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

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

<table>
<thead>
<tr>
<th>SWITCH MODEL</th>
<th>PROGRAMMABLE CONTROLLERS</th>
<th>RELAYS</th>
<th>SOLENOIDS</th>
<th>INDICATOR LIGHTS</th>
<th>MOTORS</th>
<th>TIME COUNTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>R10 or RHT REED SWITCH</td>
<td>YES</td>
<td>&lt;10VA*</td>
<td>&lt;10VA*</td>
<td>&lt;10VA*</td>
<td>&lt;10VA*</td>
<td>&lt;10VA*</td>
</tr>
<tr>
<td>RAC HIGH POWERED REED SWITCHES**</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>MSS SOLID STATE SWITCH</td>
<td>YES</td>
<td>&lt;300mA</td>
<td>&lt;300mA</td>
<td>&lt;300mA</td>
<td>YES</td>
<td>&lt;300mA</td>
</tr>
<tr>
<td>R10P REED SWITCH</td>
<td>YES</td>
<td>&lt;10VA</td>
<td>&lt;10VA</td>
<td>&lt;10VA</td>
<td>YES</td>
<td>&lt;10VA</td>
</tr>
</tbody>
</table>

*Use resistor-capacitor protection

**Minimum current = 80mA

Specify ‘MPR’ Option for ALL switch models when ordering actuators.
**ACCESSORIES: SWITCHES — REED**

**Electrical Specifications**

<table>
<thead>
<tr>
<th>Switch</th>
<th>Description</th>
<th>Contacts</th>
<th>Contact Rating</th>
<th>Input Voltage</th>
<th>Maximum Load Current</th>
<th>Actuating Time Average</th>
<th>LED Indicator</th>
<th>Temperature Range</th>
<th>Protection Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>R10</td>
<td>Miniature Reed Switch, 24&quot; (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)</td>
<td>SPST Form A (Normally Open)</td>
<td>10 Watts Max.</td>
<td>120 Volts Max. (AC or DC)</td>
<td>500 mA Max. (Resistive)</td>
<td>1.0 millisecond</td>
<td>High Luminescence Housing</td>
<td>-20°C to 70°C (-4°F to 158°F)</td>
<td>IP67</td>
</tr>
<tr>
<td>R10X</td>
<td>Miniature Reed Switch, 120&quot; (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R10Q</td>
<td>Miniature Reed Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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 / 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 / RACX**

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

**R10P / R10PX**

- **High Power AC Reed Switch, Cable Type,** (2 Wire Switch)
- Input Voltage: 120 Volts Max. AC/DC
- Maximum Load Current: 150 mA Max.

Specify ‘MPR’ Option for ALL switch models when ordering actuators.
ACCESSORIES: SWITCHES — REED

**Electrical Specifications**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Cable Type</th>
<th>Dimensions</th>
<th>Material</th>
<th>Lead Type</th>
<th>Contact Type</th>
<th>Contact Rating</th>
<th>Input Voltage</th>
<th>Maximum Load Current</th>
<th>Actuating Time Average</th>
<th>Protection Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHT</td>
<td>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)</td>
<td>Cable</td>
<td>24” (609.6mm)</td>
<td>Silicone rubber</td>
<td>Plain</td>
<td>SPST Form A</td>
<td>10 Watts Max.</td>
<td>120 Volts Max. (AC or DC)</td>
<td>500 mA Max. (Resistive)</td>
<td>3.0 milliseconds</td>
<td>IP67</td>
</tr>
<tr>
<td>RHTX</td>
<td>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)</td>
<td>Cable</td>
<td>120” (3048mm)</td>
<td>Silicone rubber</td>
<td>Plain</td>
<td>SPST Form A</td>
<td>10 Watts Max.</td>
<td>120 Volts Max. (AC or DC)</td>
<td>500 mA Max. (Resistive)</td>
<td>3.0 milliseconds</td>
<td>IP67</td>
</tr>
</tbody>
</table>

**Schematics**

**RHT / RHTX**

- **Miniature Reed Switch, Cable Type, Extended Temperature Range (2 Wire Switch)**
- **Typical Current Sourcing (PNP) Configuration**
- **Typical Current Sinking (NPN) Configuration**

**SWITCHES — SOLID STATE**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Cable Type</th>
<th>Dimensions</th>
<th>Material</th>
<th>Lead Type</th>
<th>Output Type</th>
<th>Input Voltage</th>
<th>Current Consumption (not sensing)</th>
<th>Minimum Load Current</th>
<th>Maximum Load Current</th>
<th>ON Voltage Drop</th>
<th>LED Indicator</th>
<th>Temperature Range</th>
<th>Actuating Time Average</th>
<th>Protection Rating</th>
<th>Reverse Polarity Protected</th>
<th>Transient (over voltage) Protected</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSS</td>
<td>Miniature Solid State Switch, 24” (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)</td>
<td>Cable</td>
<td>24” (609.6mm)</td>
<td>PVC Jacket</td>
<td>Plain</td>
<td>Current Sinking or Current Sourcing</td>
<td>10 to 30 Volts DC</td>
<td>1mA</td>
<td>4 mA</td>
<td>300 mA</td>
<td>2.5 Volts @ 4 mA</td>
<td>High Luminence Housing</td>
<td>-20°C to 70°C (-4°F to 158°F)</td>
<td>2.0 microseconds</td>
<td>IP67</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>MSSX</td>
<td>Miniature Solid State Switch, 120” (24 AWG Wire, PVC Jacket) Plain Cable Lead, (2 wire Switch)</td>
<td>Cable</td>
<td>120” (3048mm)</td>
<td>PVC Jacket</td>
<td>Plain</td>
<td>Current Sinking or Current Sourcing</td>
<td>10 to 30 Volts DC</td>
<td>1mA</td>
<td>4 mA</td>
<td>300 mA</td>
<td>2.5 Volts @ 4 mA</td>
<td>High Luminence Housing</td>
<td>-20°C to 70°C (-4°F to 158°F)</td>
<td>2.0 microseconds</td>
<td>IP67</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

**MSSQ**

- **Miniature Solid State Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)**
- **Typical Current Sourcing (PNP) Configuration**
- **Typical Current Sinking (NPN) Configuration**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Cable Type</th>
<th>Dimensions</th>
<th>Material</th>
<th>Lead Type</th>
<th>Output Type</th>
<th>Input Voltage</th>
<th>Current Consumption (not sensing)</th>
<th>Minimum Load Current</th>
<th>Maximum Load Current</th>
<th>ON Voltage Drop</th>
<th>LED Indicator</th>
<th>Temperature Range</th>
<th>Actuating Time Average</th>
<th>Protection Rating</th>
<th>Reverse Polarity Protected</th>
<th>Transient (over voltage) Protected</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSSQ</td>
<td>Miniature Solid State Switch, 8mm Male Quick Connect, 24 AWG Wire, PVC Jacket (2 wire Switch)</td>
<td>Cable</td>
<td>8mm (20.32mm)</td>
<td>PVC Jacket</td>
<td>Quick Connect</td>
<td>Current Sinking or Current Sourcing</td>
<td>10 to 30 Volts DC</td>
<td>1mA</td>
<td>4 mA</td>
<td>300 mA</td>
<td>2.5 Volts @ 4 mA</td>
<td>High Luminence Housing</td>
<td>-20°C to 70°C (-4°F to 158°F)</td>
<td>2.0 microseconds</td>
<td>IP67</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

*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)

**Housing Construction**
- Molded Nylon 6.6 (White)

**Rugged Threaded Connection for Positive Lock**

---

### FOR SWITCHES:
- **R10Q**
- **MSSQ**

**Housing Construction**
- Molded Nylon 6.6 (White)

**8 mm Universal (3) Pin Male Connector (Q-Option)**

---

### FOR SWITCHES:
- **R10PQ**

**Housing Construction**
- Molded Nylon 6.6 (White)

---

### 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)

**Housing Construction**
- Molded Nylon 6.6 (White)

---

### 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)**
- **C4xT (5 Meter Cable Length)**

**Conductor Colors:**
1. Brown
2. Blue
3. Black

All Dimensions are in INCHES (mm in parentheses)

---

Specify ‘MPR’ Option for ALL switch models when ordering actuators.
**ACCESSORIES: SWITCH MOUNTING DIMENSIONS**

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>BORE(1.50)</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB15</td>
<td>1.375</td>
<td>1.406</td>
<td>2.000</td>
<td>0.250</td>
<td>0.625</td>
<td>0.500</td>
<td></td>
</tr>
<tr>
<td>2.00</td>
<td>1.625</td>
<td>1.656</td>
<td>2.500</td>
<td>0.313</td>
<td>0.625</td>
<td>0.500</td>
<td></td>
</tr>
<tr>
<td>2.50</td>
<td>1.875</td>
<td>1.875</td>
<td>3.000</td>
<td>0.313</td>
<td>0.625</td>
<td>0.500</td>
<td></td>
</tr>
<tr>
<td>SB2</td>
<td>2.125</td>
<td>2.125</td>
<td>3.750</td>
<td>0.375</td>
<td>0.500</td>
<td>0.563</td>
<td></td>
</tr>
<tr>
<td>4.00</td>
<td>2.438</td>
<td>2.375</td>
<td>4.500</td>
<td>0.375</td>
<td>0.500</td>
<td>0.563</td>
<td></td>
</tr>
<tr>
<td>5.00</td>
<td>2.750</td>
<td>2.750*</td>
<td>5.500</td>
<td>0.500</td>
<td>0.500</td>
<td>0.563</td>
<td></td>
</tr>
<tr>
<td>6.00</td>
<td>3.250*</td>
<td>3.250*</td>
<td>6.500</td>
<td>0.500</td>
<td>0.500</td>
<td>0.563</td>
<td></td>
</tr>
<tr>
<td>8.00</td>
<td>4.250*</td>
<td>4.250*</td>
<td>8.500</td>
<td>0.625</td>
<td>0.500</td>
<td>0.563</td>
<td></td>
</tr>
<tr>
<td>10.00</td>
<td>5.313*</td>
<td>5.313*</td>
<td>10.625</td>
<td>0.750</td>
<td>0.500</td>
<td>0.563</td>
<td></td>
</tr>
<tr>
<td>12.00</td>
<td>6.375*</td>
<td>6.375*</td>
<td>12.750</td>
<td>0.750</td>
<td>0.500</td>
<td>0.563</td>
<td></td>
</tr>
</tbody>
</table>

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

**How To Assemble Switch and Brackets**

**Recommended Torque:**
- SB15: 6-10 Inch-Lbs. (Do Not Exceed 14 Inch-Lbs.)
- SB32: 8-12 Inch-Lbs. (Do Not Exceed 14 Inch-Lbs.)

**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

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>REPEATABILITY</th>
<th>HYSTERESIS (MAX)</th>
<th>BANDWITH (MAX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R10</td>
<td>±.010” (±.25)</td>
<td>.040” (1)</td>
<td>.200” (5)</td>
</tr>
<tr>
<td>R10X</td>
<td>±.010” (±.25)</td>
<td>.040” (1)</td>
<td>.200” (5)</td>
</tr>
<tr>
<td>R10Q</td>
<td>±.010” (±.25)</td>
<td>.040” (1)</td>
<td>.200” (5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>REPEATABILITY</th>
<th>HYSTERESIS (MAX)</th>
<th>BANDWITH (MAX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R10P</td>
<td>±.010” (±.25)</td>
<td>.085” (2.1)</td>
<td>.345” (8.8)</td>
</tr>
<tr>
<td>R10PQ</td>
<td>±.010” (±.25)</td>
<td>.085” (2.1)</td>
<td>.345” (8.8)</td>
</tr>
<tr>
<td>R10PX</td>
<td>±.010” (±.25)</td>
<td>.085” (2.1)</td>
<td>.345” (8.8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>REPEATABILITY</th>
<th>HYSTERESIS (MAX)</th>
<th>BANDWITH (MAX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSS</td>
<td>±.010” (±.25)</td>
<td>.075” (1.9)</td>
<td>.315” (8)</td>
</tr>
<tr>
<td>MSSX</td>
<td>±.010” (±.25)</td>
<td>.075” (1.9)</td>
<td>.315” (8)</td>
</tr>
<tr>
<td>MSSQ</td>
<td>±.010” (±.25)</td>
<td>.075” (1.9)</td>
<td>.315” (8)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Switch Model</th>
<th>Switch Lead Options</th>
<th>Switch Bracket</th>
</tr>
</thead>
<tbody>
<tr>
<td>R10</td>
<td>(leave blank) = 24” Plain Cable</td>
<td>SB15 = 1.50” to 2.50” Bore</td>
</tr>
<tr>
<td>R10P</td>
<td>X = 120” Plain Cable</td>
<td>SB32 = 3.25” to 12.00” Bore</td>
</tr>
<tr>
<td>RAC</td>
<td>Q = 8mm Quick Connect</td>
<td>(leave blank for switch only)</td>
</tr>
<tr>
<td>RHT</td>
<td>(not available on RAC, or RHT)</td>
<td></td>
</tr>
<tr>
<td>MSS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R10P</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.**
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.
SERIES: BALLUFF INDUCTION SENSORS
DC INDUCTIVE SENSORS

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.

HOW TO ORDER CYLINDERS WITH BALLUFF SENSORS:

STANDARD LOCATIONS:
- Ports at 1 and 5
- Cushions at 2 and 6
- Sensors at 4 and 8

Sensor Model (Head) = BES 516-300-S 295-S4
Sensor Model (Cap) = BES 516-300-S 295-S4

How To Order:
- TA-M5S 2.125 X 6 - HC
- TA-M5S 2.125 X 6 - HC
- BES 516-300-S 295-S4
- BES 516-300-S 295-S4

Note: TRD will include the Strokemaster® probe length on your order and any sensor spacers required (example: TA-M5S 2.125 X 6- HC - BES 516-300-S 295-S4 / 1.025-S21 (Head) - BES 516-300-S 295-S4 / 1.75-S21 (Cap) - Sensors at 4 & 8.

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).
SERIES: BALLUFF INDUCTION SENSORS
AC/DC INDUCTIVE SENSORS

Normally-open
Rated operational voltage $U_e$
Supply voltage $U_B$
Voltage drop $U_d$
at $I_e$
Rated insulation voltage $U_i$
Rated operational current $I_e$
Minimum operational current $I_m$
Off-state current $I_r$
Inrush current $I_k$ (t = 20 ms)
Protected against polarity reversal
Short circuit protected
Repeat accuracy $R$
Ambient temperature range $T_a$
Frequency of operating cycles $f$
Utilization categories
Function/Operating voltage indication
Degree of protection per IEC 529
Insulation class
Housing material
Material of sensing face
Connection
Approvals
High pressure rated up to

Recommended connector

BES 516-200-S 2-S21
110 V AC
20...250 V AC/DC
< 6 V
250 V AC
500 mA
< 1.7 mA @ 110 V AC
3 A max./1 Hz
yes
< 5 %
-25...+70°C
< 50 Hz
AC 140/DC 13
IP 67
1
stainless steel/aluminum
Micro connector
cULus
207 bar (3000 PSI)
C21 AE3-00-VY-150F

BES 516-200-S 2-S5
110 V AC
20...250 V AC/DC
< 6 V
250 V AC
500 mA
< 1.7 mA @ 110 V AC
3 A max./1 Hz
yes
< 5 %
-25...+70°C
< 50 Hz
AC 140/DC 13
IP 67
1
stainless steel/aluminum
Mini connector
cULus
207 bar (3000 PSI)
C05 AE1-00-VY-150F

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
• Cushion 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
- BES 516-200-S 2-S21 (Head)
- BES 516-200-S 2-S21 (Cap)
- 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

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

<table>
<thead>
<tr>
<th>Connector</th>
<th>Style</th>
<th>Configuration</th>
<th>Recommended Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-5 Pole Mini</td>
<td>Mini Size A</td>
<td>Straight Female</td>
<td>C05 AE1-00-VY-150F</td>
</tr>
</tbody>
</table>

#### S21 - Micro Connectors
(1/2”-20 UNF Threads)

<table>
<thead>
<tr>
<th>Connector</th>
<th>Style</th>
<th>Configuration</th>
<th>Recommended Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro AC 3/4” x 20 UNF</td>
<td>3 Pin Dual Keyway</td>
<td>Straight Female</td>
<td>C21 AE3-00-VY-150F</td>
</tr>
</tbody>
</table>

#### S4 - Micro Connectors
(M12x1 Metric Threads)

<table>
<thead>
<tr>
<th>Connector</th>
<th>Style</th>
<th>Configuration</th>
<th>Recommended Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro AC 3/4” x 20 UNF</td>
<td>Micro DC Single Keyway</td>
<td>Straight Female</td>
<td>C04 AE1-00-VY-050M</td>
</tr>
</tbody>
</table>

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#### Dimensions

Female 3-pin - Face view

<table>
<thead>
<tr>
<th>Pin 3 - White</th>
<th>Pin 2 - Red/Black</th>
<th>Pin 1 - Green</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 mm</td>
<td>48 mm</td>
<td>47 mm</td>
</tr>
</tbody>
</table>

Female - Face view

<table>
<thead>
<tr>
<th>Pin 3 - Red/White</th>
<th>Pin 2 - Red/Black</th>
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<tr>
<td>25 mm</td>
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</tr>
</tbody>
</table>

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#### Switches - How to Order

**Switches**

Options Page 189

Accessories Page 227

Technical Data Page 277

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Refer to Balluff Catalog for additional cable connectors.
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.
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

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

Visit [www.balluff.com](http://www.balluff.com)

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