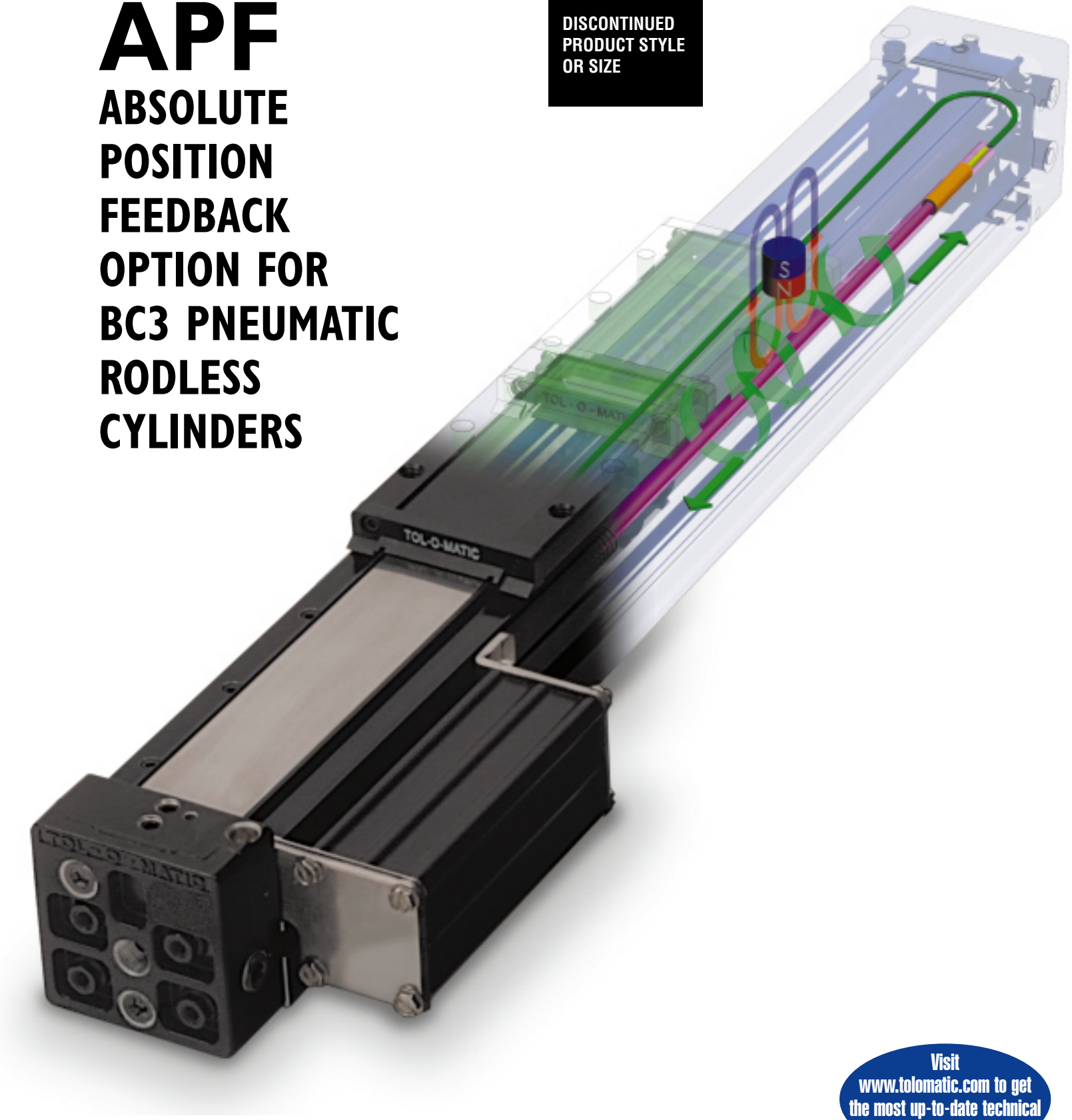
TOL-O-MATIC, INC.

APF

ABSOLUTE POSITION FEEDBACK OPTION FOR BC3 PNEUMATIC RODLESS CYLINDERS

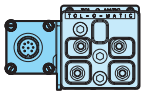
DISCONTINUED PRODUCT STYLE OR SIZE



Visit www.tolomatic.com to get the most up-to-date technical information.

APF ABSOLUTE POSITION FEEDBACK

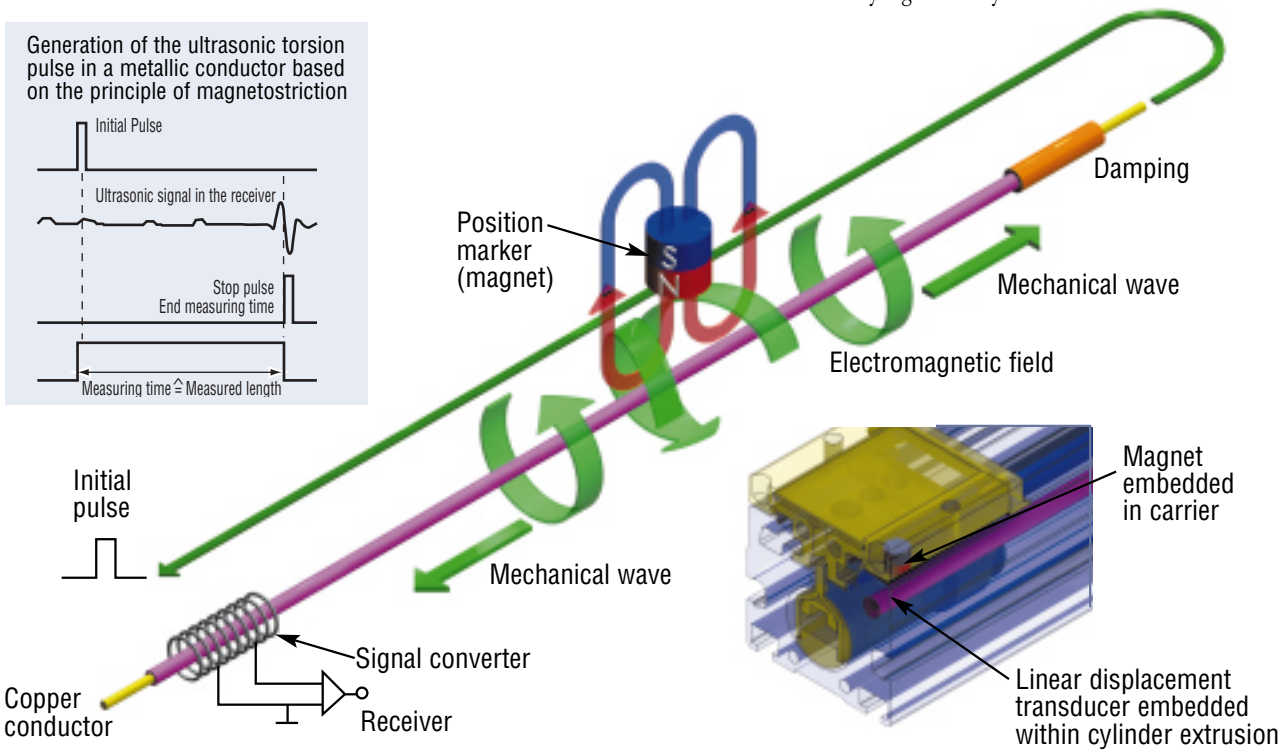
PRINCIPLES OF OPERATION



HOW IT WORKS

- An initial pulse is generated that runs through the length of the linear transducer. This pulse generates a circular magnetic field which rotates around the length of the transducer.
- A permanent magnet (embedded in the carrier) is mounted so its lines of field run at right angles to the electromagnetic field induced in the transducer.
- At the point where the two fields intersect, a magnetostrictive effect causes an elastic deformation of the transducer.
- This deformation moves in both directions from the magnet in the form of a mechanical wave.
- The velocity of the mechanical wave is 9285 feet per second and is nearly insensitive to environmental effects (temperature, shock, etc.)
- The mechanical wave that moves to the far end of the band cylinder is dampened.
- The mechanical wave that moves to the signal converter is changed to an electric signal. The wave travel time is directly proportional to the distance between the magnet and the signal converter.
- By measuring the travel time, the position of the carrier can be determined with extremely high accuracy.

Generation of the ultrasonic torsion pulse in a metallic conductor based on the principle of magnetostriction



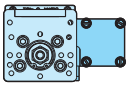
DESIGN ADVANTAGES

- Linear displacement transducer is embedded within the extrusion of the band cylinder for protection and space savings. The carrier protects the permanent magnet.
- An extruded aluminum housing protects the electronics. Compact design does not interfere with carrier movement or mounting.
- Performance is factory verified for each unit before shipping.

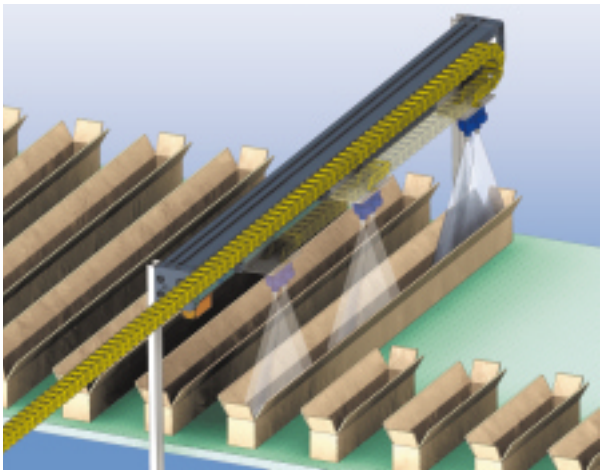
ALTERNATE TECHNOLOGIES

	TECHNOLOGY	DISADVANTAGE
Linear Potentiometers	• Conductive "wiper" rides on resistive element	• Wear spots often form, impacting performance
Incremental Linear Encoders	• Measures position by counting lines from reference point "home"	• Requires reference run to determine absolute position • Any interruption in power requires reference run before work is resumed
Cable Extension Transducers "String Pots"	• Metal cable connected to rotary feedback device	• Prone to mechanical inaccuracies (backlash) • Exposed to environment
Linear Variable Differential Transformers "LVDT's"	• Moveable core changes inductance of transformer	• AC operated, requiring additional electronics to convert signal to required DC
Optical Type Sensor	• Sensor attached to carrier tracks position	• External cables attached to moving carrier and sensor required for power and sending signals

APPLICATION EXAMPLES



FOAMING INJECTOR FOR PACKAGING



APPLICATION DESCRIPTION:

Dispense foaming packaging material into containers for shipping. Packaging contains delicate, variable length electronic devices.

- Container length varies
- Dispense between 2 to 6 “shots” of packaging material

APPLICATION REQUIREMENTS:

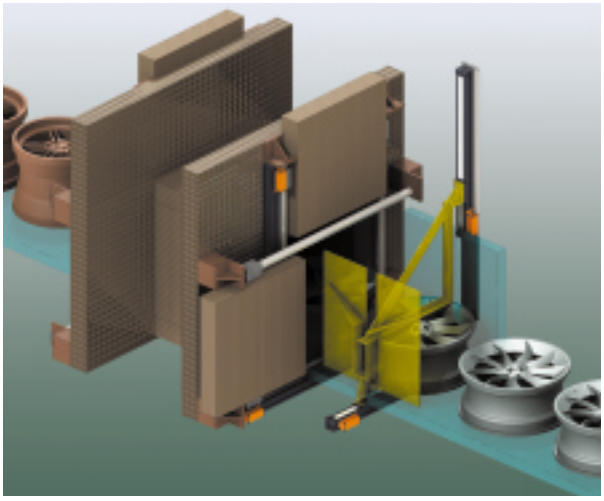
- Maximum stroke length: 36 inches
- Injection points vary with container length
- Transport injector head, supply hoses and cables
- Robust, maintenance free system with easy set-up
- High throughput

TOL-O-MATIC SOLUTION:

- BC320 with 36 inch stroke
- APF option to send carrier position to PLC
- One 4-way directional control valve

The BC320 has adequate load and moment capacity, with excellent guidance of injector head. APF option provides position feedback, eliminating the need for 8 sensing switches along the length of the rodless cylinder. PLC triggers injection at the selected injection points (dependent on container length) while the system is in motion. High level of throughput is achieved.

OVEN DOOR CONTROL



APPLICATION DESCRIPTION:

Identify part size to control the oven door opening for heat testing apparatus. To conserve energy, a dual door system is employed for both the oven entry and oven exit. Each furnace door to open only enough to accommodate the current part.

- Previous method opened the doors completely, resulting in rapid cooling of the interior chamber

APPLICATION REQUIREMENTS:

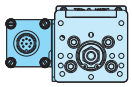
- Doors open only enough to accommodate current part
- Measurement of height and width of each part
- Max force required to move parts: 75lbs.
- Pneumatic system
- Energy conservation

TOL-O-MATIC SOLUTION:

- (2) BC315 with APF option

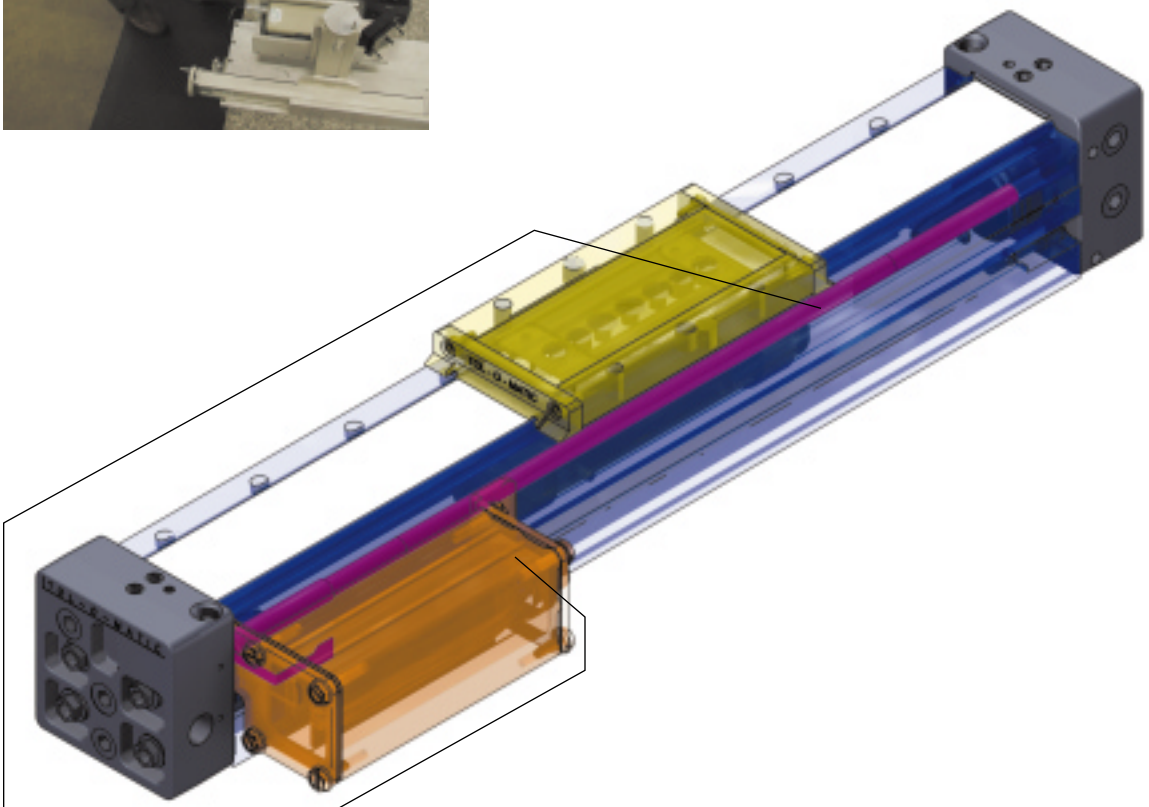
The BC315 band cylinders move the part to align with the door and measure part height and width. The APF sends the measurement signal to the PLC which coordinates the opening size to the oven entry doors. The same door opening is signalled to the exit doors on completion of heating cycle. This unique combination of pneumatic rodless cylinder and position feedback allows faster cycle times as well as energy savings.

APF ABSOLUTE POSITION FEEDBACK

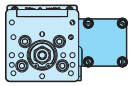


FEATURES, ADVANTAGES, BENEFITS

FEATURE	ADVANTAGE	BENEFIT
• Absolute position feedback – signal sent as analog output to control system or PLC	• Provides load position feedback	• Accommodates work point variances without stoppage for manual set-ups • Work events can be programmed with PLC eliminating the need to physically move trigger switches
• Each APF option installed is factory tested before shipping	• Transducer performance has been tested, after installation, on each cylinder	• Assurance that each cylinder will meet specifications



FEATURE	ADVANTAGE	BENEFIT
• Analog signal of 0 to +10Vdc or -10 to +10Vdc	• Select appropriate voltage based on control device	• Makes full use of controller's A to D resolution capacity
• Transducer is embedded within the band cylinder	• Reduces chance of damage to the transducer	• Eliminates need for complex external mounting and offers protection
• Non-contact linear displacement transducer	• Magnetostrictive system has no mechanical wear • Transducer directly measures load position	• High life expectancy, speed, linearity and repeatability when compared to linear potentiometers
• Transducer may be ordered in any length	• Does not limit stroke	• Order in any incremental stroke length from 2 to 156 inches



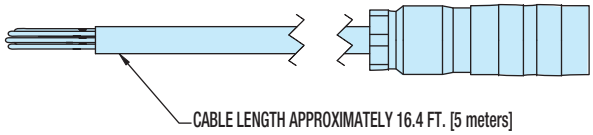
SPECIFICATIONS

Sensor Type:	Magnetostrictive Linear Displacement Transducer
Stroke Range:	2 in. to 156 in. [51 mm to 3,962 mm]
Operating Temperature:	-40 to 185°F [-40 to 85°C]
Supply/Operating Voltage:	24 Vdc ±20%
Output Signal Interface/Type:	Analog/Voltage (0 to +10 Vdc -or- ±10 Vdc)
Resolution:	<0.1 mV
*Linearity:	±.005 in. [.13 mm] up to 20 in. [508 mm] stroke, ±.025% (of full stroke) over 20 in. [508 mm] stroke
*Repeatability:	<.003 in. [.08 mm]

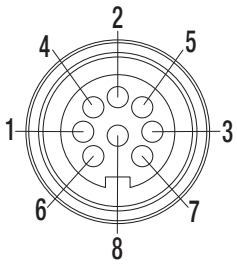
**Linearity and repeatability specifications are based on empirical data.*

CABLE

CABLE DIMENSION



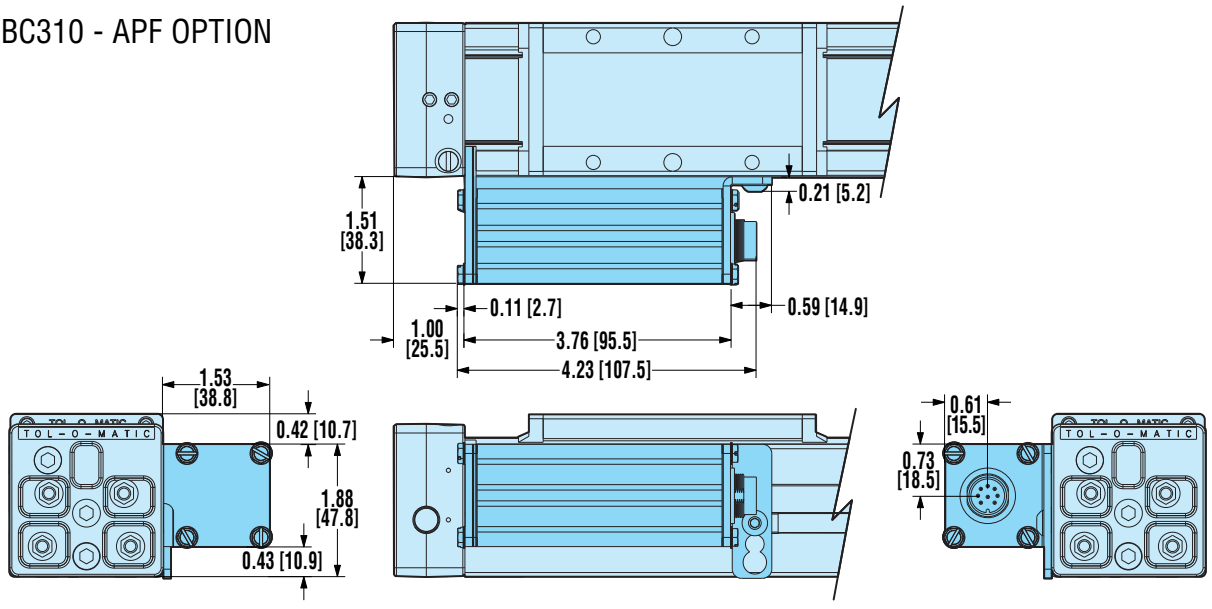
CABLE PINOUT - APF OPTION

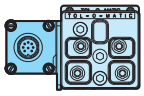


1	Yellow:	— —
2	Gray:	Analog Common
3	Pink:	Analog Output, Falling
4	— —	Not Used
5	Green:	Analog Output, Rising
6	Blue:	Ground
7	Brown:	+24 V
8	White:	Ground

DIMENSIONS

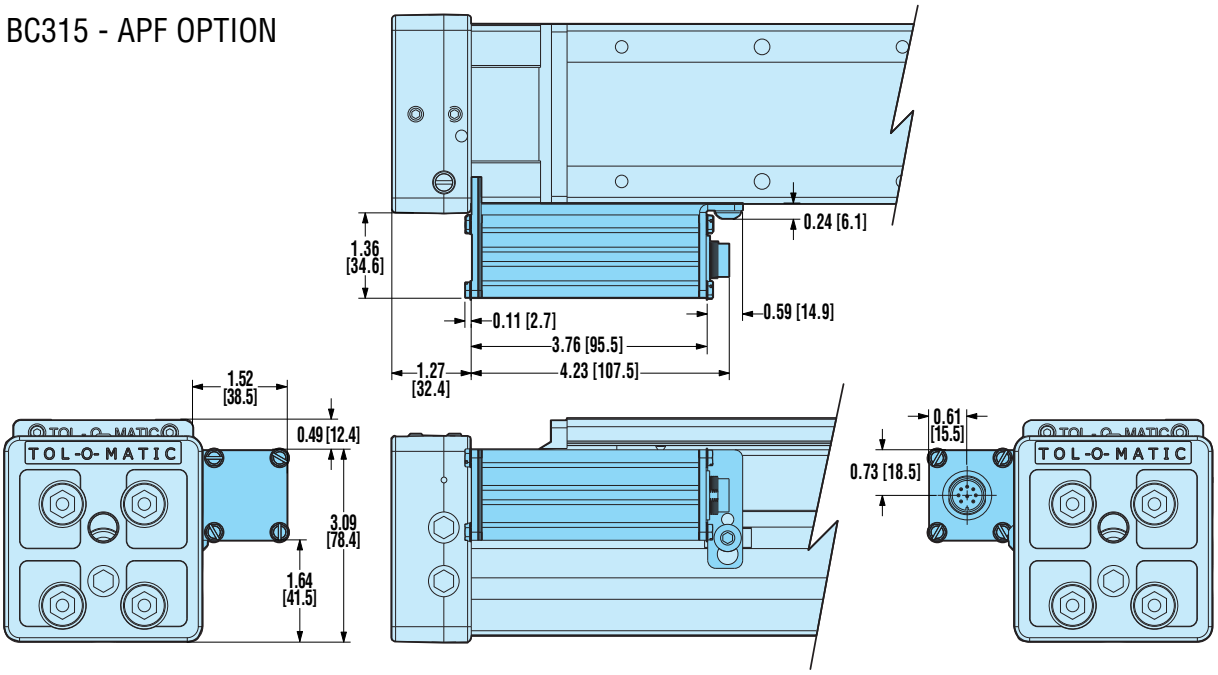
BC310 - APF OPTION



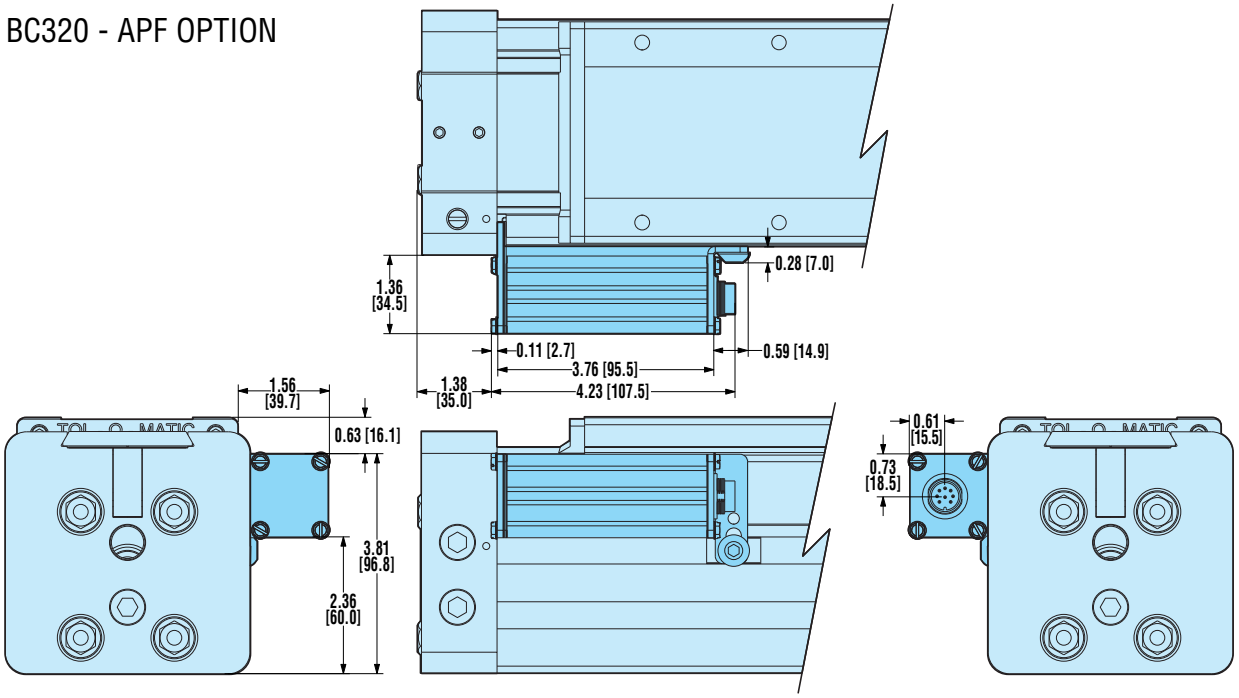


DIMENSIONS

BC315 - APF OPTION



BC320 - APF OPTION

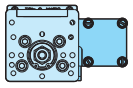


Unless otherwise noted, all dimensions are in inches [dimensions in brackets are in millimeters]

APF ABSOLUTE POSITION FEEDBACK

ORDERING *(SEE CATALOG FOR COMPLETE ORDERING INFORMATION)*

The dark gray background indicates items that are not compatible with the APF option



MODEL, BORE, AND STROKE				ACCESSORIES AND OPTIONS
1.	2.	3.	4.	5.
BC3		15	SK100.25	APFGFCATS2

The above example describes a BC3 Series Band Cylinder with a 1-1/2 in. (40mm) bore size and a stroke of 100.250 inches. Options include the absolute position feedback -10 to +10Vdc range, cable for the APF and two tube supports.

Boxes above represent the number of fields available for each section and not all of them will be used in every application. Omit empty boxes when you construct your configurator number (placeholders are not required). For the above example, the order string would appear as follows: **BC315SK100.25APFGFCATS2.**

First, determine the model, the bore size and the stroke required.

1. MODEL TYPE

Enter:

BC3 for U.S. standard version
BC3M for metric version with taper port
BC3MM for metric version with parallel port

2. DUAL 180˚ CARRIER OPTION

Enter:

§**D** for Dual 180˚ Carrier

3. BORE SIZE

Enter:

10 for 1.0 in./25 mm
15 for 1.5 in./40 mm
20 for 2.0 in./50 mm

4. STROKE LENGTH

Enter

SK then required stroke length in **inches**
Example:
SK100.25 for 100.250 inch stroke

NOTE: Prelubrication is standard on all BC3 Band Cylinders (see Application Guidelines on page 241 of Fluid Power Catalog).

*Each TS includes two (2) tube support halves

+ When shocks are ordered, cushion seals are removed.

§ Not available with APF option

5. ACCESSORIES AND OPTIONS

Once the model, bore size and stroke have been determined, you can add any of the options or accessory items shown below in any order. If the optional item indicates an "x", specify quantity.

When ordered with any BC3 Series model, all options and accessories listed will be factory installed unless specified. For special model and option requirements not shown, consult Tol-O-Matic, Inc.

OPTIONS AND ACCESSORIES CODES
"x" indicates quantity.

APFB	BC310, Linear Transducer, 0 to +10Vdc
APFA	BC315, BC320 Linear Transducer, 0 to +10Vdc
APFH	BC310, Linear Transducer, -10 to +10Vdc
APFG	BC315, BC320 Linear Transducer, -10 to +10Vdc
FCA	Cable, Connects APF to external device (3m)
§§ **BTx**	Form C Reed Switch with 5-meter lead
§§ **BMx**	Form C Reed Switch with 5-meter lead Quick-Disconnect
§§ **RTx**	Form A Reed Switch with 5-meter lead
§§ **RMx**	Form A Reed Switch with 5-meter lead Quick-Disconnect
§§ **CTx**	AC Triac Reed Switch with 5-meter lead
§§ **CMx**	AC Triac Form A Reed Switch w/ 5-meter lead Quick-Disconnect
§§ **KTx**	Hall-effect (Sinking) Switch with 5-meter lead
§§ **KMx**	Hall-effect (Sinking) Switch with 5-meter lead Quick-Disconnect
§§ **TTx**	Hall-effect (Sourcing) Switch with 5-meter lead
§§ **TMx**	Hall-effect (Sourcing) Switch with 5-meter lead Quick-Disconnect
FMx	Foot Mount (ea.)
***TSx**	Tube Support (ea.)
§+**ADx**	Standard Shock, Hardware Only (ea.)
§+**AHx**	Standard Shock, Heavy Duty (ea.)
§+**ALx**	Standard Shock, Lite Duty (ea.)
TN	T - Nuts (ea.)
****DW**	Auxiliary Carrier (with piston)

§§ APF option replaces switches in most uses

****When ordering auxiliary **carrier option,** determine the minimum distance required between carriers (dimension "D" in Auxiliary Carrier Bending Moments chart, page 42 of Fluid Power Catalog). Determine your working stroke and your "D" dimension, then enter these into your configuration string. (Example: BC315SK50.00DW15.00RT2) **The configurator will calculate the overall length of the actuator.**

ORDERING PROCEDURE

NOTE: BC3 pneumatic rodless cylinders with the APF option are custom engineered to your specifications in just 10 working days.

FIELD RETROFIT KITS

ITEM	BC310	BC315	BC320	BC3M(MM)10	BC3M(MM)15	BC3M(MM)20
Cable for APF option 9.8 ft. (3m)	3604-1573	3604-1573	3604-1573	3604-1573	3604-1573	3604-1573
Tube Supports (with APF option)	3410-9361	3415-9006	3420-9006	4410-9361	4415-9006	4420-9006
Tube Supports (without APF option)	3410-9006	3415-9006	3420-9006	4410-9006	4415-9006	4420-9006

INDUSTRY PROVEN PRODUCTS

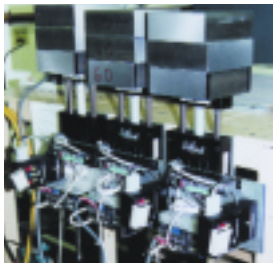
TOL-O-MATIC, INC.

COMMITTED TO BEING THE PREMIER SUPPLIER OF WORLD CLASS MOTION CONTROL PRODUCTS

PRODUCT INNOVATIONS MAKE TOL-O-MATIC THE LEADER IN LINEAR MOTION.

- **Invented the first rodless cylinder in 1955.**
- **Introduced the first load carrying band cylinder.**
- **Created the first rodless cylinder with integral recirculating load-bearing feature.**
- **Offered the first cut-to-length rodless electric actuator.**
- **Offered the first fully programmable, pneumatic, linear motion positioning system.**
- **Innovations continue with products for resistance welding, plastic injection molding and medical industries.**

FIELD TESTED / INDUSTRY PROVEN



- Precision tooling is built on site at Tol-O-Matic with the highest standards of quality, care and dedication to details.
- Before a new product is released, extensive lab and field testing is conducted.
- Over 50 years of motion and control experience.

EXPERIENCED KNOWLEDGE BASE

- Our sales and engineering staff is your resource, only a phone call away. 1-800-328-2174
- Get valuable information at www.tolomatic.com, or email us at help@tolomatic.com.
- Knowledgeable local distribution and representative network.

TOL-O-MATIC TRAINING CENTER

- We supply the most advanced in-depth training in the industry—free of charge to all our distributors and customers.
- Our commitment to training includes:
  - On-site classroom
  - On-site training lab
  - Computer based education materials
  - Traveling education at your location

OUR HIGH QUALITY COMMITMENT

ISO certified management system since 1997.

A USEFUL WEB SITE

Product support available 24-7 at www.tolomatic.com

Our web site is your definitive source for Tol-O-Matic information. This database driven site has the most up-to-date literature, product information, CAD files *(3D models available!)*, distributor information … everything you want to know about Tol-O-Matic and our products.

ALSO CONSIDER THESE OTHER TOL-O-MATIC PRODUCTS:

AXIDYNE LINEAR MOTION PRODUCTS
BROCHURE #9900-9074 CATALOG #9900-4609

FLUID POWER PRODUCTS
BROCHURE #9900-9075 CATALOG #9900-4000

POWER TRANSMISSION PRODUCTS
BROCHURE #9900-9076 CATALOG #9900-4009

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