WORLD CLASS PERFORMANCE
FABCO-AIR
PNEUMATIC PRODUCTS

Pneumatic Linear Slides

Product Index

Introduction–

GB750 with adjustable stop collars and bumpers

"GB" Series –

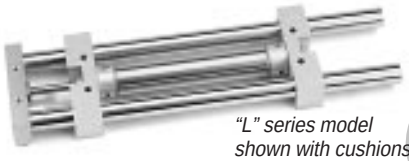
Model Size	Guide Shaft Dia.	Bore	Standard Stroke Lengths
375	3/8"	12mm	1/2, 1, 1-1/2, 2
500	1/2"	20mm	1, 2, 3, 4
750	3/4"	32mm	1, 2, 3, 4

EG500 with dovetail style sensors

EO500 with hydraulic shock absorbers

"E" Series –

Model Size	Guide Shaft Dia.	Bore	Standard Stroke Lengths (mm)
375	3/8"	5/8"	25, 50, 75, 100
500	1/2"	1-1/16"	25, 50, 75, 100, 150, 200, 250
625	5/8"	1-1/2"	25, 50, 75, 100, 150, 200, 250, 300, 350, 400
750	3/4"	2"	25, 50, 75, 100, 150, 200, 250, 300, 350, 400, 450, 500

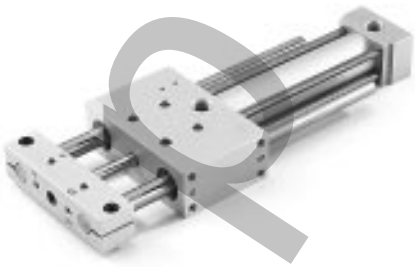


"L" series model shown with cushions

"S" series model shown with cushions

"L & S" Series –

Model Size	Guide Shaft Dia.	Bore	Standard Stroke Length
250	1/4"	5/16"	1/2", 1", 1-1/2", 2", 3", 4"
375	3/8"	5/8"	1/2", 1", 1-1/2", 2", 3", 4", 5", 6"
500	1/2"	3/4"	1", 2", 3", 4", 6", 8", 10", 12"
750	3/4"	1-1/16"	1", 2", 3", 4", 6", 8", 10", 12"
1000	1"	1-1/2"	1 to 4 by 1" incr., 6 to 24 by 2" incr.
1250	1-1/4"	2"	1 to 4 by 1" incr., 6 to 24 by 2" incr.
3–1250	1-1/4"	3"	1 to 4 by 1" incr., 6 to 24 by 2" incr.



"SE" series model shown with dowel hole/slot options on surfaces 2, 3 & 4

"SE" Series –

Model Size	Guide Shaft Dia.	Bore	Standard Stroke Length
250	1/4"	1/2"	1/2" to 4" by 1/2" increments
375	3/8"	3/4"	1" to 6" by 1" increments
500	1/2"	1-1/8"	1" to 10" by 1" increments
625	5/8"	1-1/8"	1" to 10" by 1" increments
750	3/4"	2"	1" to 6" by 1" increments 8" to 18" by 2" increments
1000	1"	2-1/2"	1" to 6" by 1" increments 8" to 20" by 2" increments
1500	1-1/2"	3-1/4"	2" to 30" by 2" increments

EZ625 with J72B electronic sensors

"EZ" Series –

Model Size	Guide Shaft Dia.	Bore	Standard Stroke Length
250	1/4"	1/2"	1/2" to 4" by 1/2" increments
375	3/8"	3/4"	1" to 6" by 1" increments
500	1/2"	1-1/8"	1" to 10" by 1" increments
625	5/8"	1-1/8"	1" to 10" by 1" increments
750	3/4"	2"	1" to 6" by 1" increments 8" to 18" by 2" increments
1000	1"	2-1/2"	1" to 6" by 1" increments 8" to 20" by 2" increments
1500	1-1/2"	3-1/4"	2" to 30" by 2" increments

"EZP" Series – (pick & place)

EZP5025

EZP7550

"TS" Series –

TS200-3.0-MH3-TGSB-S03SB-H2R-H3L-RPB

Model Size	Bore	Guide Shaft Dia.	Standard Strokes in 1" Increments
112	1-1/8"	1/4"	1" to 10"
150	1-1/2"	3/8"	1" to 12"
200	2"	1/2"	1" to 15"
250	2-1/2"	5/8"	1" to 20"
325	3-1/4"	3/4"	1" to 20"
400	4"	1"	1" to 20"

Other Fabco-Air Linear Guided Motion Products

Global Series® Cylinders
Guided Toolplate models
Catalog # GC-14

Pancake® Cylinders
with External Guide Pins
(Option "G")
See ***Catalog # CV8***

Square 1® Cylinders
with External Guide Pins
(Option "G")
See ***Catalog # CV8***

FABCO-AIR Linear Slides

Fabco-Air offers a wide assortment of linear slides, each suited to a vast variety of applications. But how does one know which slide to select? This section of the catalog will guide you through the selection process by providing useful information and helpful hints.

Selecting a linear slide involves five factors

Factor 1: Bore size of cylinder
(determines power factor and linear thrust)

Factor 2: *Guide Shaft Diameter*
(determines slide's load capacity)

Factor 3: Stroke (select from standard available strokes, or Fabco-Air can provide special stroke lengths)

Factor 4: Bearing Type and Guide Shaft material
(linear ball bearing or sleeve type bearing; guide shaft material is matched to bearing type and application environment)

Factor 5: Selection of slide series
(determines physical layout of the cylinder, bearings, guide shafts, toolbar/ toolplate)

Factors 1 through 3 – Bore, Guide Shaft Size & Stroke

In this catalog, each slide series is detailed in its own section. Engineering information can be found at the beginning of each section, detailing cylinder bore size, guide shaft size, and standard strokes, as well as loading information listing how much load can be supported at a given stroke and what amount of shaft deflection can be expected. Refer to this data to determine correct model size required for your application.

Factor 4 – Bearings & Guide Shafts

Linear ball bearings vs. sleeve type bearings. . .

Linear ball bearings provide three major benefits:

1. Precision and accuracy - linear ball bearings can operate with little or no “play”, providing precise, repeatable motion.
2. Smooth, low friction motion - linear ball bearings can handle even severe overhung loads without sticking or binding. Rolling elements mean no sliding friction.
3. Long life - reduced friction provides long service life, especially on long strokes with high loads.

Sleeve type bearings – Duralon® or Rulon®

1. Sleeve bearings work best when used to support “carriage” type loads (where load is applied equally to the four bearings)
2. Sleeve bearings can handle moderate overhung loading. Heavy overhung loads can cause bearing to wear “egg-shaped”.
3. Sleeve bearings *must* have running clearance between I.D. and guide shaft. Therefore, some “play” will be exhibited at the toolbar. The closer the bearing-to-bearing spacing and/or the longer the stroke, the more free play motion at the toolbar.

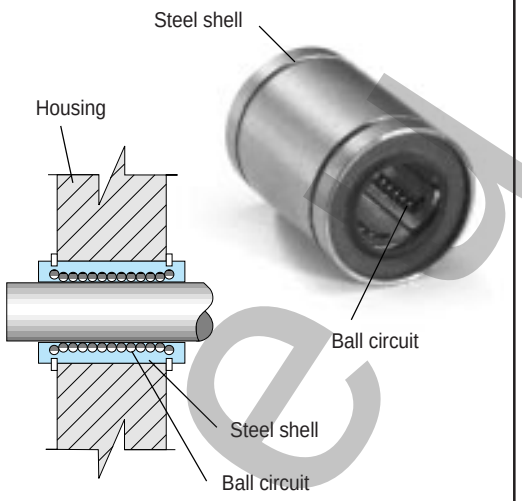
Helpful bearing selection hints

- Long stroke, high speed applications are best handled by linear ball bearings.
- Short stroke, high cycle rate applications are best handled by Sleeve Type bearings. (example: 1" stroke @ 200 cycles per minute). Short, fast reciprocating motion can shorten the life of linear ball bearings and/or guide shafts because the inertia of the ball circuit causes “skidding” when direction is rapidly reversed.

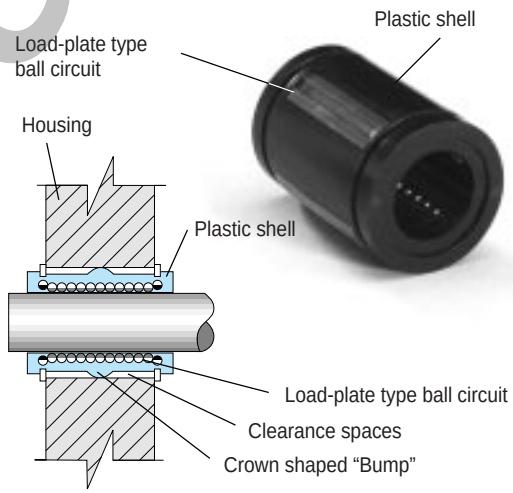
Steel shell linear ball bearings – Yes!
Inexpensive linear ball bearings – No!

Fabco-Air linear ball bearing slides use high quality, high precision "steel shell" bearings that provide superior load support. Here's why. . With steel shell bearings, the bearing load is distributed back to the housing bore via the entire bearing O.D. The ball bearing's I.D. is unaffected by the housing bore size, therefore providing a very precise "fit" to the guide shaft. Bearing-to-shaft pre-load can be accurately established and maintained.

Problem: bearing load is distributed back to the housing bore through small, crown shaped "bumps" on the load plates. High loads and/or sudden impacts cannot be supported by such a small area, causing the crowns to deform the housing bore. Furthermore the *ball bearing's I.D. is DIRECTLY* affected by the housing bore size. Enlarged housing bores, whether caused by deformation or by improperly finished I.D.s will cause bearing "slop" and toolbar "play".



Fabco-Air's steel shell bearing construction



Plastic and load-plate type bearing construction

Competitor's slides, equipped with bearings with plastic housings and load-plate type ball circuit construction can be problematic. This self aligning bearing concept is useful in applications where misalignment is likely. But it is unnecessary and often detrimental when used with packaged linear slides in which bearing housings are machined to such a high degree of accuracy.

Conversely, bores that are too small, such as when closed up by over anodizing, will increase the pre-load to the shaft. Excessive pre-load causes bearing overload and premature bearing and/or shaft failure.

Some recently developed plastic housing linear ball bearings have a ring or band in the center to help support the load. This feature still does not have support equal to the steel shell bearings used on Fabco-Air slides, and because the ring is "split", the bearing's I.D. is still directly affected by the final housing bore diameter.

FABCO-AIR Linear Slides

Factor 4 – continued

Linear Ball Bearing Loading and Life Expectancy

Many slide applications involve an overhung load applied to the end of the guide shaft. In almost all of these cases, the slide's load capacity is determined by the strength of the guide shaft and its ability to resist bending. Linear ball bearings are ***not*** the limitation because their load capacities dramatically exceed the bending strength of the guide shafts.

Linear Ball Bearing Load Capacities

For Shaft Diameters of	Rolling Load Ratings
.250"	60 lbs each bearing
.375"	64 lbs each bearing
.500"	177 lbs each bearing
.625"	272 lbs each bearing
.750"	300 lbs each bearing
1.000"	410 lbs each bearing
1.500"	900 lbs each bearing

Example: from the load sizing guide found on page 45, a model EZ1000 slide with 2.0" stroke has a recommended overhung load of 200 pounds (produces .005" max. toolbar deflection or less). This load is supported by two linear bearings rated at 410 lbs each, 820 lbs total - which translates to a "safety factor" of more than 4 to 1! For a 20" stroke with the same .005" deflection, the load sizing guide gives a load recommendation of 4 pounds – a factor of over 200 to 1!

Linear ball bearings provide precise "no play" motion ***and*** long life is assured because it is loaded only to a small fraction of its capacity.

Life expectancy is 3 million to over 10 million cycles. This general cycle life can be predicted regardless of its stroke because the linear ball bearing is being so lightly loaded, compared to its rated capacity. Cycle life is determined as much by the number of "ball circuit reversals" as any other factor, including inches of total shaft travel.

Loading of Sleeve Bearings

Sleeve type bearings offer simplicity and low cost. They are ideal for moderate overhung loads, and can easily handle high loads in moderate speed carriage load applications.

Fabco-Air's superior Duralon® bearing offers increased performance over other sleeve bearing materials. Self-lubricating, low friction Duralon® is a composite of Teflon®/Dacron® fabric liner bonded to filament-wound, high strength fiberglass and epoxy shell. Duralon® is resistant to corrosion, moisture, and temperature to 325° F. It has outstanding physical properties, very low friction, and will not gall or score guide shaft material.

Duralon® bearings are provided as standard on "GB" and "L & S" Series slides, and are available as an optional substitution (specify option code "X") on all other Fabco-Air linear slides. Rulon® bearings can be substituted for linear ball bearings by specifying option code "W". These bearings have an anodized aluminum shell with a Rulon® liner, and are available for users preferring this type of bearing material.

Guide Shaft Material Selection

The "GB" and "L & S" series slides are provided standard with pre-chrome plated stainless steel shafting. This material is supplied on other slides when option "X" (Duralon®) or option "W" (Rulon®) is specified. Slides with linear ball bearings are supplied with case hardened and ground steel (1045) shafting (shaft surface acts as inner race for the linear ball bearings). Models "E" and "SE" use a slightly larger tolerance material than "EZ" and "TS" slides, to provide a controlled pre-load for "no-play" motion. When option "Z", stainless steel shafting, is specified for use with linear ball bearings, a 440C case hardened and ground stainless material is supplied, ground to the same tolerance as 1045 shaft would be for that slide model.

Note: 1045 shafting is hardened to 60-65 R_C, while 440C stainless is hardened to 52-56 R_C. Higher loaded slides may have a slight shaft life expectancy reduction with the 440C material.

Moisture Environments – Application Tips

Coolant splash, water spray, and humidity applications can be handled by several methods. Duralon® and pre-chrome stainless steel shafting can be used. When linear ball bearings are used, Fabco-Air can supply units greased with a special moisture displacing lubricant and corrosion resistant plated guide shafts.

Operating Speed Considerations

An often overlooked aspect in the selection of linear slides is the speed at which it will operate. It can be difficult to obtain true and accurate speed information, yet ignoring speed factors can have disastrous results.

Safe speed range is generally 6 to 8 inches per second if no external stop options are utilized. A 12" stroke in 2 seconds is approximately 6"/second speed. It is approximate speed because we have not taken into account acceleration and deceleration time. On shorter strokes, ignoring acceleration/deceleration can be very misleading. A 1" stroke in 0.16 second is an average speed of 6"/second, but in reality, mid-stroke speed is much higher because a good portion of time was accelerating up to speed. It then requires a higher speed to travel that same distance in the 0.16 second time span. This higher speed develops severe impact forces when it suddenly stops at the end of stroke.

Machine cycle speed can also be misleading. Cycling at 30 parts per minute is a comfortable speed for moderate strokes. But, is the slide reciprocating at a uniform speed, or does it dwell (remain stationary) for part of the cycle? If so, the slide has to operate at a higher speed to make up for the time lost during dwell.

High speeds can be handled safely and reliably with the right combination of bearings/shaft, adjustable stops, and bumpers or hydraulic shock absorbers. Here are some tips:

Handling High Speeds

High speeds are best accomplished using linear ball bearings, as they can handle speeds up to 100 inches of travel per second. One exception is on short stroke (less than 1"), high cycle applications. Short, fast reciprocating motion tends to make the recirculating balls skid on the guide shaft when direction is reversed quickly, due to the inertia of the balls travelling in their track. A sleeve bearing may be superior in those applications. Fabco-Air offers both linear ball and sleeve bearings on most slide and pick & place models.

High speeds can cause heat buildup in the air cylinder caused by the friction of the seals. To minimize friction, most Fabco-Air slides are equipped with high quality, 80 durometer nitrile (Buna N) lip-type seals. Slides can be operated non-lubricated, but life expectancy is increased on high speed applications by using lubricated air.

High speed can cause damaging impact forces when the slide suddenly stops at the end of stroke. Adjustable stops should be used wherever possible to absorb impact externally rather than allowing the piston to bottom out inside the cylinder. “TS200” models and larger, “EG500” models and larger, and “L & S 500” models and larger are available with air cushions to help decelerate the slide near end of stroke. Also, most slide models are available with either urethane bumpers or hydraulic shock absorbers. Urethane bumpers are an inexpensive way to absorb moderate impact forces while providing quieter operations. Precision end of stroke stop positioning is not possible though, as allowance must be made for the urethane to deform.

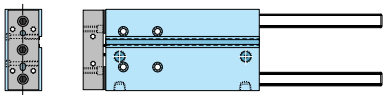
High loads at high speeds are best decelerated using hydraulic shock absorbers. Hydraulic shocks can be sized to the application, and provide a reliable way of decelerating a load over a given distance, bringing the motion to a safe, smooth stop in much the same way that a car is braked to a uniform stop (linear motion energy is converted to heat and dissipated). Hydraulic shocks are used in conjunction with adjustable stops. End of stroke stop positioning is precise (within .001") and pistons are not bottomed out in the cylinder. Linear energy remaining at the end of stroke after the hydraulic shock has decelerated the load is absorbed safely by the adjustable stop in the form of a minor impact force. With proper shock sizing, moderate to heavy loads can be operated at speeds up to 24 inches per second – and lighter loads even faster.

FABCO-AIR Linear Slides

Factor 5 – Quick Reference Guide to Slide Selection

Each Fabco-Air slide series is shown here for size and layout comparison.
For size comparison, drawings are to scale, showing 4" stroke slides with 1/2" diameter guide shafts.

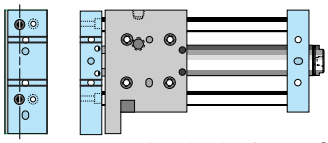
"GB" Series (sleeve bearings)
Air cylinder is machined into bearing block. Standard features include bottom, side & rear mounting holes, top & side ports. Toolbar with top, front, and bottom mounting holes.



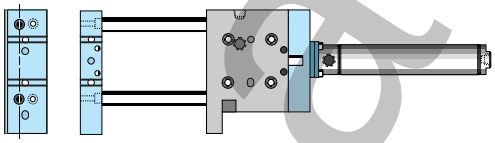
GB500-4

Reasons to select:
Rugged block slide, featuring replaceable Duralon® bearings, repairable built-in cylinder, interchangeable bolt pattern. Dual port locations, multiple mounting surfaces. Four inch stroke or less.

"E" Series (Linear ball bearings)*
Metric linear slides with non-repairable air cylinders. One set of parts can make either of two styles of slide: "EO" (cylinder on-board) toolbars reciprocate; "EG" (gantry style) bearing block reciprocates.



EO500-100 (4" stroke)

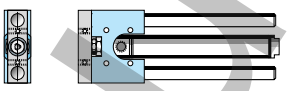


EG500-100 (4" stroke)

Reasons to select:
"EO" Series – metric interchangeable with "European" slides and offers (as standard) additional longer stroke lengths, linear ball bearings, short overall length.

"EG" Series – metric gantry style slide, linear ball bearings, provides moving saddle slide arrangement with a compact overall length.

"L & S" Series (Sleeve bearings)
An inexpensive series using non-repairable air cylinders. The "L" Series is similar to the "EZ" Series while the "S" Series is similar to the "SE". Note: Sleeve bearings need clearance to operate. Therefore some toolbar play exists. "L" & "S" slides are not intended for ultra-precision applications.



S500-4.0-MH1

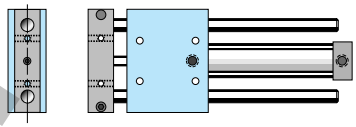
L500-4.0-MH1

Reasons to select:
Used for applications where the extreme precision of a linear ball bearing slide is not required.

"S" Series – Shorter than "L", but less capacity and more "play".

"L" Series – high load capacity. Less "play" than "S" because bearings are further apart.

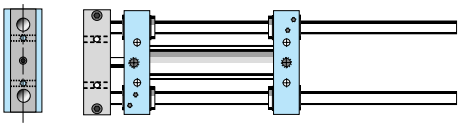
"SE" Series (Linear ball bearings)*
A shortened version of the "EZ" Series to save length. Cylinder is built into the bearing block which houses four linear ball bearings.



SE500-4.0-MS1

Reasons to select:
Shorter than "EZ". Good load capacity. Wide spacing of guide shafts to resist torsional load. Linear ball bearings at each end of bearing block provide "no-play" precision motion.

"EZ" Series (Linear ball bearings)*
Rugged slide with guide shafts either side of integral air cylinder. The bearings are spaced further apart as stroke increases, providing exceptional bearing support.



EZ500-4.0-MH1

Reasons to select:
Wide spacing of guide shafts to resist torsional load. Good load capacity. Provides "no-play" precision motion. Widest choice of tooling, stop, and shock options.

"TS" Series (Linear ball bearings)*
Very compact. It is the only linear ball bearing slide available that is "built into" the air cylinder.

TS200-4.0-MV2

Reasons to select:
Used where space is limited. High load capacity. Linear ball bearings at each end of cylinder provide "no-play" precision motion. Many tooling options available.

**Note: Linear ball bearing slides are also available with sleeve bearings as substitutions*

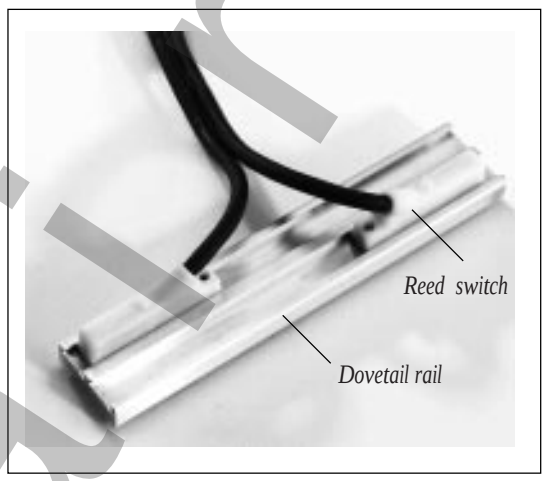
New Attachment Method for Dovetail Style Sensors

Introducing the universal sensor system
Now, one magnetically operated electronic sensor* can be used across the board on all pneumatic elements of your equipment design projects – on every cylinder, every linear slide, every gripper, and every press requirement.

This dovetail style sensor can be installed into integral dovetail slots on Fabco-Air Pancake® and Square 1® cylinder products, plus "GB" series slides and Global Series™ air cylinders equipped with magnetic pistons. The same sensor can be specified on Fabco-Air "SPG" series parallel grippers and the square or round body angular grippers.

By utilizing Fabco-Air's new and unique "double dovetail slot extruded aluminum rail", shown in the photo (right), these same sensors can be used on "EG" (Gantry style), "L & S", "SE", "EZ", "EZP", and "TS" series slide products by simply specifying a sensor option code in the catalog number. The extruded rail and dovetail sensors can also be purchased separately and installed on nearly any tube and tie-rod or "non-repair" type cylinder equipped with magnetic piston band.

How it works
An extruded aluminum rail with two side-by-side dovetail slots is attached to the cylinder body with a special adhesive-backed foam tape. The sensor inserts into one of the dovetail

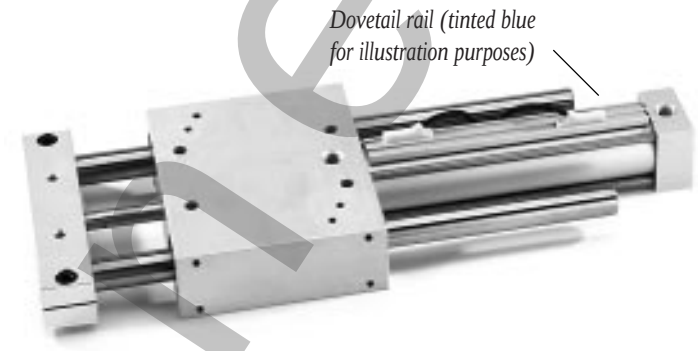


slots, is positioned as desired, and locked in place with a hex socket screw.

Double rail design allows side by side placement of the sensors to accommodate even the shortest stroke cylinders.

This compact and easy to install sensor mounting system is now available on the following Fabco-Air linear slide series: "E" (Gantry style only), "L & S", "SE", "EZ", "EZP" and "TS".

**Note: Reed switch also available on most series.*



Typical installation
The photo above shows an "SE" series linear slide with rail attachment and two sensors. Installation is quick and easy, and can be removed and remounted by simply peeling off and installing new tape. High-performance tape was originally developed for automotive trim parts, and provides a reliable attachment method with the convenience of "peel and stick" type tape.

Sensor adjustment is accomplished by simply sliding switch to proper position and locking the set screw at the wire exit end of the switch (photo above right).

To order the rail separately. . .
Use catalog number "ER – (length in inches)".
Example: ER–12.06 (overall length = 12 1/16")
Rail is provided complete with adhesive foam tape.
To install, peel tape backing and apply to cylinder tube.
To order sensors for "ER" extruded rail, see page 13 of this catalog.