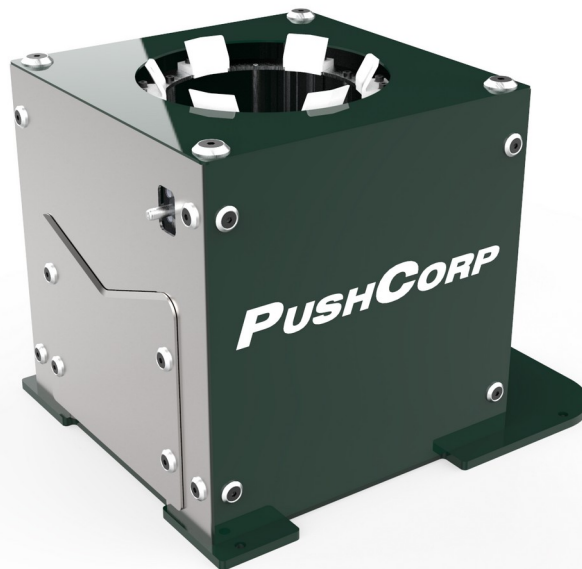


# ***RPC100- 75/125/150***

## **Robotic Paper Changer User Manual**



***PUSHCORP, INC.***

**Dallas, Texas**

October, 2020

## **CAUTION**

**The Robotic Paper Changer  
contains calibrated electronics.  
HANDLE WITH CARE DO NOT DROP**

## **DO NOT USE LUBRICATED AIR.**

**This device requires a dry, non-lubricated 43.5 to 72.5 psi (3 – 5 bar) air supply filtered to 5  $\mu$ m and a 0.3 micron oil mist separator.**

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

**(See Section 4.3)**

**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.* Robotic Paper Changer or Robotic Paper Changer 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 *PushCorp, Inc.* Robotic Paper Changer or RPC100 provides an efficient and robust method to change abrasive sanding discs for finishing applications with the use of a robot and Random Orbital Sander. The RPC100 can allow a robot to change 75mm (3"), 125mm (5"), or 150mm (6") paper autonomously through the application of pneumatic actuators, sensors, and removal blade within the RPC100. When purchasing, the disc size must be specified: RPC100-75 for 75mm (3") discs, RPC100-125 for 125mm (5") discs and RPC100-150 for 150mm (6") discs.

The RPC100 is comprised of a blade for removing the paper from a hook and loop pad, a cylinder for applying the paper to the pad and sensors to verify that the process is completed successfully. Worn sanding discs are removed from the hook and loop backing pad using an adjustable blade mounted to the side of the unit. The RPC100's blade can be set to accommodate any grit of abrasive disc by stacking shim washers based on the thickness and grit. The paper changing process is validated with the utilization of a probe sensor, which is calibrated to send a 24V signal indicating that the paper has been successfully removed. This signal can be used as an indicator in the robot program to proceed to the paper changing process. A pneumatic cylinder provides a repeatable force to consistently apply new paper to the backup pad. The design of the RPC100 allows concentric placement on the ROS so the paper is aligned everytime. This is achieved with guides that center the disc in relation to the pad. Sensors can be set to send 24V signals when paper is low and/or completely out.

To operate the RPC100, electrical and pneumatic connections are required. The electrical connection on the RPC100 is a male "A-code" M12 8pin connector. Power as well as digital inputs and outputs are all fed through this single connection. The pneumatic connection is a 1/4" or 6mm line that connects to a solenoid valve. With a 24V signal the solenoid is actuated causing the cylinder to extend. It is imperative that the air connection is filtered, non-lubricated, and has air pressure ranging from 43.5 to 72.5 psi (3 – 5 bar). It is recommended that the RPC100 is securely mounted to the RPC100 Base with the appropriate bracket both designed and manufactured by PushCorp, Inc.

### **3.0 Quick Start**

This section contains step-by-step instructions on how to quickly get the RPC100 up and running for a test of its capabilities. Complete details on all the features are described in the sections that follow. It is recommended that the user read the entire manual before operating to fully understand all the aspects and features of the RPC100.

Step 1: Carefully unpack the RPC100 and verify that all parts indicated on the packing list are present and in good condition. If there is a problem, please notify the factory immediately so that corrective action may be promptly initiated.

Step 2: Securely attach adapter plate to the RPC100 plate as shown in figure 1.

Step 3: Mount the RPC100 to the RPC100 adapter plate

Step 4: Connect a dry, non-lubricated, 5 $\mu$ m filtered 43.5 to 72.5 psi (3 to 5 bar) air supply to the RPC100 per Section 4.2.

Step 5: Connect female "A-code" M12 8pin cable to the RPC100 unit and hardwire the connections per figure 10 in Section 6

Please read the following sections to learn the full potential and features of the PushCorp RPC100 Pad Changer Device.

## 4.0 Installation

### 4.1 Mounting Process Equipment

While not necessary, it is recommended that the RPC100 is securely mounted atop the RPC100 Pedestal with a PushCorp designed mounting bracket. The bracket is mounted to the RPC100 Adapter Plate with four M8 cap head fasteners; the RPC100 is then mounted to the bracket with four M8 cap heads.

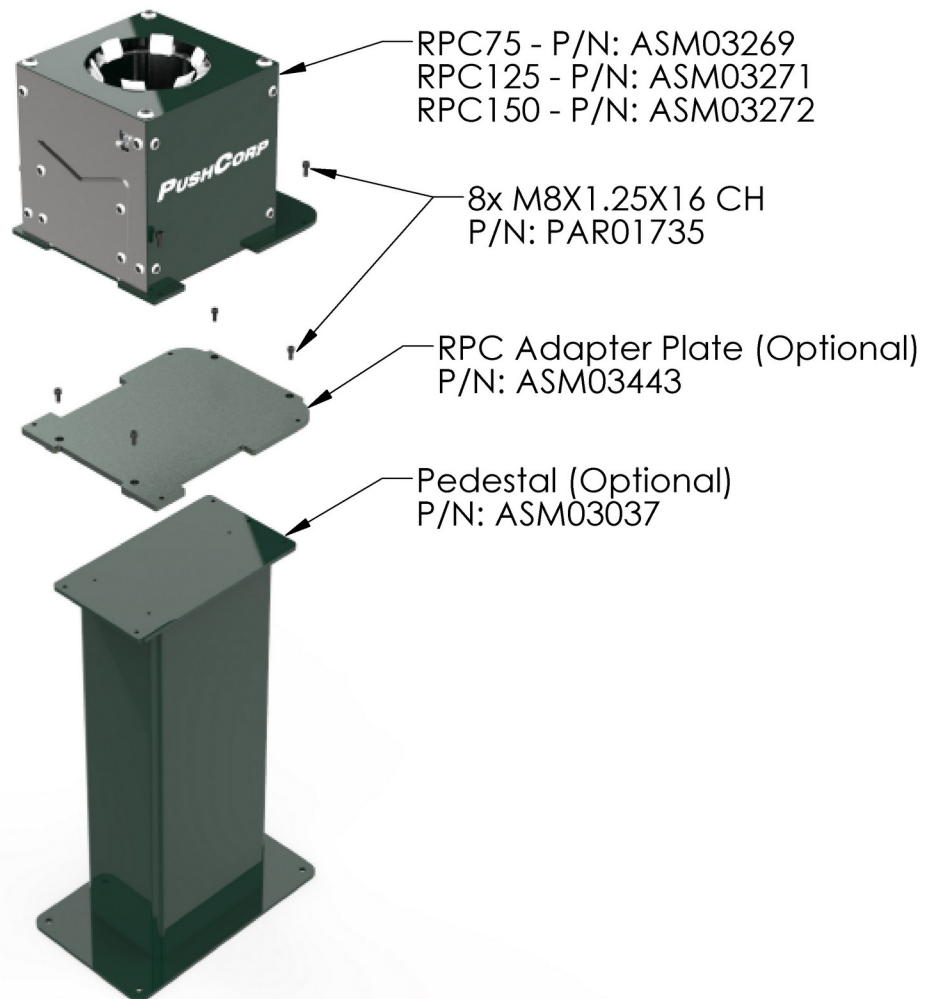


Figure 1: RPC100 Mounting Assembly



The bolt pattern on the adapter plate is designed for M8 fasteners with all tapped through holes. The outline shown in Figure 2 shares its perimeter with the RPC100 and RPC100 Base plate. This is critical because it allows the discarded paper to fall through without interfering with the operation of the pad changing device. There are three cutouts that allow for the orientation of the blade to be configured based on your cell layout. The unit will ship with it configured as shown in Figure 6.

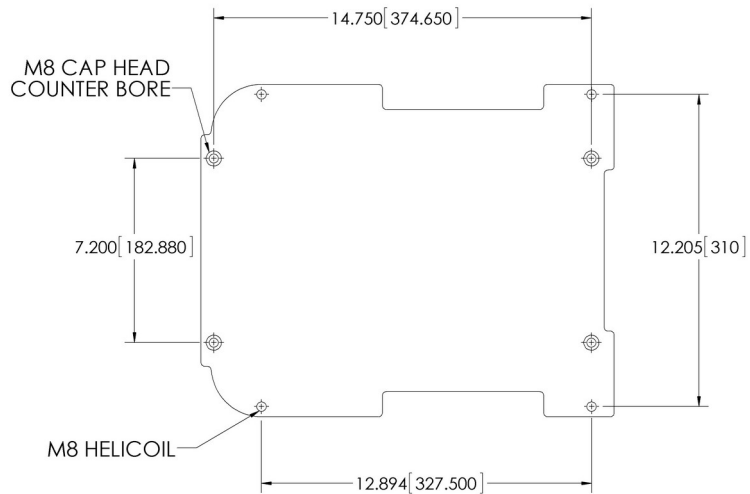


Figure 2: RPC Adapter Plate

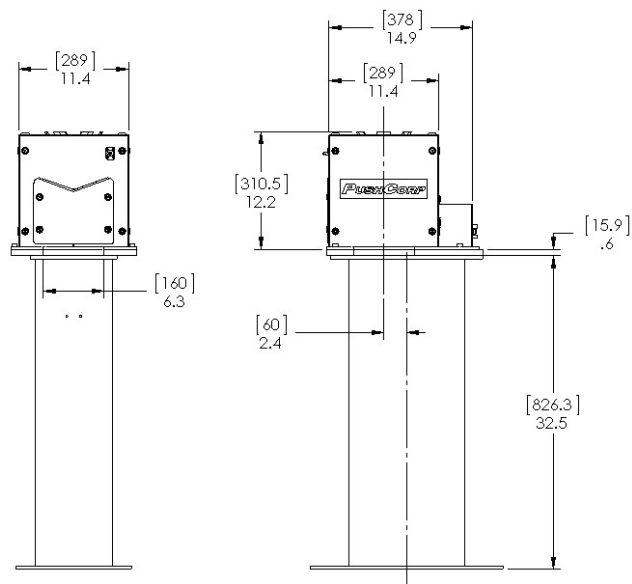


Figure 3: RPC Overall Dimensions

## 4.2 Pneumatic Connection

The RPC100 requires a dry, non-lubricated, 5µm filtered, 43.5 to 72.5 psi (3 – 5 bar) air supply. Failure to provide supply air to these specifications can degrade performance and will void any warranty repairs concerning pneumatic components. Filtered air is required since this actuates the cylinder thus moving the paper into the appropriate paper changing position. As a result, this component cannot tolerate ANY foreign material in the supply air. Additionally, a minimum 43.5 psi (3 bar) air pressure must be maintained at the supply air port for the device to operate within published specifications. Operating at lower air pressure can cause inferior performance and possibly failure. The pneumatic supply system should be configured as shown in Figure 4.

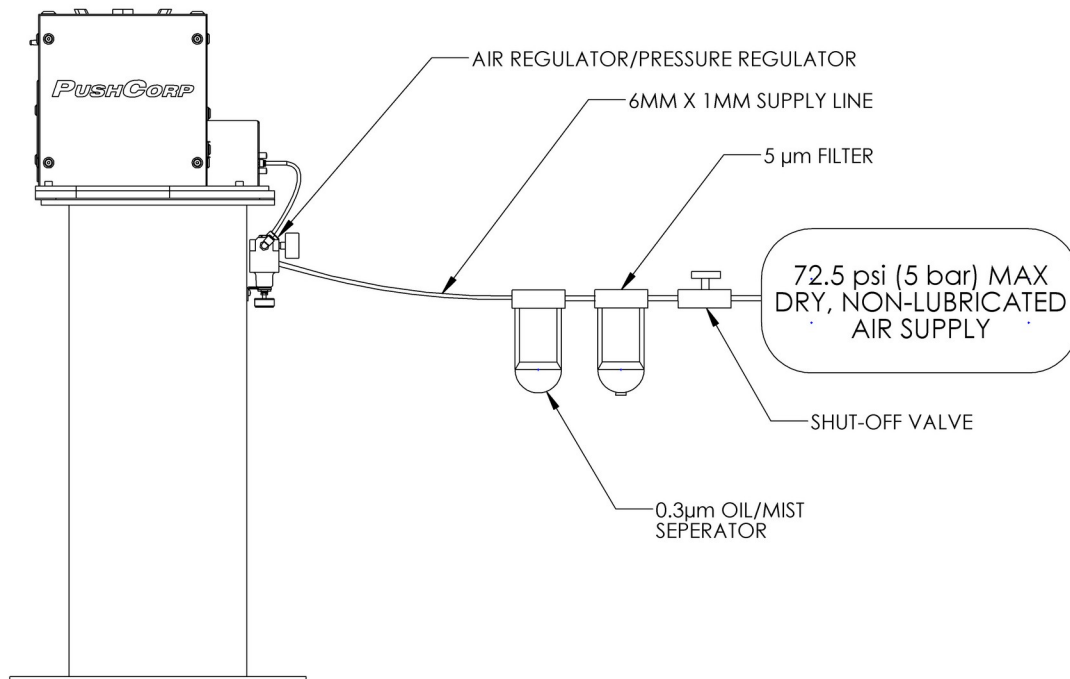


Figure 4: Pneumatic configuration

If water condensation is a problem in your air supply system, an air dryer device is highly recommended. The ideal solution is an industrial chiller dryer capable of reducing the dew point to less than 32 F (0C). Moisture inside the cylinder will cause premature failure that will not be covered under warranty.

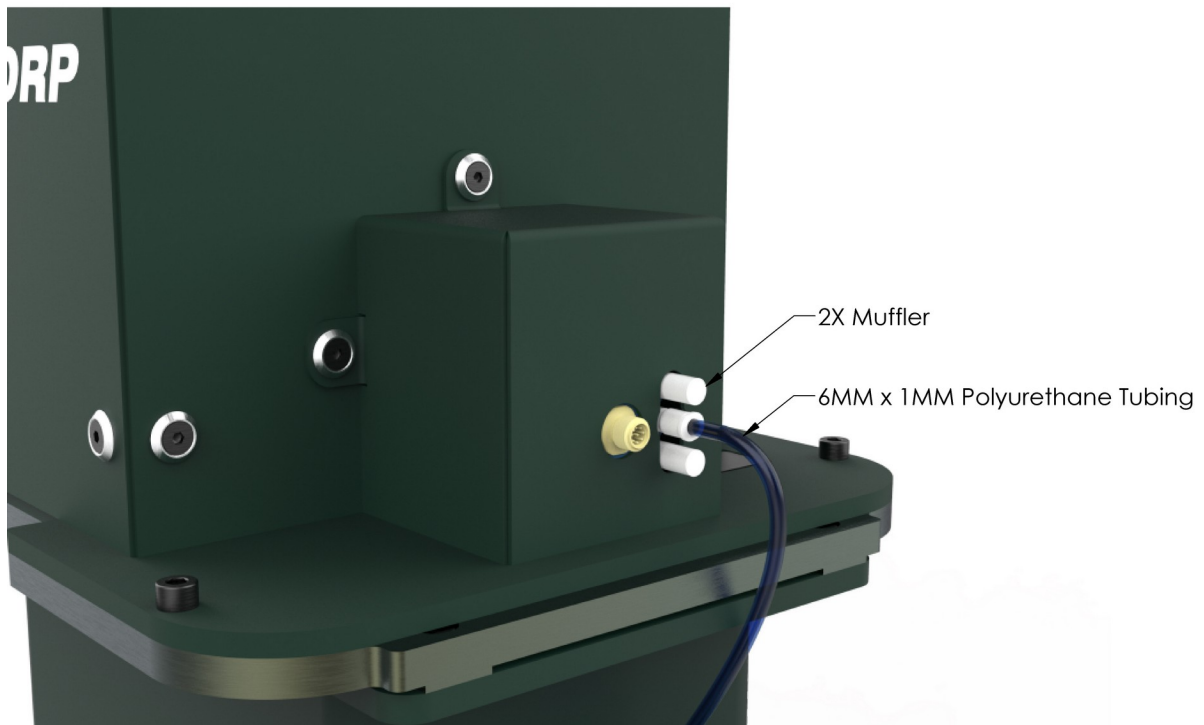


Figure 5: RPC100 Air Connections

The Supply Line to the device should be 1/4 inch (wall thickness 3/64 inch) or 6mm (wall thickness 1 mm) diameter flexible polyurethane tubing. The tubing should be routed to the RPC100 such that there are no kinks. Before inserting the Supply Line into the air fitting, open the Shut-Off valve to blow out any contaminants which may be in the line. The tubing can now be pushed into the self-locking fitting located on the side of the RPC100. Charge the Supply Line with compressed air and verify that there are no air leaks and that there is a minimum of 43.5 PSI (3 bar).

**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. This severely limits air flow and can cause inadequate pressure to the cylinder.**

To remove the Supply Line, first discharge all air pressure in the system, 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 any contaminants from entering the RPC100.

## 5.0 Operation

After ensuring proper electrical and pneumatic connections, secure mounting, and a magazine full of abrasive discs, the RPC100 is ready to operate. The amount of discs in the magazine varies based on the grit of the paper, but can be determined by placing discs into the unit while the cylinder is not pressurized. These can be stacked until they reach the bottom of the six white guides at the top of the unit. A typical random orbital sander and force control setup can be seen in Figure 6.

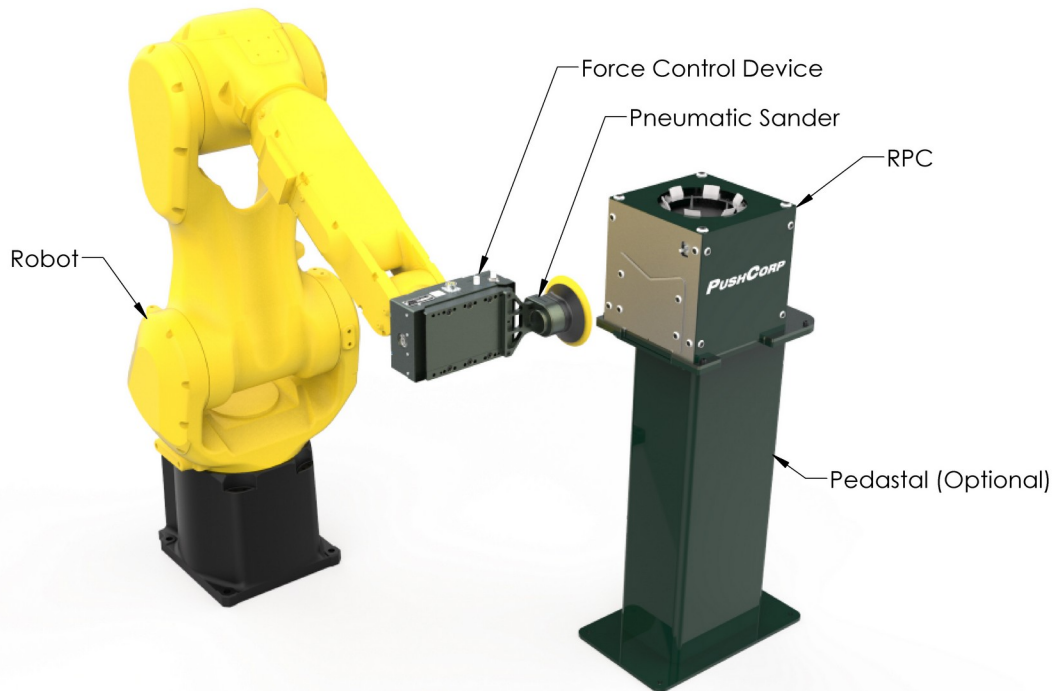


Figure 6: RPC100 Full Assembly

If the sander does not have a sanding disc, the first step is to program a robot point where the pad is parallel with the bottom of the white guides shown in Figure 7. These guides will center the sanding pad due to its eccentricity and help ensure that the pad and disc are concentric with each other.

Note: The magnetic sensors attached to the air cylinder are set at the fully retracted (bottom sensor – pin 3) and extended position (top sensor – pin 4). If pin 4 is on then the unit is out of paper.

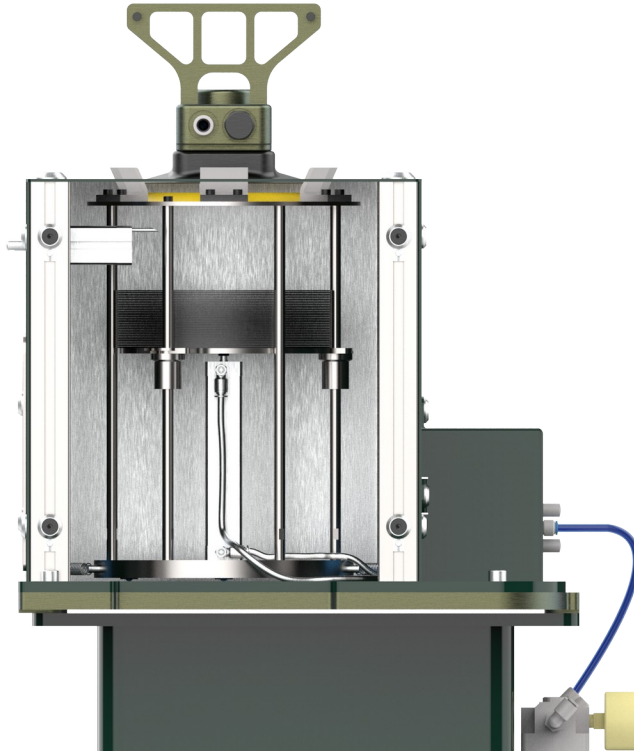


Figure 7: RPC100 Pad Retrieval - Retracted

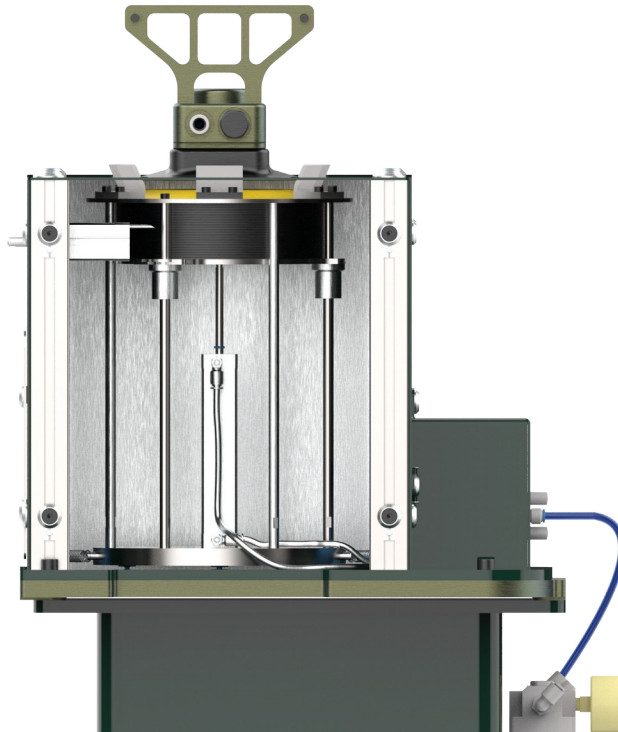


Figure 8: RPC100 Pad Retrieval - Extended

To actuate the air cylinder that raises the magazine, a 24V signal is sent to the pneumatic sensor via pin 6 of the electrical connector. This will raise the magazine to allow for the disc to engage with the hook and loop pad.

When the abrasive is worn, these are the steps that must be taken to ensure its removal. The removal process occurs using the blade shown below in Figure 9. The blade can be adjusted depending on sanding disc grit/thickness to allow for a complete transition through the channel. This height can be set using shim washers shown below.

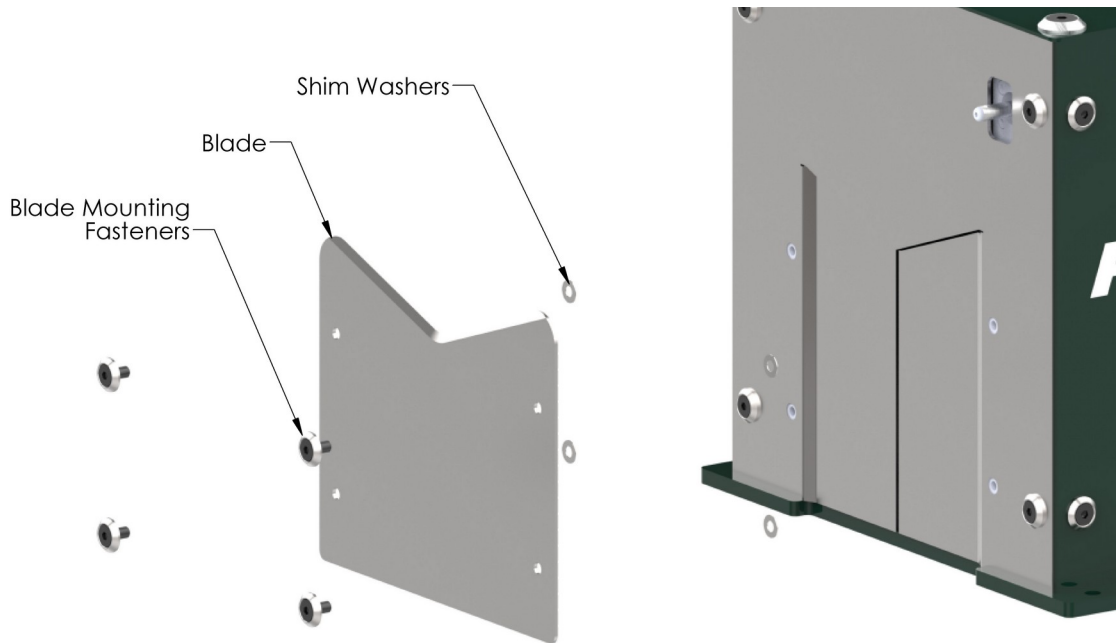


Figure 9: Shim Washer Stack Up

The first robot point will be flat against the body of the paper changer and tangent with the blade's edge.

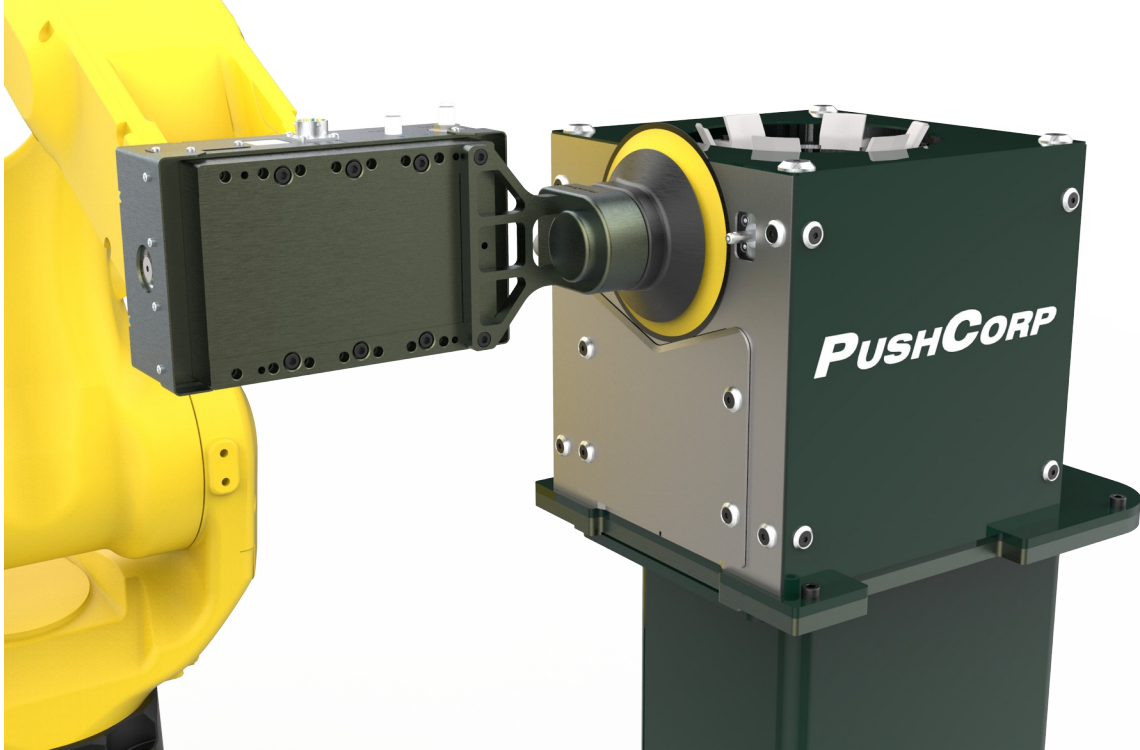


Figure 10: RPC100 Pad Removal

Then, move the pad down towards the ground so the paper is halfway into the blade as shown in the Figure 8b. Next, create another point so the paper is  $\frac{3}{4}$  of the way into the blade and the pad is at a roughly 5 degree angle. The final step will be a quick downward motion maintaining the 5 degree angle. This is to prevent the paper from getting pinched by the blade. The speed to achieve this can vary based on grit, but a good starting point is 75 mm/s.

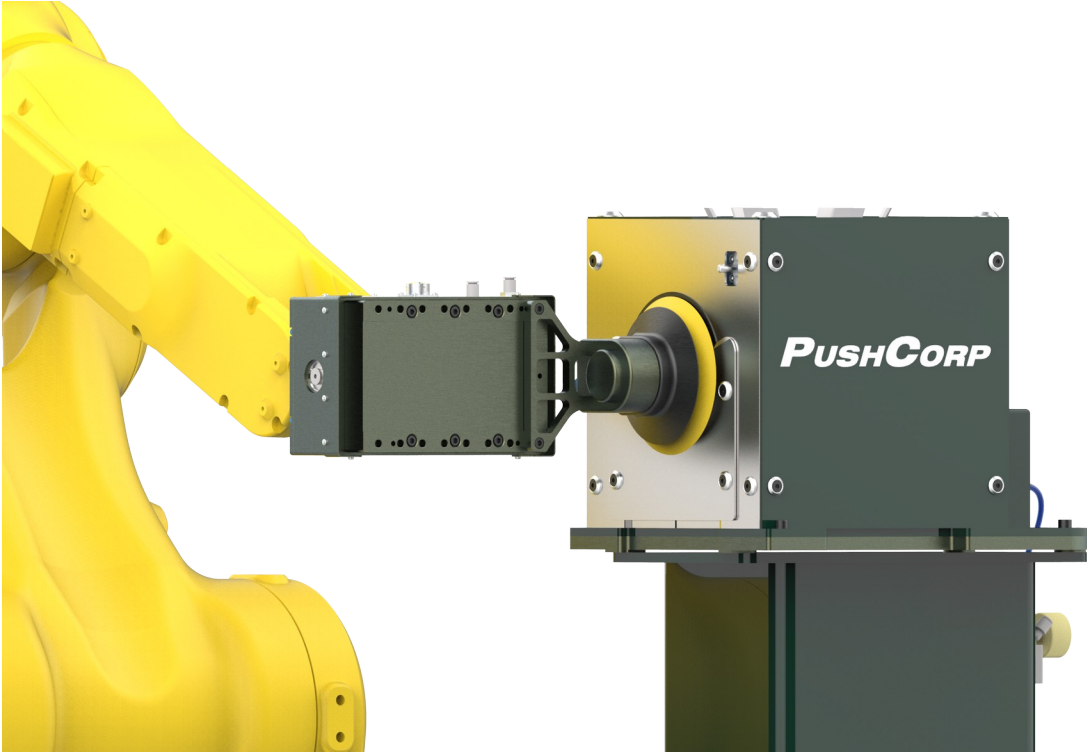


Figure 11: RPC100 Pad Removal

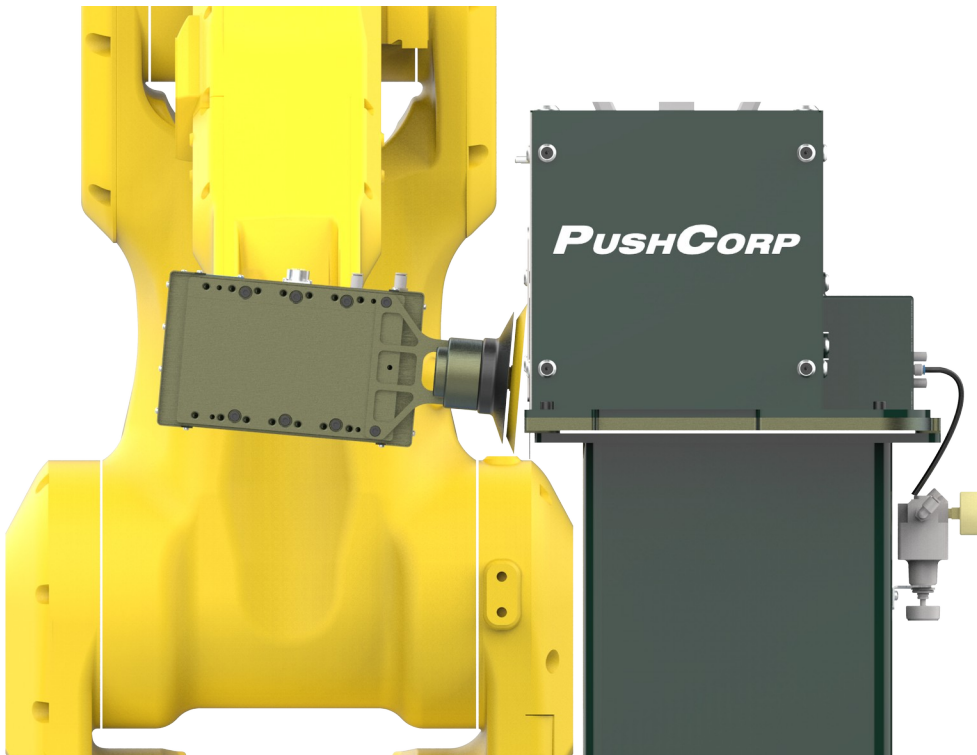


Figure 12: RPC100 Pad Removal



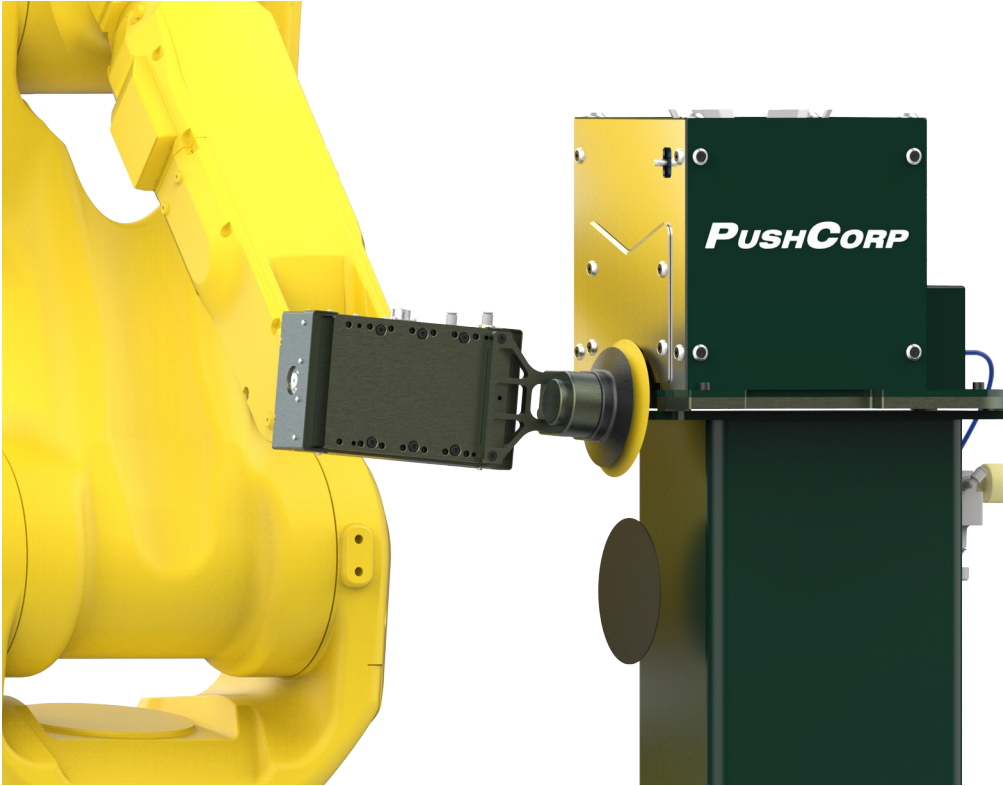


Figure 13: RPC100 Pad Removal

To ensure the paper has been applied or removed properly a probe sensor is used to validate the process. This is a spring loaded probe sensor, which is shown in Figure 14. The pad must have a counter bore at its center to allow for proper sensor detection. There are several off the shelf options that can be purchased from your abrasive distributor. Please refer to the following table for necessary counter bore size:

Orbit Size	Counter Bore Diameter
0	9mm
9.5mm (3/8")	20mm
4.8 mm (3/16")	15mm
2.4 mm (3/32")	13mm

For the validation process a single point is programmed on the robot. This is done without a disc on the backup pad. Program the point so that the touch probe is inside of the counter bore of the backup pad as described above. You will want to center this point with the rotation of the spindle shaft so that regardless of the eccentricity the probe will not be touched. Then, If the pad has paper it will press the touch probe and a 24V signal is sent to pin 5 of the electrical connection indicating that disc is present. Otherwise, a signal will not be sent if there is no paper present.

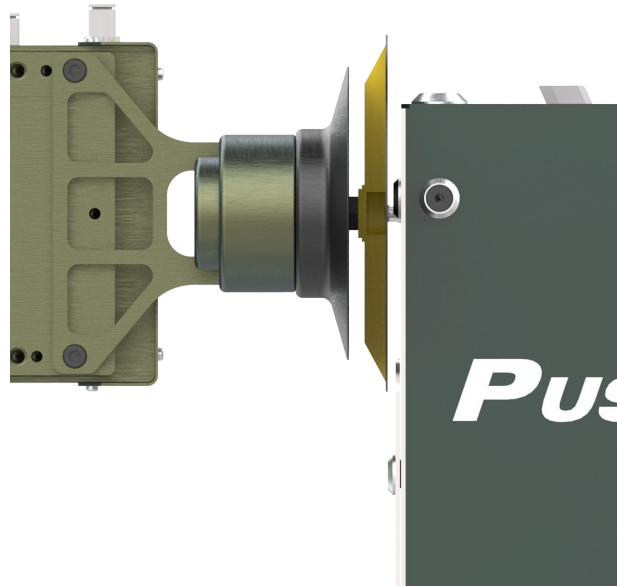


Figure 14: RPC100 Sensor with Paper

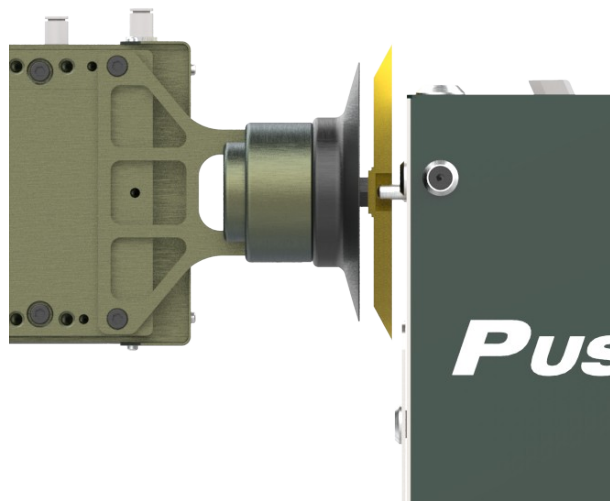


Figure 15: RPC100 Sensor without Paper

## 6.0 Electrical Connections

The electrical connection is located next to the pneumatic connection shown below in Figure 16. To wire the connector and the sensors as described throughout the manual, please refer to the wiring diagram shown below in Figure 17.

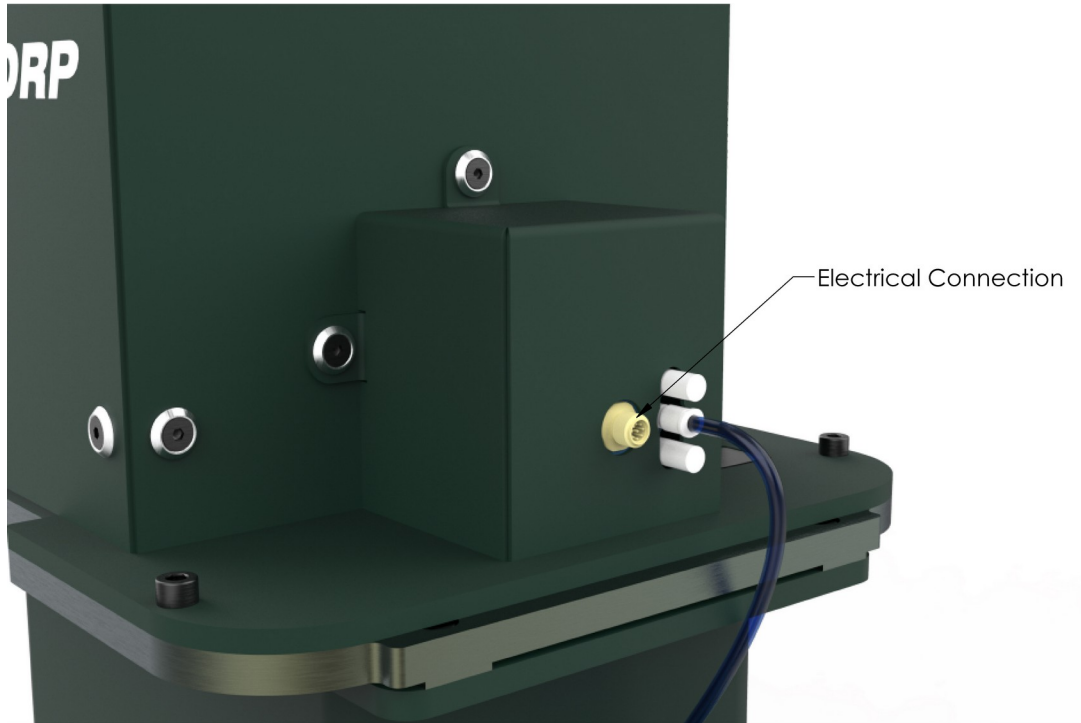
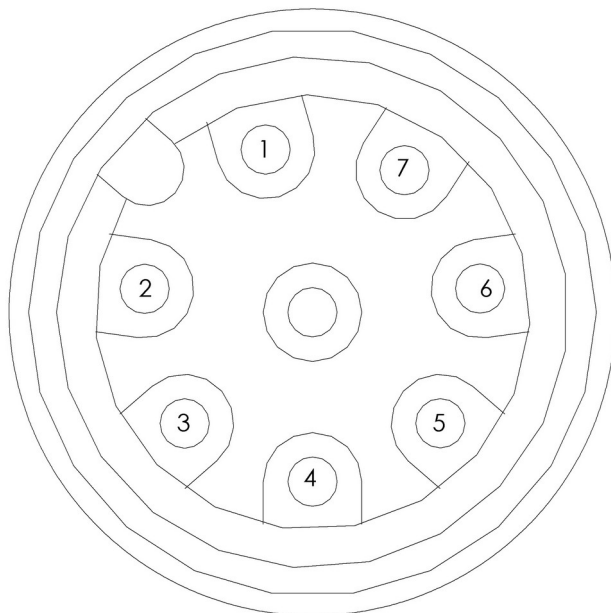


Figure 16: Male "A-code" M12 8pin Connector



### Wiring Diagram

- |   |                             |
|---|-----------------------------|
| 1 | 24V                         |
| 2 | 0V                          |
| 3 | Magnetic Sensor Bottom (IN) |
| 4 | Magnetic Sensor Top (IN)    |
| 5 | Probe Sensor (IN)           |
| 6 | Pneumatic Valve (OUT)       |
| 7 | Not Used                    |
| 8 | Not Used                    |

Figure 17: RPC100 Wiring Diagram

## 7.0 Technical Specifications

Disc Size:	3",5" or 6"
Power:	24VDC 1.5A
Weight:	16.2 lbs. (7.4 kg)
Temperature:	0° to 122° F (10° to 50° C)
Humidity:	5% to 95%, Non-Condensing
Supply air:	Non-lubricated, Dry, 5µm Filtered, 43.5-72.5 psi (3-5 bar) 2 SCFM (56 l/min)

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
M8 x 1.25	348	29.0	39.3	0.33	8.4

## 8.0 Spare Replacement Parts

Part	Description	P/N
RPC Blade	Paper Removal Blade	PAR05181
Sensor Screw	M4 Thread; 0.7mm Pitch; 8mm Length; Button Head	PAR01037
Guide Wiper	3D Printed; Pad Guide to RPC	PAR05026
RPC Front Panel	Blade Mounting Panel	PAR05180

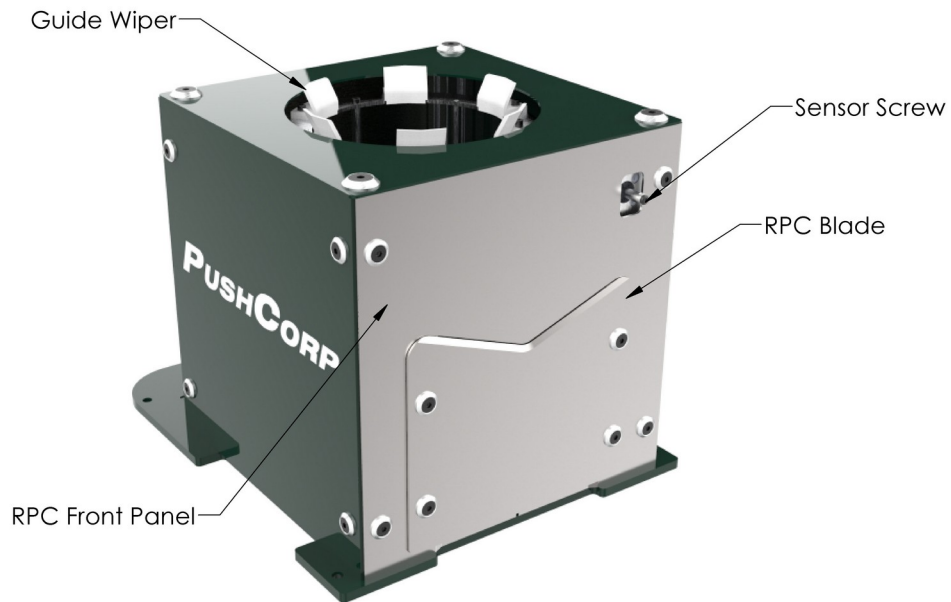


Figure 18: Spare Replacement Parts

## 9.0 Preventative Maintenance Schedule

It is highly recommended to adhere to the preventative maintenance schedule in order 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.

<b>PUSHCORP, INC. AFD</b>			
<b>Maintenance</b>	<b>Weekly</b>	<b>Monthly</b>	<b>3 Months</b>
Remove debris from RPC100	X		
Check that the connectors are not bent/damaged	X		
Check to see if the magazine moves back and forth easily and smoothly	X		
Check for flow in the pneumatic supply port		X	

Agency/Organization: \_\_\_\_\_

Date Completed: \_\_\_\_\_