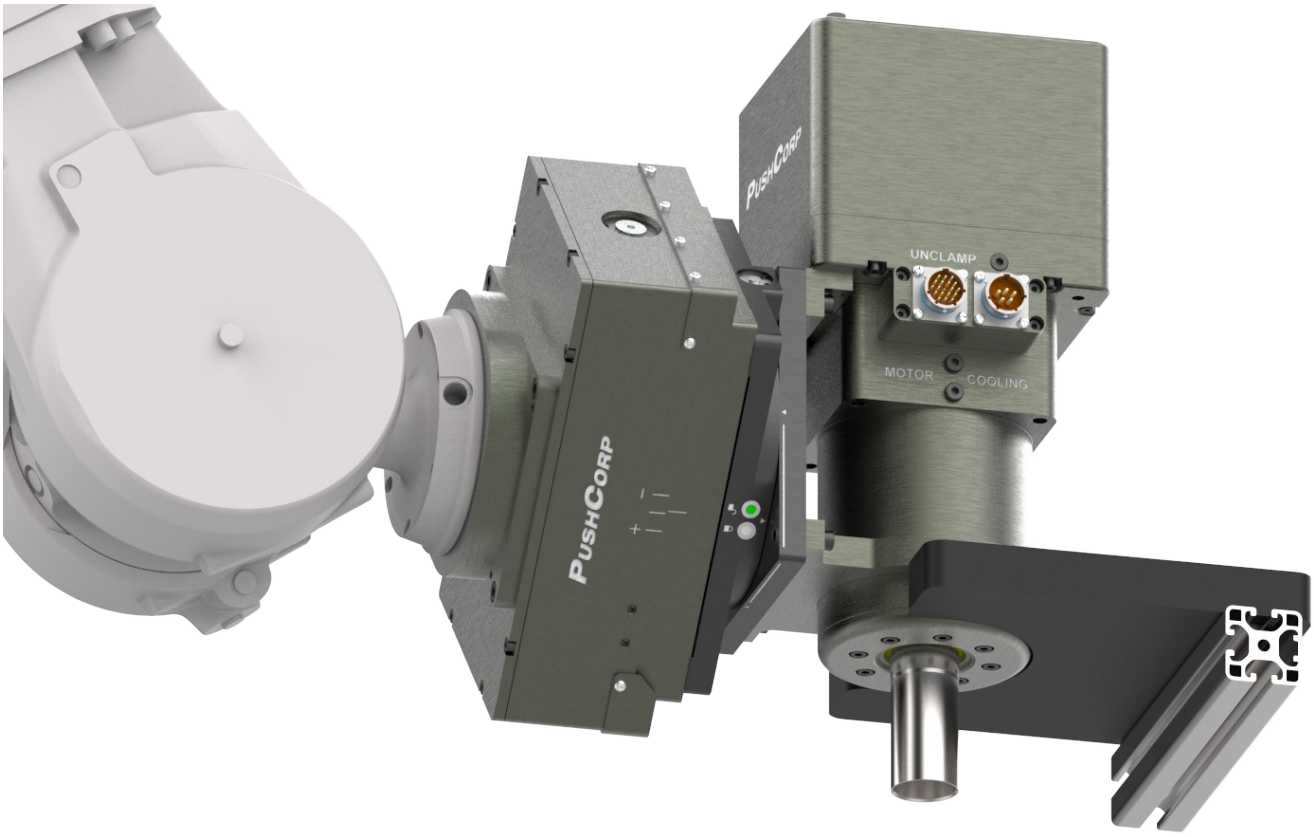
RI-90
Rotary Interface



Manual

PUSHCORP, INC.

Dallas, Texas

! CAUTION !

Do NOT apply air pressure to release the pivot plate locking mechanism unless the spindle is docked in the pivot plate.

DO NOT USE LUBRICATED AIR. This device requires a dry, non-lubricated 90-100 psi (6.2-6.9 bar) air supply filtered to 5 µm and a 0.3 micron oil mist separator.

Non-compliance with these requirements will void the manufacturer's warranty.

All fasteners, mounting holes, and pipe threads on this tool are METRIC.

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1.0 Limited Warranty

Duration:

One year from date of delivery to the original purchaser.

Who gives this warranty (warrantor):

PushCorp, Inc.
Telephone: (972) 840-0208

Corporate Address:
P. O. Box 181915
Dallas, Texas 75218

Shipping Address:
3001 W Kingsley Rd
Garland, Texas 75041

Who receives this warranty (purchaser):

The original purchaser (other than for purposes of resale) of the *PushCorp, Inc.* product.

What products are covered by this warranty:

Any *PushCorp, Inc.* industrial equipment or accessory supplied or manufactured by the Warrantor.

What is covered under this warranty:

Defects in material and/or workmanship which occur within the duration of the warranty period.

What is NOT covered in this warranty:

A. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANT-ABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO ONE YEAR FROM THE DATE OF ORIGINAL PURCHASE. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.
B. ANY INCIDENTAL, INDIRECT, OR CONSEQUENTIAL LOSS, DAMAGE or EXPENSE THAT MAY RESULT FROM ANY DEFECT, FAILURE, MALFUNCTION OF THE *PUSHCORP, INC.* PRODUCT. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you.
C. Any failure that results from an accident, purchaser's abuse, neglect, unauthorized repair or failure to operate the products in accordance with the instructions provided in the owner's manual(s) supplied with the product.

Responsibilities of the Warrantor under this warranty:

Repair or replace, at Warrantor's option, products or components which have failed within the duration of the warranty period.

Responsibilities of the purchaser under this warranty:

A. Deliver or ship the *PushCorp, Inc.* product or component to PushCorp, Inc. Service Center, Dallas, TX. Freight and insurance costs, if any, must be borne by the purchaser.
B. Use reasonable care in the operation and maintenance of the product as described in the owner's manual(s).

When warrantor will perform repair or replacement under this warranty:

Repair or replacement will be scheduled and serviced according to the normal work flow at the service center, and depending on the availability of replacement parts. Purchasers requiring quicker repair may receive such with payment of a *PushCorp, Inc.* predetermined expediting fee.

This Limited Warranty gives you specific legal rights and you may also have other rights which vary from state to state.

2.0 General Overview

The RI-90 Rotary Interface, known as the RI-90, enables a robot, along with a PushCorp compliant device and servo spindle to apply BOTH radial and axial forces in a single, easy setup. When mounted to any PushCorp compliance device, a robot utilizes the RI-90 Rotary Interface to change the orientation of a spindle relative to the applied force at any time during processing. Its clever design uses a simple and quick robot motion to rotate the spindle 90 degrees. This eliminates the need for costly and complex hardware to change out the end-of-arm tooling (EOAT) or for a separate robotic system entirely.

Instead, this compact, lightweight, and robust product simplifies the system completely. Externally mounted LEDs allow the user to visually verify the unit's locked status from a distance. Industrial standard digital outputs provide this locking as well as the positional status to the robot or PLC controller to ensure fail-safe operation. The RI-90's unique design brings an unprecedented level of flexibility and its purpose built design ensures maximum uptime for your material removal process.

3.0 Installation

3.1 Mounting to a PushCorp AFD compliant tool

The RI-90 is designed to be mounted to the carriage of any PushCorp AFD310/70 Force Device. The swivel mounts to the carriage via four (4) M6x1x25mm socket head cap screws. To mount the STC1503/0605 & SM1503/0605 to the AFD Swivel, first mount the hoop bracket to the swivel with two (2) M6x1x20mm socket head cap screws; repeat this process with the foot bracket and two (2) more M6x1x20mm socket head cap screws. Next locate the spindle in the hoop bracket and mount it to the foot bracket via two (2) M6x1x145mm socket head cap screws for the STC1503/0605, and two (2) M6x1x25mm socket head cap screws for the SM spindles. Finally secure the spindle within the hoop bracket by tightening the M6x1x25 socket head cap screw at the top of the hoop bracket.

CAUTION: Make sure that the M6x1 fasteners do not exceed a depth of 0.40" (10mm) into the AFD Carriage Helicoils or damage will occur.

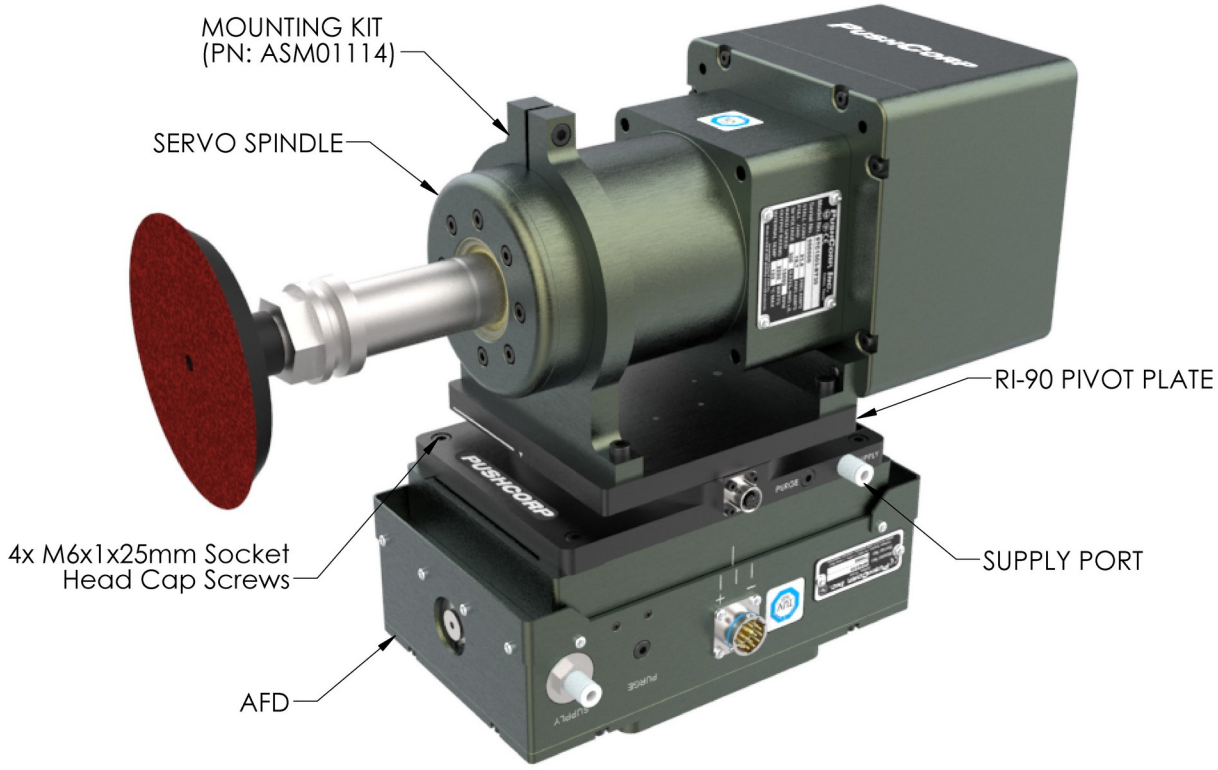

Figure 1: RI-90 AFD Mounting

3.2 Pivot Fork

The pivot fork is designed to work with the RI-90 to allow for the rotation from axial to radial force compliance, and radial to axial force compliance. It is critical that the fork be rigidly mounted, and be repeatably located if removed. To design a setup to mount the RI-90 pivot fork (ASM03692-1), refer to Figure 2 for the appropriate bolt pattern.

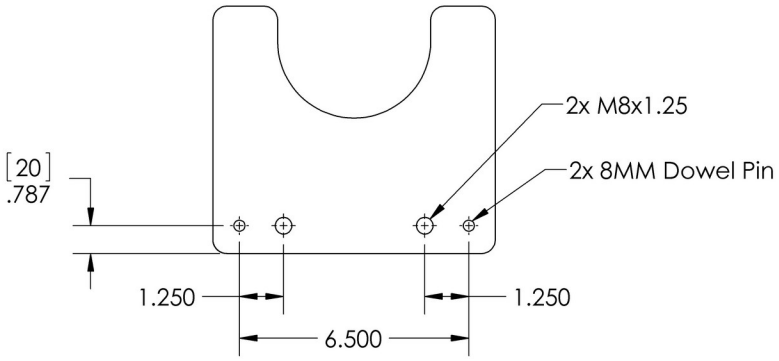

Figure 2: RI-90 Pivot Fork Hole Pattern Dimensions

An off the shelf mounting set up can be created via a Profile 12 item strut (Vendor: item; P/N: 0.0.001.06) and M12 T-slot nut (Vendor: item; P/N: 0.0.003.65); this will allow for accurate alignment with the 12MM dowel pins.

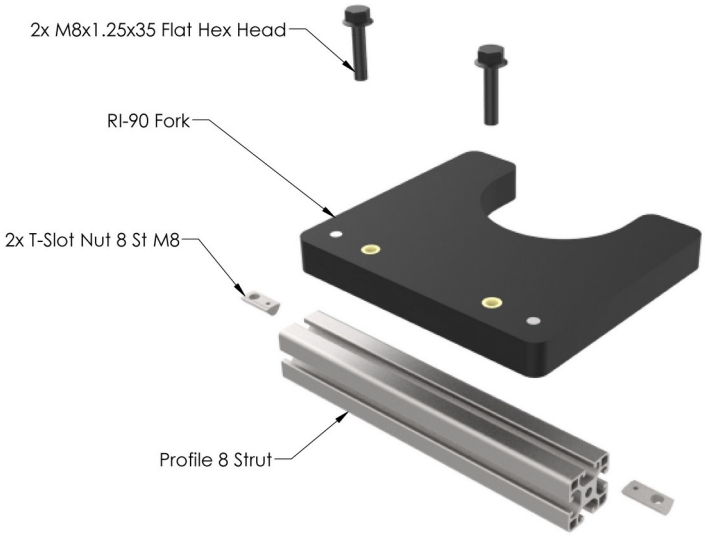

Figure 3: RI-90 Pivot Fork Mounting

3.3 Pneumatic Connection

The RI-90 requires a dry, non-lubricated, filtered air supply, with a minimum pressure of 90 psi (6.2 bar) and a maximum pressure of 100 psi (6.9 bar). Failure to provide air supply to these specifications can degrade performance and will void any warranty repairs concerning pneumatic components. If the supply air pressure is too low then the RI-90 will be unable to rotate. Not allowing the RI-90 to rotate will result in the inability to transition between axial and radial compliance. Exceeding the maximum air pressure could result in permanent damage to the RI-90.

The pneumatic supply system should be configured as shown in Figure 4. An electrically operated valve should be used to energize the RI-90 for rotating capability, and the valve must exhaust **ALL** line pressure when unenergized.

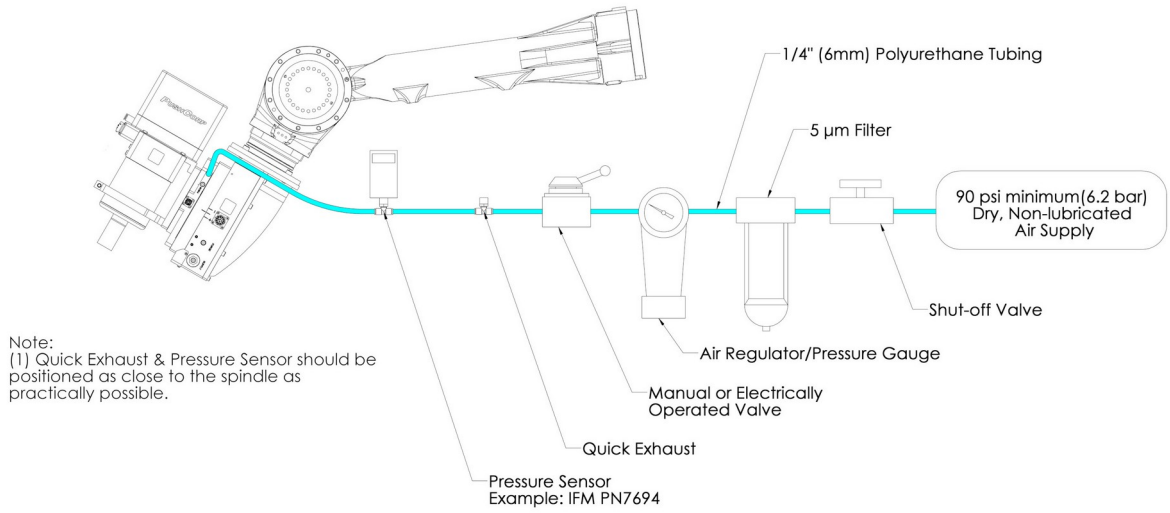

Figure 4: RI-90 Pneumatic Configuration

The RI-90 is provided with a ¼ inch and 6mm diameter tubing push-lock fittings for installation in the R1/8 (Metric) Supply Port located on the side of the RI-90 base plate. Remove the shipping plug and install the desired size push-lock fitting. If another type of fitting is desired, unscrew the existing fitting and replace it with any fitting having an R1/8 (Metric) thread. Be sure to use a thread seal product and do not over tighten the fitting.

The Supply Line to the device should be ¼ inch or 6mm diameter flexible polyurethane tubing. The tubing should be routed to the device such that there are no kinks and that there is plenty of slack to allow for manipulator motion. Before inserting the tubing into the RI-90 air fitting, open the Shut-Off Valve to blow out any

contaminates which may be in the Supply Line. The tubing can be pushed into the self-locking fitting located on the Base Plate. Charge the Supply Line with compressed air and verify that there are no air leaks and that there is a minimum of 90 PSI (6.2 bar) at the RI-90. If a minimum air pressure cannot be achieved, then an auxiliary air compressor or booster pump must be installed.

NOTE: PushCorp highly recommends the use of flexible polyurethane tubing as opposed to nylon tubing. This is because nylon tubing tends to crimp shut when it is bent.

To remove the Supply Line for service, first discharge air pressure in the RI-90, then while pushing inward on the fitting's plastic ring, simultaneously pull the tubing out. Cover or plug the self-locking fitting any time the Supply Line is not connected. This will keep contaminants from entering the RI-90.

4.0 Electrical Connections

The electrical connection is located next to the pneumatic connection shown below in Figure 5. The electrical connection is located next to the pneumatic connection shown below in Figure 5. This connection is an M12 8 Position A Code Connector. To wire the connector and the sensors as described throughout the manual, please refer to the wiring diagram shown below in Figure 6. The unit is powered with 24V using pin 2 and 7. Then the various states of the unit can be monitored via the 4 digital outputs by connecting them to a robot controller or PLC.

Figure 5: RI-90 M12 8 Position A Code Connector

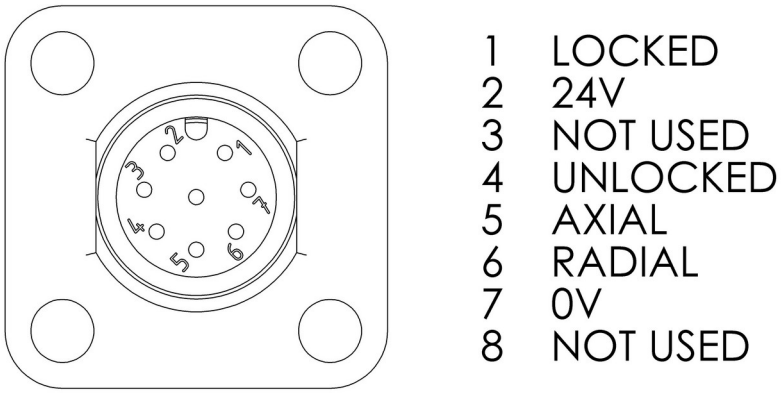

Figure 6: RI-90 Wire Diagram

Table 1: Electrical Connections

Pin	*Power*	*Output*	*Color*
1		LOCKED	WHITE
2	24V		BROWN
3	NC		GREEN
4		UNLOCKED	YELLOW
5		AXIAL	GREY
6		RADIAL	PINK
7	0V		BLUE
8	NC		RED

5.0 Operation

After ensuring proper electrical and pneumatic connections, and secure mounting, the RI-90 is ready to operate. If the application requires a different plane of force compliance follow the following steps to either transition from axial to radial force compliance, or radial to axial force compliance.

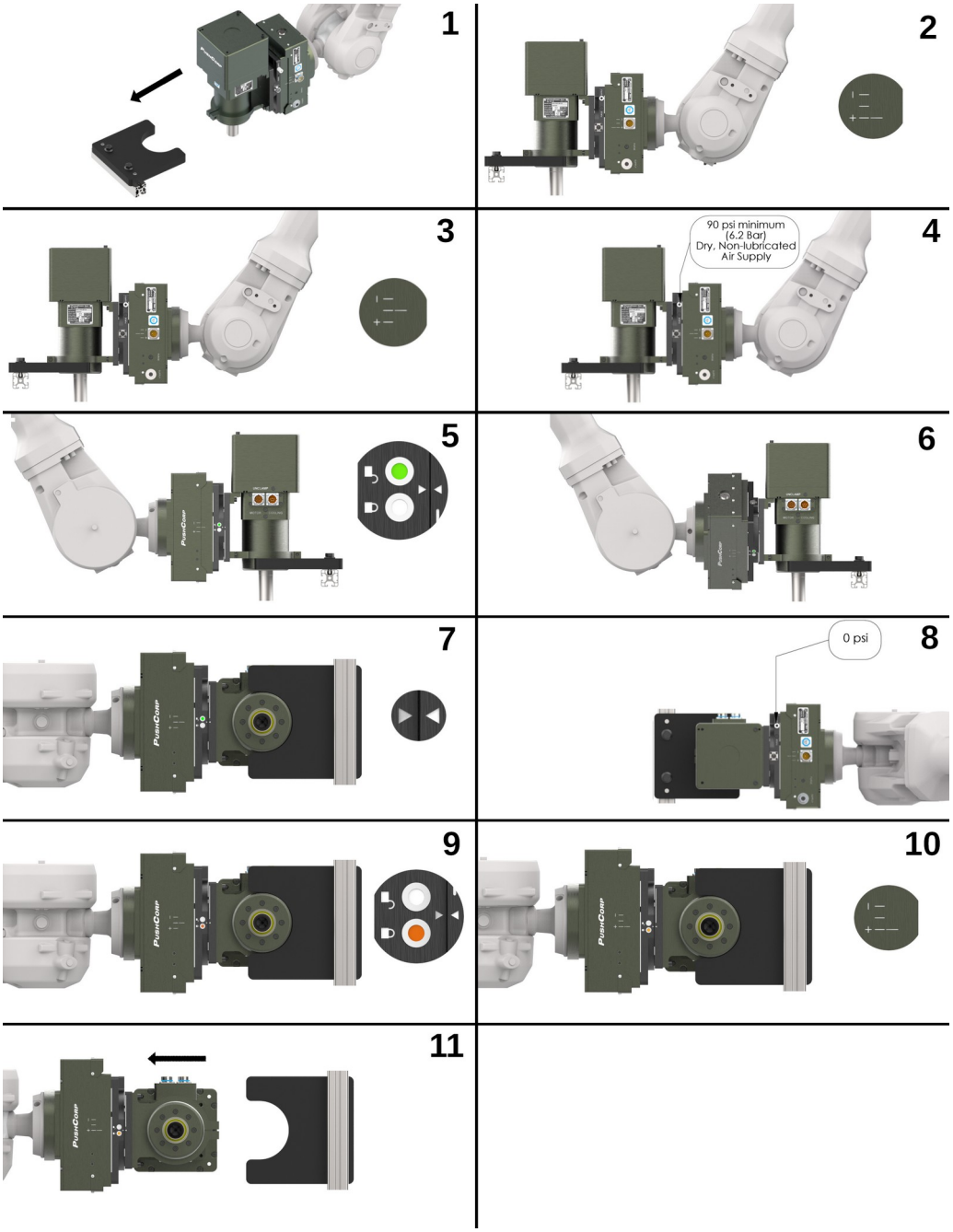

Figure 7: RI-90 Rotation Sequence

1-2	Dock the spindle into the tool fork based on axial or radial force compliance orientation
3	Move the AFD to the middle of the compliance stroke
4	Apply 90-100 PSI to the supply port
5	Verify the RI-90 has unlocked via the output LED and IO signal
6-7	Rotate 90 degrees following the path of the white line located on the stationary RI-90 pivot plate, until the arrows are aligned
8	Release the 90-100 PSI
9	Verify the RI-90 has locked via the output LED and IO signal
10	Move the AFD to the end of the compliance stroke
11	Retract out of the tool fork and proceed to perform the spindle tool change

6.0 Technical Specifications

Model:	RI-90
Range of Motion:	90 Degrees
Power:	24V +/- 10% 1 Amp Max
Tool Weight:	4.4 lbs (2 kg)
Led Status:	Green - Unlocked Orange - Locked

Specifications subject to change without notice. These values are based on measurements taken in a laboratory environment. Real-world results may be degraded due to external factors beyond PushCorp's control.

Fastener Tightening Torque Specs					
Fastener Size	Torque			Minimum Depth	
	in-lbs	ft-lbs	N-m	In	mm
M6x1	140	11.7	15.8	0.25	6.3
M12x1.75	1224	102	138.3	0.43	11

7.0 Preventative Maintenance Schedule

It is highly recommended to adhere to the preventative maintenance schedule in order to help extend the longevity of the specified PushCorp, Inc. equipment. Failing to do so could cause a loss in functionality as well as a decrease in product life.

PushCorp, Inc. RI-90			
Maintenance	**Weekly**	**Monthly**	**3 Months**
Remove debris from RI-90	X		
Check that the connectors are not bent/damaged	X		
Check to see if RI-90 locks and unlocks easily and smoothly	X		
Check for flow in the pneumatic supply port		X	

Agency/Organization: _____

Date Completed: _____