Robotic Accessories
Tool Changer

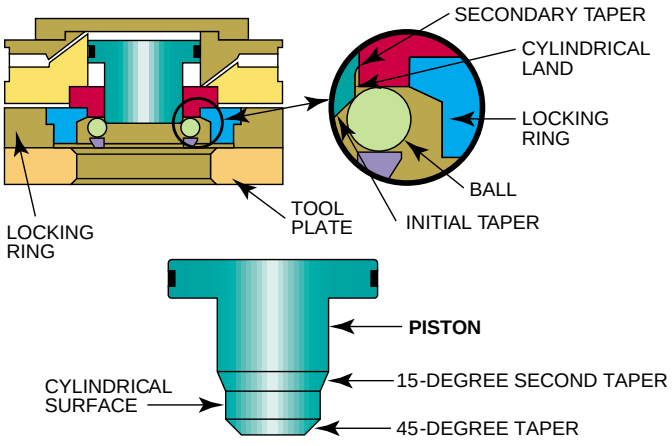
Operating Principle

The tool changer uses a pneumatic piston, located in the master plate, to force steel balls into engagement with the lock ring on the tool plate. Double tapers in the piston insure concentricity repeatability while protecting the tool from disengagement in the event locking pressure is lost. Pressure must be applied to the unlocking port to release the tool plate.

Features

- Unmatched Repeatability–The unique double-taper locking piston in combination with the two locating pins provides unmatched repeatability. Million-cycle testing, at rated loads, shows that the typical repeatability is much better than the guaranteed values shown in the specifications.
- High Rigidity–The tool changer has a large moment capacity due to the locking piston's high coupling strength and large diameter. Because the coupled tool changer does not rock during high-inertia moves, locking failure and repeatability problems are prevented.
- Excellent Reliability–The patented double-taper locking mechanism actually self-compensates for wear. The pneumatic ports use uniquely designed, long-life rubber bushings which prevent any loss of air pressure. Spring probe electrical pins on the Master Plate insure contact with fixed pins in the Tool Plate. Simply put, this Tool Changer is built to last.
- Superior Fail-Safe Locking Mechanism–The new patented locking mechanism locks the Master Plate to the Tool Plate and remains locked even if pressure is accidentally removed. The built-in fail-safe feature eliminates the need for a spring.
- No-Touch Locking™ Technology
  The tool changer can lock successfully with a gap between the master and tool plates.

Design of Locking Mechanism



- Available in Ten Sizes–The Tool Changer accommodates payloads ranging from 5 to 455 kg. Standard models include as many as 74 electrical lines and 14 pneumatic ports.
- 3 year warranty–Based on years of observation and analysis by our customers in the field, and extensive laboratory testing.
- Long-life bushings for pneumatic pass-through.
- Small size and weight to payload ratio.
- All locking parts are made of R_c58 stainless steel.
- Maximum pressure of 100 psi (7 bar).

Specifications

Additional Specifications

1. The Z-axis force must be less than the coupling force to achieve the specified repeatability.
2. The Master Plate can only be decoupled if air pressure is applied to the Unlock port, even if Z-axis force exceeds the coupling force.
3. Extra electrical contact option and extra pneumatic line option cannot be provided together.
4. Special Tool Changer models and options are available. Call for details.
5. Interface plates are available for any robot model.

Tool Changer Model Number

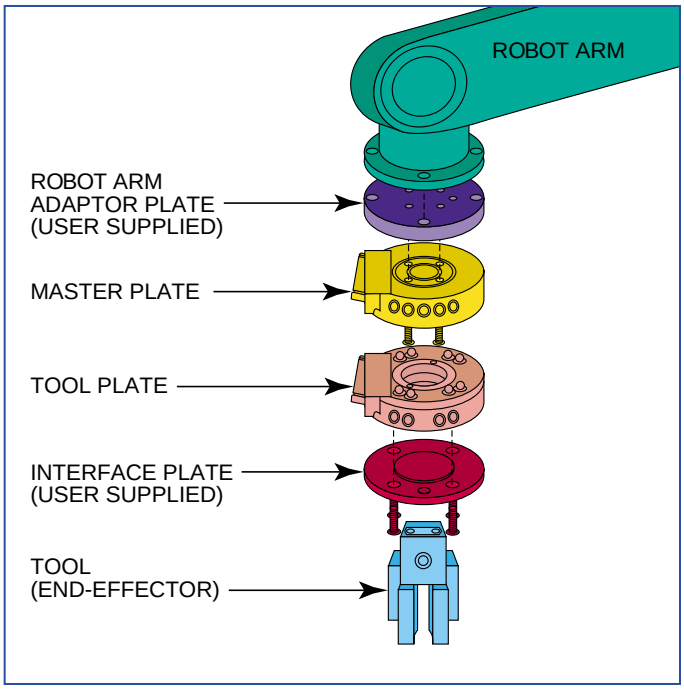
Specification Description	TC-5 Page 6	TC-11 Page 7	TC-20 Page 8	TC-21 Page 9	TC-40 Page 10	TC-41 Page 11	TC-60 Page 12	TC-71 Page 13	TC-100 Page 14	TC-150 Page 15	TC-300 Page 16
Static Moment Capacity (X& Y) **(English, lb-in)**	**110**	**220**	**500**	**500**	**1390**	**1390**	**1740**	**3500**	**6940**	**10400**	**29100**
Static Moment Capacity (X& Y) **(Metric, N-m)**	**12.5**	**25**	**56.5**	**56.5**	**157**	**157**	**197**	**395**	**784**	**1175**	**3289**
Static Moment Capacity (Z) **(English, lb-in)**	**150**	**300**	**690**	**690**	**1910**	**1910**	**2600**	**3500**	**6940**	**9000**	**25000**
Static Moment Capacity (Z) **(Metric, N-m)**	**17**	**34**	**78**	**78**	**216**	**216**	**294**	**395**	**784**	**1017**	**2825**
Pneumatic Pass-Through (Qty) Size	(6) M5 or #10-32	(6) M5 or #10-32	(12) M5 or #10-32	(8)† 1/8 NPT	(8)† 1/8 NPT	(6) 3/8 NPT (4) 1/8 NPT	(8)† 1/8 NPT	(8)† 1/4 NPT	(8)† 3/8 NPT	(10)† 3/8 NPT	(10)† 3/8 BSPT
Pneumatic Lock & Unlock Port Size	M5 or #10-32	M5 or #10-32	M5 or #10-32	M5 or #10-32	1/8 NPT	1/8 NPT	1/8 NPT	1/8 NPT	1/8 NPT	1/8 NPT	1/4 BSPT

†Additional pneumatic pass-through ports are available for these models.
All models can handle a dynamic moment 3X higher than the static moment capacity. Moment tests show failure point at 12 times X & Y static moment specifications.

Mounting the Tool Changer

The Master Plate is attached to the robot flange using an interface plate (furnished by the user). Screws and O-ring are provided for the Master Plate (a cover plate is provided). A boss and dowel pin hole are provided on the Master Plate for high accuracy location.

The Tool Plate is attached to the tool (end-effector) using an interface plate (furnished by the user). Use screws that match the tapped holes in the Tool Plate. A boss and dowel pin hole are provided on the Tool Plate for high accuracy location.



How to Select a Robotic Tool Changer

Sizing–If your moment is low or moderate, select a Tool Changer model with a payload rating similar to the robot it will be mounted on. If your moment is high, or if you prefer to use a TC model better suited to the application, you can use a more exact method.

More Exact Method–Moment capacity is a critical factor in selecting the proper Tool Changer model. Use the following to approximate your worst-case moment.

a) Find the approximate center-of-gravity (CG) of your heaviest end-effector.

b) Calculate the distance (D) from the CG to the bottom of the Tool Plate.

c) Calculate the weight (W) of the heaviest end-effector.

d) Multiply (W) times (D) to get an approximate static moment (M) (or a moment based on one G of acceleration).

e) Select a Tool Changer with a moment capacity equal to or greater than (M).

Robots may produce moments two to three times higher than (M) due to their potentially high acceleration. The Tool Changer models with moment capacity of (M) are designed to handle dynamic moments that are three times higher than (M).

Pneumatic and Electrical–Determine the number and size of pneumatic ports and electrical contacts needed. Larger Tool Changer models have larger and more numerous pneumatic ports and electrical contacts.

Temperature and Chemicals–The Tool Changer uses nitrile bushings to pass air to the Tool Plate, and Buna-N o-rings to seal the pneumatic locking mechanism. Not only are these rubber materials able to survive most chemicals, they are able to withstand

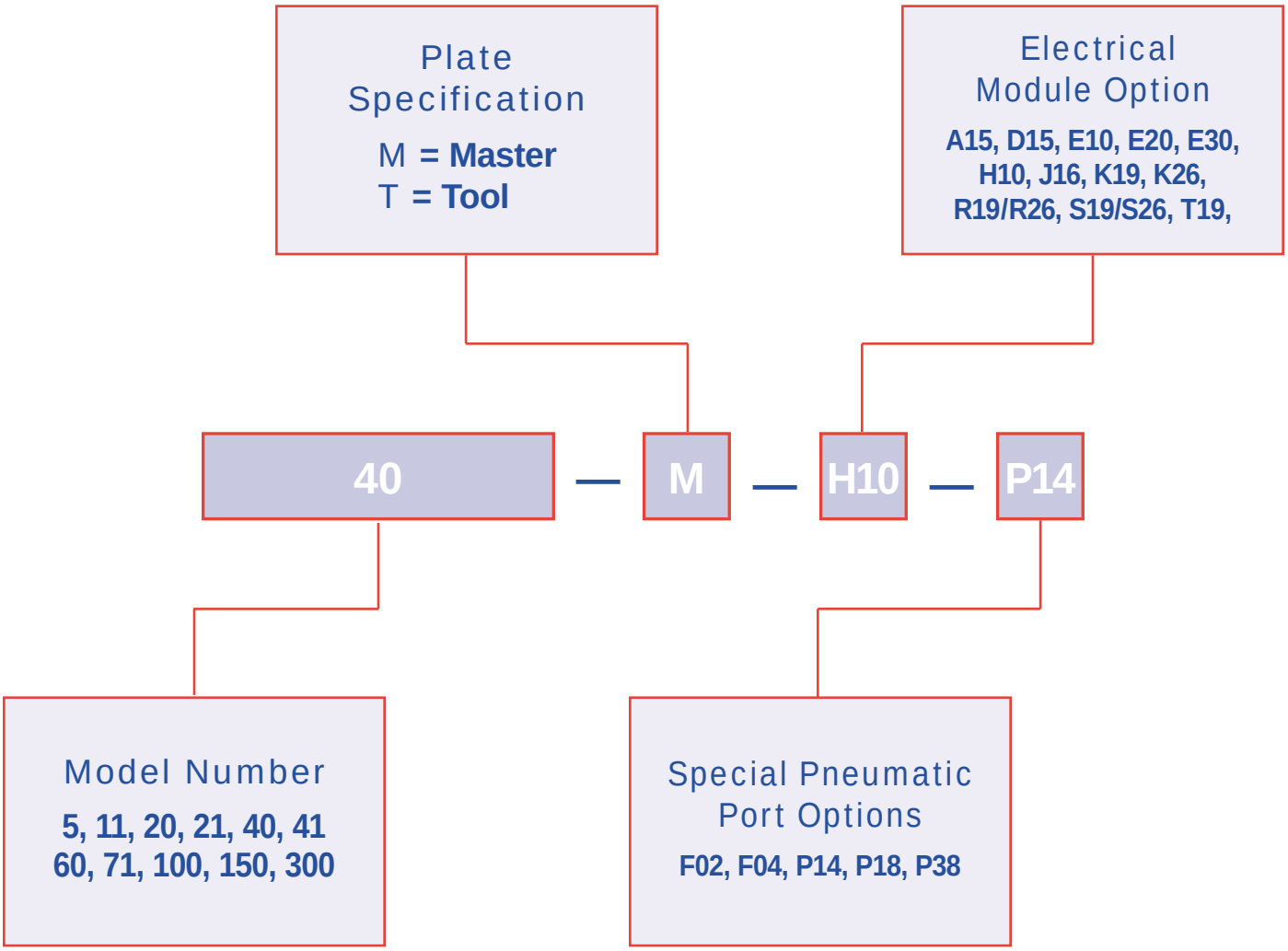
temperatures ranging from -20°F to 150°F. Please contact us for additional information if you have questions regarding temperatures or chemicals within your particular environment.

Precision Applications–Check the repeatability specifications when dealing with applications that require high repeatability.

REMEMBER

A tool changer affects your robot's moment capacity, payload, size, and repeatability. For a given payload, the Tool Changer is designed to exceed the robot's specifications.

Ordering Data



Sensor Interface Plate System

The Sensor Interface Plate (SIP) system has been designed to provide lock and unlock sensing inside the Robot Interface plate. The SIP consists of lock and unlock sensors, sensing peg, sensing plate and interface plate. Figures 1 through 4 show how the SIP works. The SIP Plate serves as the robot interface in Models TC-40 and higher. Please consult the Sales Department for TC-21 and lower interface plate.

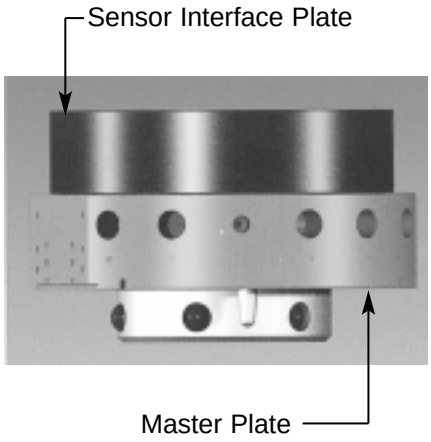


Figure 1

Side view of Master Plate with Sensor Interface Plate (SIP) system.

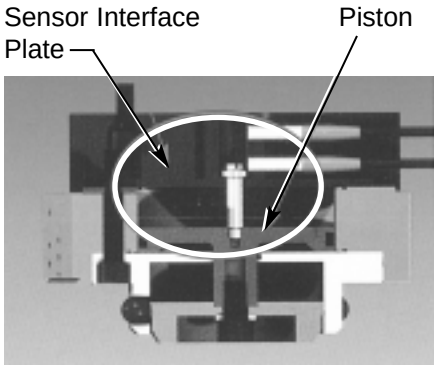


Figure 2

Section view of Figure 1 showing position of SIP system when locked without Tool Plate. Neither the lock nor unlock sensors are activated.

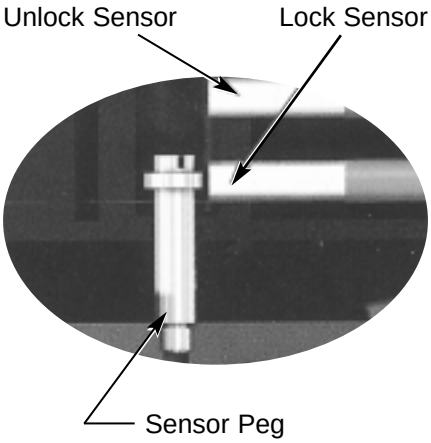


Figure 3

Close-up of SIP in lock position with the Tool Plate. Lock sensor activated by sensor peg.

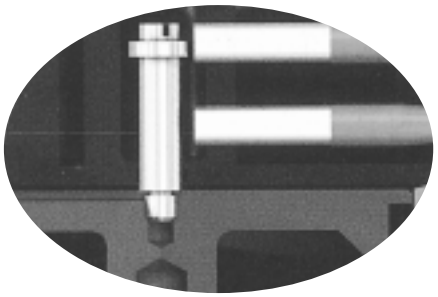


Figure 4

Close-up of SIP in unlock position. Unlock sensor activated by sensor peg. Lock sensor is not activated.