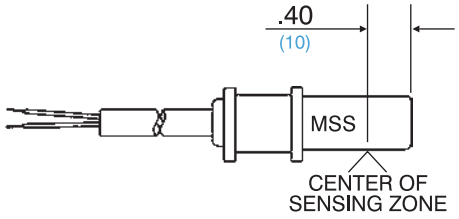
SWITCH	REPEATABILITY	HYSTERESIS (MAX)	BANDWITH (MAX)
R10 RHT R10X RHTX R10Q	±.010″ (±.25)	.040″ (1)	.200″ (5)



SWITCH	REPEATABILITY	HYSTERESIS (MAX)	BANDWITH (MAX)
R10P R10PQ R10PX	±.010″ (±.25)	.040″ (1)	.200″ (5)



SWITCH	REPEATABILITY	HYSTERESIS (MAX)	BANDWITH (MAX)
RAC RACX	±.010″ (±.25)	.085″ (2.1)	.345″ (8.8)



SWITCH	REPEATABILITY	HYSTERESIS (MAX)	BANDWITH (MAX)
MSS MSSX MSSQ	±.010″ (±.25)	.075″ (1.9)	.315″ (8)

Note:
Dimensions are in inches (mm in parentheses).
Results are based upon TRD piston and magnet assemblies. Results may vary if used with other manufacturers cylinder products.

Specify 'MPR' Option for ALL switch models when ordering actuators.

ACCESSORIES: SWITCH ORDERING INSTRUCTIONS

TO ORDER, SPECIFY: Switch Model, Lead Type and Bracket Size

R10 X - SB15

Switch Model	Switch Lead Options	Switch Bracket
R10 = AC/DC Reed RAC = High Power AC Reed RHT = Extended Temperature Reed MSS = Solid State R10P = AC/DC Reed with Circuit Protection	(leave blank) = 24″ Plain Cable X = 120″ Plain Cable Q = 8mm Quick Connect (not available on RAC, or RHT)	SB15 = 1.50″ to 2.50″ Bore SB32 = 3.25″ to 12.00″ Bore (leave blank for switch only)

Switch Accessories

Quick Connect Cord Sets

MODEL	DESCRIPTION
C4-T	8mm Straight Quick Connect Cord X 2 Meter (78″)
C4X-T	8mm Straight Quick Connect Cord X 5 Meter (196″)

About our switches...

Our switches are different! The most common complaint in the market is the unreliability of magnetically operated switches. Most cylinder piston magnets have about 10-30% more power than required to operate the switch. This results in erratic operation, a nuisance for maintenance and lowering overall plant productivity.

TRD designed our magnet to have 50-100% more power than required to operate our switch! The combination of TRD R10, R10P, RAC, RHT and MSS Switches and our Cylinders, raises the reliability of switch operation comparable to that of many mechanically operated limit switches.

Application recommendations and precautions...

- Noise suppression - Motors and valve solenoids will produce high pulses throughout an electrical system. Therefore, primary and control circuit wiring should not be mixed in the same conduit. Separate power supplies for both logic level signals (Microprocessor, P.C., CPU, Input Devices) and Output Field Devices (Motors, Valve Solenoids) is recommended.
- Never connect R10, R10P, RHT or MSS type switches without a load present. The switch will be destroyed.
- Some electrical loads may be capacitive. Capacitive loading may occur due to distributed capacity in cable runs over 25 feet. Use switch model RAC whenever capacitive loading may occur.
- To obtain optimum performance and long life, switches should not be subjected to strong magnetic fields, extreme temperatures (outside of specifications) or excessive ferrous filings or chip buildup.
- Improper wiring may damage or destroy the switch. Therefore, the wiring diagrams along with the listed power ratings, should be carefully observed before connecting power to the switch.

Following these tips can save time and provide trouble-free installations!

Other switches available:

- 12mm Quick Connect
- Special Length Cable
- Weld Immune Switch
- Pulse Extension Switch (For Sensing Mid-Stroke Positions)
- Change Over Switch (SPDT)

(Consult factory for details)

Specify 'MPR' Option for ALL switch models when ordering actuators.

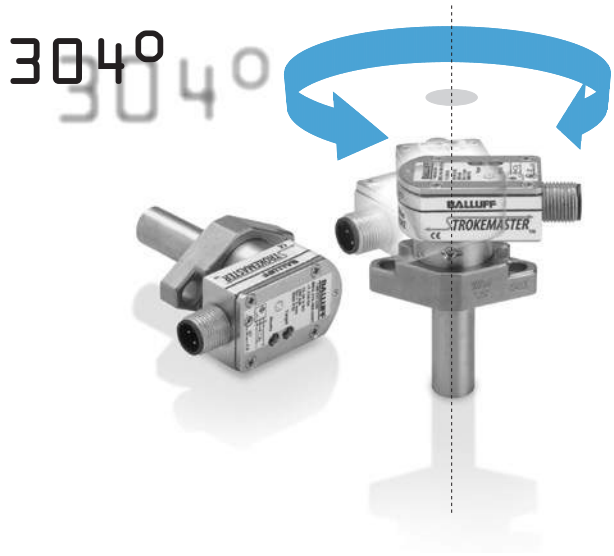
BALLUFF STROKEMASTER™ Inductive Sensors

Flexible Solutions for an Often Inflexible World

Balluff's Strokemaster®® cylinder-piston sensors provide precision end-of-stroke sensing for hydraulic cylinders. The sensor body allows 304° of rotation to eliminate the hassle of post-installation cable management, which in some competitive designs requires unbolting the flange and breaking the hydraulic seal.

A high-pressure inductive proximity sensor, the Strokemaster®® provides a 2mm (0.08") sensing range to detect the "spud" of hydraulic/pneumatic cylinders and indicate fully retracted or extended position. It mounts with two socket-head cap screws and seals with a Viton O-ring. Withstanding cylinder pressures to 3000 psi (207 BAR), the embeddable design keeps most of the switch protected within the cylinder, with only a 0.62" (16mm) high housing exposed outside.

Strokemaster®® sensors are available in 3-wire DC and 2-wire AC/DC versions, both with mini or micro connectors. Switching frequency is 50 Hz for the AC/DC versions. All units are weld-field immune, short-circuit, and reverse polarity protected. They fit all TRD series cylinder designs, with standard available probe lengths of 0.912" - 4.560" (23.165mm - 115.8mm). Custom probe lengths can be achieved by using TRD supplied spacer kits. Probes are made of stainless steel with a high-strength ceramic face. Both DC and AC/DC sensors have all-metal housings. The Strokemaster®® sensor is UL-listed, CE-certified, and its housing is sealed to IP67 requirements.



CE cULus

SERIES: BALLUFF INDUCTION SENSORS

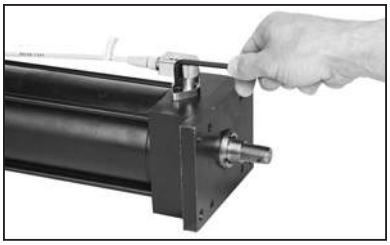
DC INDUCTIVE SENSORS

BALLUFF STROKEMASTER™

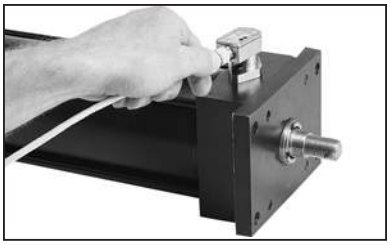
Features/Advantages

Inductive cylinder switch for piston position feedback in cylinders.

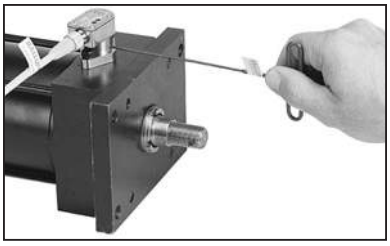
- Magnetic field immune, for use with welding equipment
- Available in DC or all current (AC/DC) versions
- Easy installation - sensor mounts to cylinder with two (2) fasteners
- Sealed directly at flange, connector can be oriented after installation
- Various lengths available for different cylinder sizes



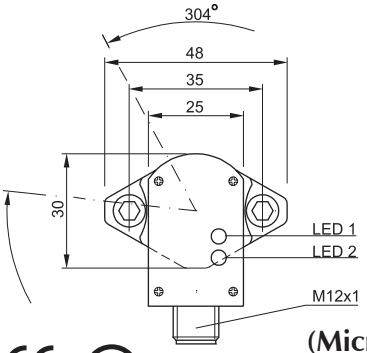
Bolt sensor to cylinder.

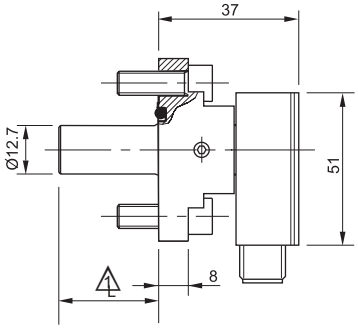


Position cable to desired orientation (even over mounting bolts).



Lock chosen position with one or both of the two integral set screws.



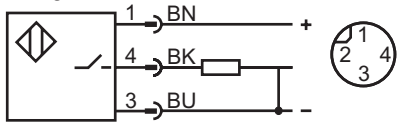


CE cULus

(Micro M12DC Connector)

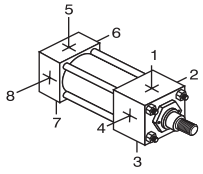
PNP Normally-open	BES 516-300-S 295-S 4
Rated operational voltage U_e	24 V DC
Supply voltage U_B	10...30 V DC
Voltage drop U_d at I	≤ 2.5 V
Rated insulation voltage U_i	75 V DC
Rated operational current I_e	200 mA
No-load supply current I_o d./und.	≤ 18 mA/≤ 10 mA
Off-state current I_r	≤ 80 µA
Protected against polarity reversal	yes
Short circuit/overload protected	yes/yes
Load capacitance	≤ 1.0 µF
Repeat accuracy R	≤ 5 %
Ambient temperature range T	-25...+70°C
Frequency of operating cycles f	10 Hz
Utilization categories	DC 13
Function/Operating voltage indication	yes/yes
Degree of protection per IEC 529	IP 67/connector IP 65
Housing material	stainless steel/aluminum
Material of sensing face	ceramic
Connection	Micro connector
Approvals	cULus
High pressure rated up to	207 bar (3000 PSI)
Recommended connector	**C04 AEL-00-VY-050M**

Wiring **PNP Normally Open** Pinout



⚠ TRD will supply the correct length probe and spacer combination (if required) for each cylinder. Using the combination of standard probe lengths & spacers will give the appropriate .030" gap between sensor and cylinder spud. The spacers supplied have the same base profile as the sensor (Material: Stainless Steel).

HOW TO ORDER CYLINDERS WITH BALLUFF SENSORS:



STANDARD LOCATIONS:

- **Ports at 1 and 5**
- **Cushions at 2 and 6**
- **Sensors at 4 and 8**

(Specify non-standard locations)

How To Order:

Cylinder Model Number ➡ **TA - MS2 3.25 X 6 - HC**

SENSOR MODEL (HEAD) ➡ **-BES 516-300-S 295-S4 (Head)**

SENSOR MODEL (CAP) ➡ **-BES 516-300-S 295-S4 (Cap)**

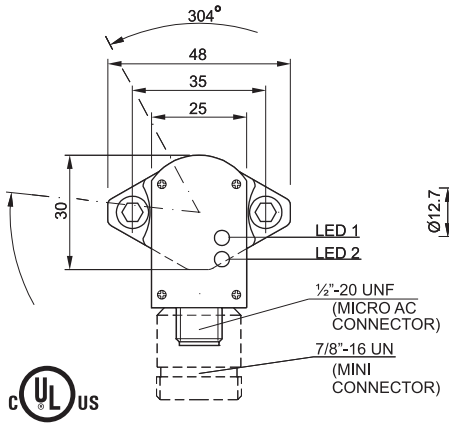
(Include ALL Sensor positions) ➡ **-Sensors at 4 & 8**

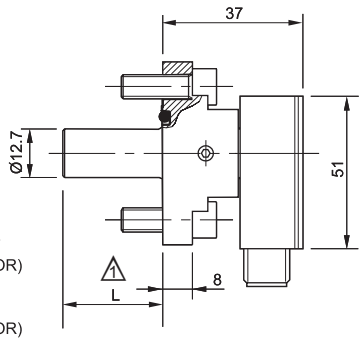
Note: TRD will include the Strokemaster® probe length on your order and any sensor spacers required (example: TA-MS2 4 X 6-HC- BES 516-300-S4 /1.025-S21 (Head) -BES 516-300-S4 /1.75-S21 (Cap)- Sensors at 4 & 8.

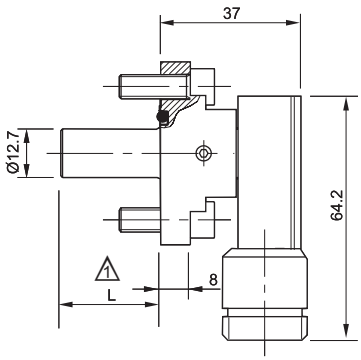
SERIES: BALLUFF INDUCTION SENSORS

AC/DC INDUCTIVE SENSORS

BALLUFF STROKEMASTER™

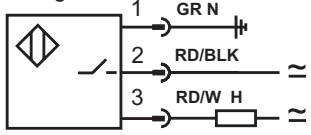






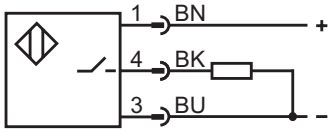
Normally-open	BES 516-200-S 2-S21	BES 516-200-S 2-S5
Rated operational voltage U_e	110 V AC	110 V AC
Supply voltage U_B	20...250 V AC/DC	20...250 V AC/DC
Voltage drop U_d at I	≤ 6 V	≤ 6 V
Rated insulation voltage U_i	250 V AC	250 V AC
Rated operational current I_e	500 mA	500 mA
Minimum operational current I_m	5 mA	5 mA
Off-state current I_r	≤ 1.7 mA @ 110 V AC	≤ 1.7 mA @ 110 V AC
Inrush current I_k (t_f = 20 ms)	3 A max./1 Hz	3 A max./1 Hz
Protected against polarity reversal	yes	yes
Short circuit protected	yes	yes
Repeat accuracy R	≤ 5 %	≤ 5 %
Ambient temperature range T	-25...+70°C	-25...+70°C
Frequency of operating cycles f	≤ 50 Hz	≤ 50 Hz
Utilization categories	AC 140/DC 13	AC 140/DC 13
Function/Operating voltage indication	yes/yes	yes/yes
Degree of protection per IEC 529	IP 67	IP 67
Insulation class	1	1
Housing material	stainless steel/aluminum	stainless steel/aluminum
Material of sensing face	ceramic	ceramic
Connection	Micro connector	Mini connector
Approvals	cULus	cULus
High pressure rated up to	207 bar (3000 PSI)	207 bar (3000 PSI)
Recommended connector	**C21 AE3-00-VY-150F**	**C05 AE1-00-VY-150F**

Wiring



Pinout

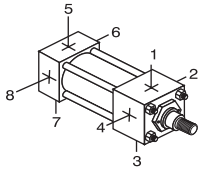
Wiring



Pinout

⚠ TRD will supply the correct length probe and spacer combination (if required) for each cylinder. Using the combination of standard probe lengths & spacers will give the appropriate .030" gap between sensor and cylinder spud. The spacers supplied have the same base profile as the sensor (Material: Stainless Steel).

HOW TO ORDER CYLINDERS WITH BALLUFF SENSORS:



STANDARD LOCATIONS:

- **Ports at 1 and 5**
- **Cushions at 2 and 6**
- **Sensors at 4 and 8**

(Specify non-standard locations)

How To Order:

Cylinder Model Number ➡	**TA - MS2 3.25 X 6 - HC**
SENSOR MODEL (HEAD) ➡	**-BES 516-200-S 2-S21 (Head)**
SENSOR MODEL (CAP) ➡	**-BES 516-200-S 2-S21 (Cap)**
(Include ALL Sensor positions) ➡	**-Sensors at 4 & 8**

Note: TRD will include the Strokemaster® probe length on your order, and any sensor spacers required (example: TA-MS2 4 X 6-HC- BES 516-200-S 2 /1.025-S21 (Head) -BES 516-200-S 2 /1.75-S21 (Cap)- Sensors at 4 & 8.

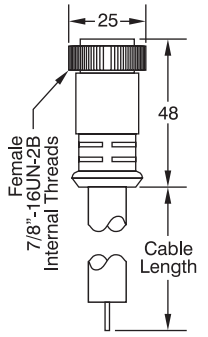
SERIES: BALLUFF INDUCTION SENSORS

CABLE CONNECTORS

BALLUFF STROKEMASTER™

S5 - Mini Connectors (7/8"-16 UNF Threads)

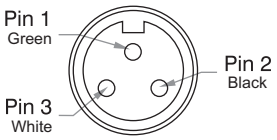
Connector	3-5 Pole Mini
Style	Mini Size A
Configuration	Straight Female
Recommended Connector	**C05 AE1-00-VY-150F**



	ORDER NUMBER
3 Pole	C05 AE1 00 * Y 150
Voltage Rating	300 V AC/DC
Amperage	10A
Wire Gauge	16 AWG
Jacket	PVC
Coupling Nut	Black Epoxy Coated Zinc
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4 - 221°F (-21 to 105°C)
UL Listed	Yes
CSA Certified	Yes

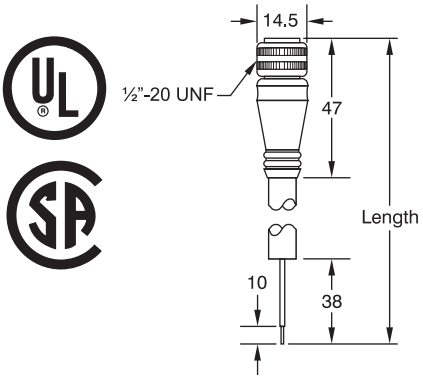
* Insert **V** = PVC Cable
T = TPE Cable
For 3 pole versions only

Female 3-pin - Face view



S21 - Micro Connectors (½"-20 UNF Threads)

Connector	Micro AC 1/2" x 20 UNF
Style	3 Pin Dual Keyway
Configuration	Straight Female
Recommended Connector	**C21 AE3-00-VY-150F**

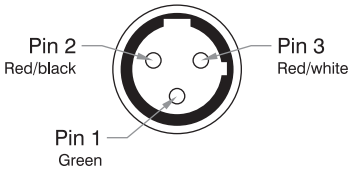


	ORDER NUMBER
Ordering Code	
3 Pin Dual Keyway	C21 AE3 00 * Y 150F
Voltage Rating	250 V AC/DC
Amperage	4A
Wire Gauge	22 AWG
Jacket	Yellow PVC or TPE
Coupling Nut	Black Epoxy Coated Zinc
O-Ring	Viton
Overmold Head	TPE
Protection	IP68 / NEMA 6P
Ambient Operating Temp.	-4 - 221°F (-21 to 105°C)
UL Listed	Yes
CSA Certified	Yes

Note: 15 ft cable is standard (other lengths available - contact factory)

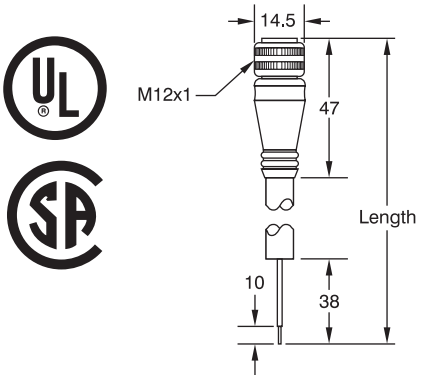
* Insert **V** = PVC Cable
T = TPE Cable
For 3 pole versions only

Female - Face view



S4 - Micro Connectors (M12x1 Metric Threads)

Connector	Micro
Style	M12 DC Single Keyway
Configuration	Straight Female
Recommended Connector	**C04 AEL-00-VY-050M**



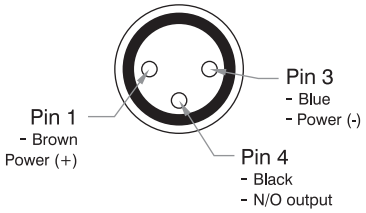
	Note	ORDER NUMBER
3 Wire DC		
3 Wire Normally Open, non-LED	**1,2,3**	C04 AEC 00 * Y 050M
3 Wire Normally Open PNP w/ LED		C04 AEH 00 * Y 050M
4 Wire DC (NO/NC)		
4 Wire (Universal), non-LED	**1,2,3**	C04 AEL 00 * Y 050M
4 Wire PNP w/LED	**1,3**	C04 AEM 00 * Y 050M
Voltage Rating		10 - 30 V DC
Amperage		4 Amps
Wire Gauge		22 AWG
Jacket		Yellow PVC or TPE
Coupling Nut		Black Epoxy Coated Zinc
*Optional Stainless Steel		*Stainless Type 303
Protection		IP68 / NEMA 6P
Ambient Operating Temp.		-4 - 221°F (-21 to 105°C)
UL Listed		Yes
CSA Certified		Yes

Note: 5 meter cable is standard (other lengths available - contact factory)

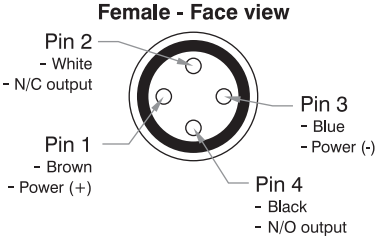
* Insert **V** = PVC Cable
T = TPE Cable
For 3 pole versions only

Note: **1** Add **B** = Braided 80% Metallic Braid, i.e. 050 M**B**
2 Add **S** = S-Shielded 360 Degree Shield through Coupling Nut, i.e. 050 M**S**
3 Stainless Steel Couple Nut: Change **E** to **S**, i.e. C04A**S**C00TY050M

Female - Face view



Female - Face view



Refer to Balluff Catalog for additional cable connectors.

BALLUFF

MICROPULSE Linear Position Transducers

Enhanced Magnetostrictive Technology

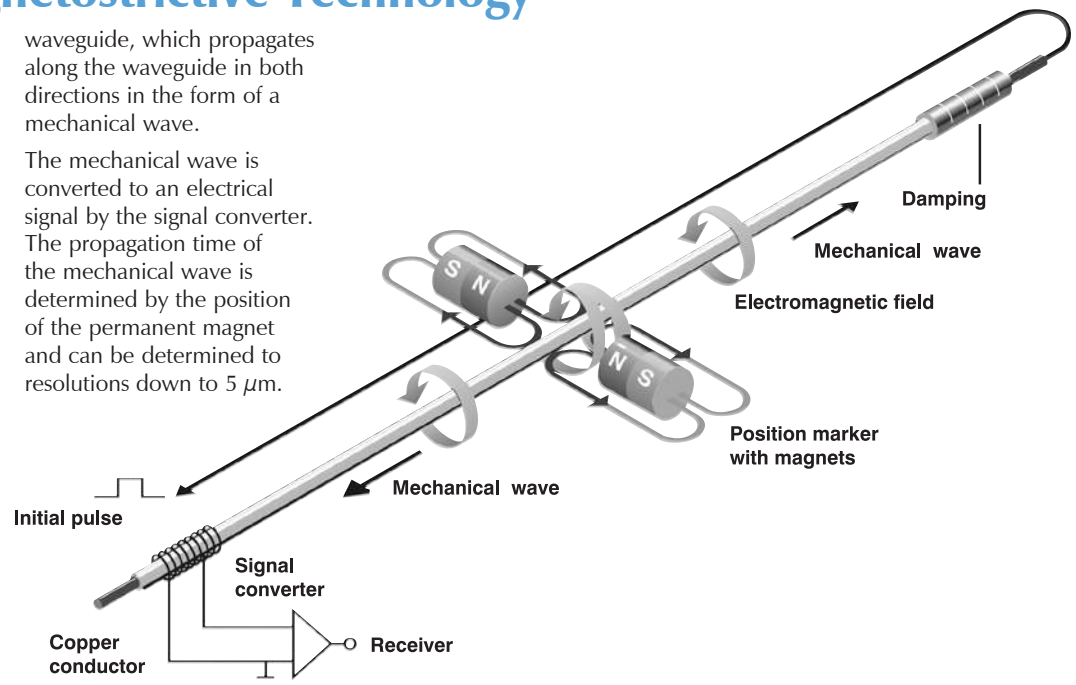
The waveguide consists of a special nickel-iron alloy with 0.7 mm O.D. and 0.5 mm I.D.

A copper conductor is introduced through the length of this tube. The start of measurement is initiated by a short current pulse. This current generates a circular magnetic field which rotates around the waveguide.

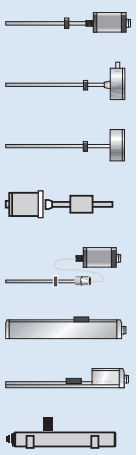
A permanent magnet at the point of measurement is used as the marker element, whose lines of field run at right angles to the electromagnetic field.

In the area on the waveguide where the two fields intersect, a magnetostrictive effect causes an elastic deformation of the waveguide, which propagates along the waveguide in both directions in the form of a mechanical wave.

The mechanical wave is converted to an electrical signal by the signal converter. The propagation time of the mechanical wave is determined by the position of the permanent magnet and can be determined to resolutions down to 5 µm.



MICROPULSE



Balluff has the right transducer for any application!

- Rod styles
- Profile styles
- Tubular styles
- Embeddable style
- Explosion-proof style

Rod Style

Z

- 3/4″-16 UNF threads
- Pressure rated to 8700 PSI for use in hydraulic cylinders
- Replaceable electronics head
- Analog signal adjustable in field

Rugged, Compact Rod Style

W

- Rugged all stainless steel housing
- Designed for demanding applications
- Eliminates the need for protective cover
- 3/4″-16 UNF threads
- Pressure rated to 8700 PSI

Compact, Bolt-in Rod Style

K

- Rugged all stainless steel housing
- Bolt in design
- Pressure rated to 8700 PSI
- Eliminates the need for protective cover

	Z	W	K
Sensor Output Options			
Analog			
0...10 V and 10...0 V	•	•	•
-5...+5 V and +5...-5 V	•	•	•
-10...+10 V and +10...-10 V	•	•	•
4...20 mA or 20...4 mA	•	•	•
0...20 mA or 20...0 mA	•	•	•
Digital			
Start/Stop, RS422	•	•	•
Pulse-**W**idth **M**odulated, RS422	•	•	•
PWM (w/ recirculation), RS422	•	•	•
Specialized			
Synchronous **S**erial **I**nterface*	•	•	•
CANopen	•		
Profibus DP	•		
Quadrature	•		
Resolution			
0.1 mV (analog)		•	•
0.2 µA (analog)		•	•
16 bit (analog)	•		
Controller-dependent (Start/Stop & PWM)	•	•	•
1,2,3,5,10 µm selectable (Quadrature output)	•		
1,5,10,20,40 µm selectable (SSI output)	•	•	•
5 µm increments selectable (CANopen & Profibus)	•		
10 µm			
Stroke Length			
Active measurement area: 2" to 156" (Consult factory for longer lengths)	2" - 156"	2" - 156"	2" - 156"
Wiring Options			
Quick disconnect	•	•	•
Cable-out	•	•	•
Operating Voltage			
24 V DC (±20%)	•	•	•
±15 V DC (±2%)	•	•	•

*(24 or 25 bit binary or gray code)

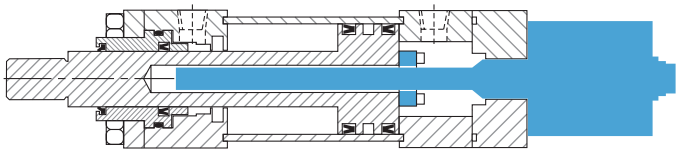
BALLUFF TRANSDUCERS

TRD will build your cylinder with the proper magnet, spacer plates (if required), drilling and tapping, intermediate supports (if required) and furnish the transducer as a complete unit. ***All cylinder/transducer assemblies are 100% tested at TRD before shipping.***

INTERNAL MODELS (BALLUFF Z, W, K SERIES)

- Not available on MP1 and MP2 Mounts
- 1.50″ to 8″ Bores
- Gun-drilled piston rod (Requires 1″ piston rod or larger)
- Balluff Magnet (Installed on piston)
- May require additional cap length

SERIES "Z" SHOWN



- Complete BALLUFF MICROPULSE™ Transducer information is available in catalog form or electronic PDF downloads.

  Visit www.balluff.com

- Other Balluff models are available. Call TRD Mfg. (800-654-2535) for information and cylinder design assistance.