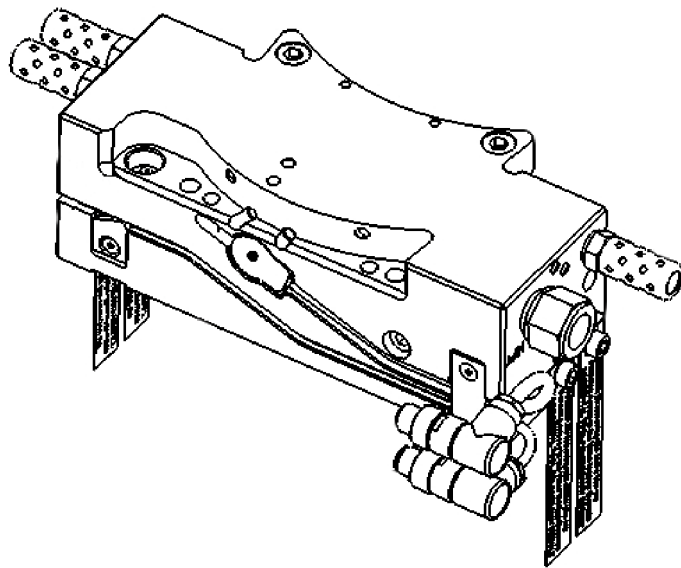


# Valve adapter

## JR4

### Assembly and Operating Manual



## Imprint

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Reg. No. 003496 QM08



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## 1 Description

The JR4-M valve adapter provides a pneumatic air supply to the Tool Changer Master for actuation of the locking mechanism. The valve adapter employs dual double-solenoid valves to provide redundant protection against unintended tool release, refer to [\(☞ 1.1, Page 5\)](#) for a detail description. The JR4 is equipped with sensors to monitor the solenoid valves for detection of failure of either valve. Solenoid valve 1 is monitored using a pressure sensor and solenoid valve 2 is monitored using a proximity sensor. Refer to [\(☞ 1.2, Page 7\)](#) for additional information. The valve adapter when used in combination with the DL5 Control/Signal Module, satisfy the PL d safety reliability level in accordance with ISO standard 13849-1. The valve adapter mounts to the Master body of the Tool Changer. A JR4-T spacer module is required to align the DL5 Master and Tool modules and mounts to the Tool body of the Tool Changer. The JR4-M valve adapter provides a single ¼ G air port for the customer supplied pneumatic connection. The solenoid valve and sensor electrical connections are integrated into the valve adapter. See figure "Valve Adapter and Spacer Module" and [\(☞ 7, Page 21\)](#) for more details.

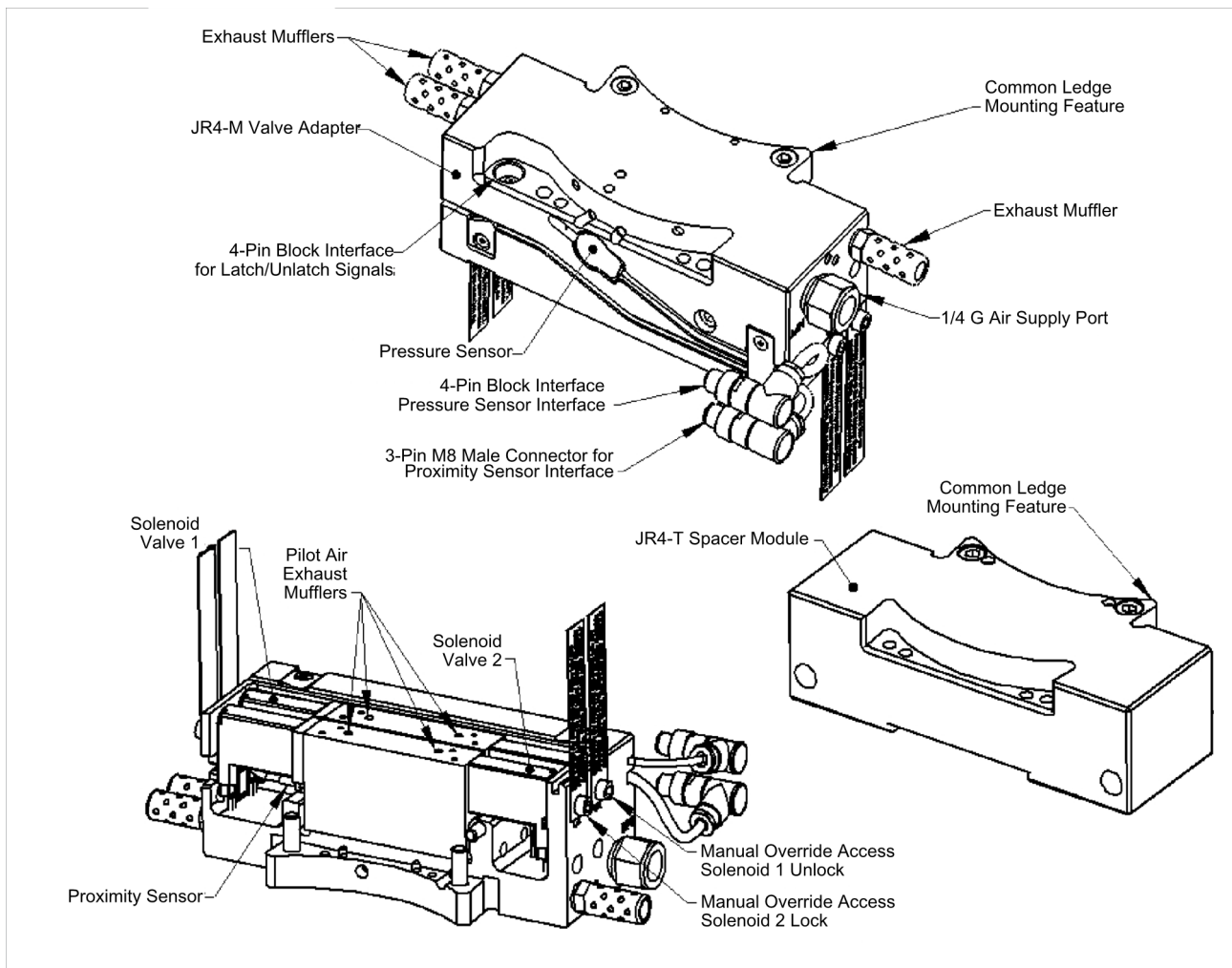


Fig. 1 Valve Adapter and Spacer Module

## 1.1 Dual Double-Solenoid Valve Function

The Dual Double-Solenoid Valve Adapter employs two double-solenoid valves. The valves are incorporated in a pneumatic circuit that is designed to reduce the probability of an unintended unlatch of the Tool Changer. If any one of the valves was to fail the Tool Changer would remain latched. The pneumatic circuit is designed in such a way that both valves must be in the Unlatch position before the Tool Changer will unlock. The valves remain in their current position when the solenoids are de-energized. The dual double-solenoid valves have pilot exhaust ports, which are exhausted separately from the primary exhaust (not shown in the circuit diagrams).

The figure below shows the Tool Changer in the Locked position when the latch command has been provided by the robot. The air is supplied to the locking mechanism through valve 1 and air is exhausted through valve 2. At this point the pressure sensor should be nearly zero indicating that valve 1 is functioning properly and the proximity sensor output should be high indicating that valve 2 is functioning properly. The output from these sensors is provided to the DL5 Control/Signal Module to be evaluated to determine if it is safe to latch or unlatch the Tool Changer or if a valve failure has occurred. Once the data has been verified and the Tool Changer has locked, the latch signal to the valves is turned off.

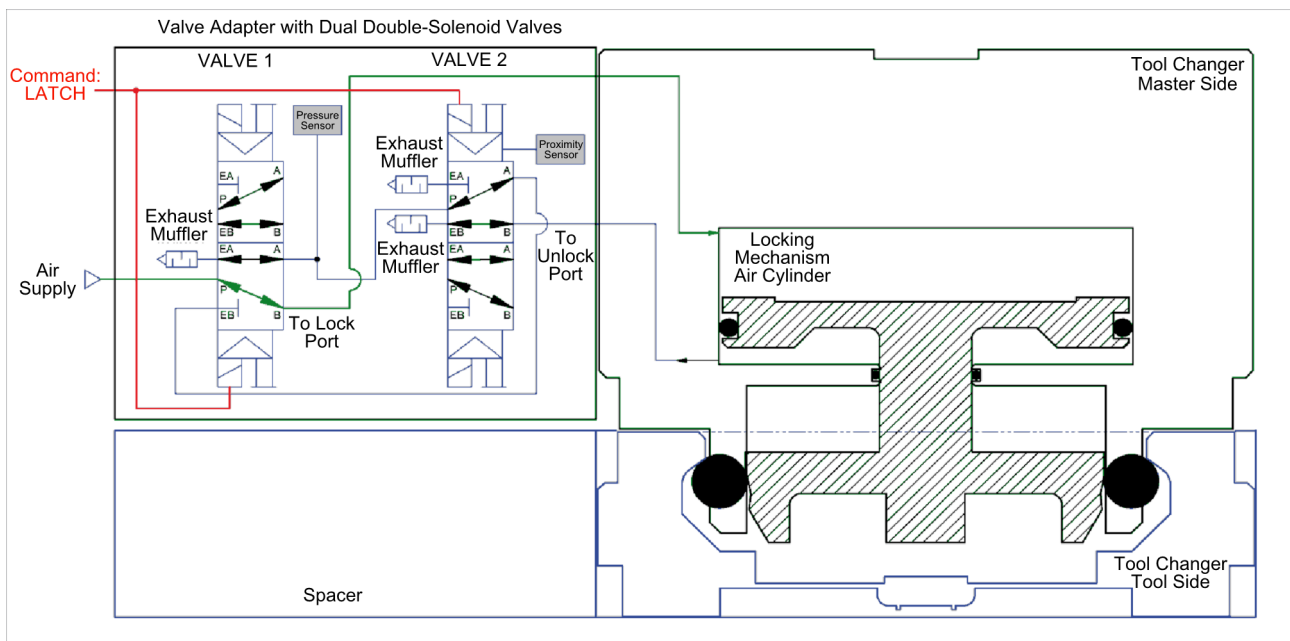


Fig. 2 Dual Double-Solenoid Valve Adapter Pneumatic Circuit in Latched Position

A separate unlatch command is provided to each solenoid valve in accordance with the requirements of a dual-channel safety system. At this point the pressure sensor should measure a pressure equivalent to the supply air pressure indicating that valve 1 is functioning properly and the proximity sensor output should be low indicating that valve 2 is functioning properly. Once the data has been verified and the Tool Changer has unlocked, the unlatch signal to the valves is turned off. The Master can now move away from the Tool. Refer to figure "Dual Double-Solenoid Valve Adapter Pneumatic Circuit in Unlatched Position".

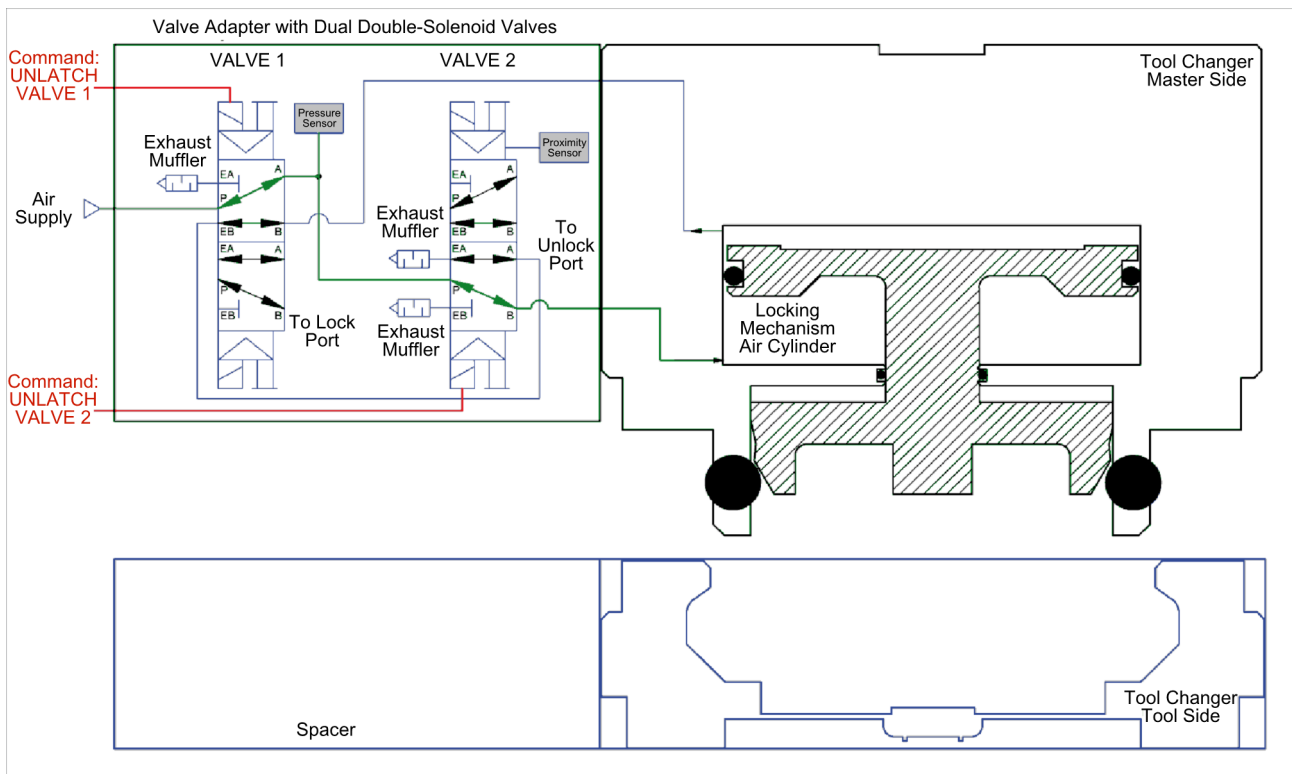


Fig. 3 Dual Double-Solenoid Valve Adapter Pneumatic Circuit in Unlatched Position

## **1.2 Monitoring Solenoid Valves**

A pressure sensor is used to monitor solenoid valve 1 to detect if the valve is functioning properly. The pressure sensor can detect if the solenoid valve has failed. Solenoid valve 2 uses a proximity sensor to detect if the valve has failed. The DL5 Control/Signal Module monitors the sensor outputs, refer to the DL5 Manual for more information.

### **1.2.1 Pressure Sensor Solenoid Valve 1**



When the Tool Changer is in the locked position the pressure sensor should be nearly zero indicating that valve 1 is functioning properly. In the unlocked position the pressure sensor should measure a pressure equivalent to the supply air pressure indicating that valve 1 is functioning properly.

### **1.2.2 Proximity Sensor Solenoid Valve 2**

When the Tool Changer is in the locked position the proximity sensor output should be high indicating that valve 2 is functioning properly. In the unlocked position the proximity sensor output should be low indicating that valve 2 is functioning properly.

## 2 Installation

The valve adapter is typically installed by SCHUNK prior to shipment. The steps below outline the field installation or removal as required. The JR4-M valve adapter is mounted on flat A of the Tool Changers Master Plate. The JR4-T Spacer module is mounted on flat A of the Tool Changers Tool Plate.

	 <b>WARNING</b>
	<p><b>Do not perform maintenance or repair on Tool Changer or modules unless the tool is safely supported or docked in the tool stand and all energized circuits (e.g. electrical, air, water, etc.) have been turned off.</b></p> <p>Injury or equipment damage can occur with tool not docked and energized circuits on.</p> <ul style="list-style-type: none"><li>• Dock the tool safely in the tool stand and turn off all energized circuits before performing maintenance or repair on Tool Changer or modules.</li></ul>

### 2.1 Installing the JR4-M Valve Adapter

- 1 It may be necessary to clean the mounting surface (flat A) on the Tool Changer prior to installing the module in order to remove any debris that may be present.
- 2 Two O-rings are required on flat A of the Master plate of the Tool Changer interface. Make sure these O-rings are present and lightly lubricated.
- 3 Using the ledge feature as a guide place the JR4 Valve Adapter adjacent to flat A of the Tool Changer Master Plate mounting surface. Align the Valve Adapter with the Tool Changer using the dowels in the bottom of the ledge feature.
- 4 If fasteners do not have pre-applied adhesive, apply Loctite 242<sup>®</sup> to the supplied M6 SHCS fasteners. Install the two M6 socket head screws securing the Valve Adapter to the Tool Changer and tighten to 7,9Nm.
- 5 If the M5 fastener does not have pre-applied adhesive, apply Loctite 222<sup>®</sup> to the supplied M5 SHCS fastener. Install the M5 socket head screws securing the Valve Adapter to the Tool Changer and tighten to 6,2Nm.
- 6 Make the pneumatic air supply connection to the air/valve adapter housing as required. Ensure that the connector is cleaned prior to being secured as appropriate.



### CAUTION

Once the air supply is connected the Master locking mechanism should fully retract, the factory setting for the JR4 Valve Adapter is in the unlocked position.

Failure to unlock the Tool Changer will cause ball bearings to damage the Tool Bearing Race when attempting to couple.

- If Tool changer is locked, use the procedure in ([3.1, Page 15](#)) to unlock the Tool Changer before attempting to latch Master with a Tool.

### NOTE

The Electrical connections will be made when installing the DL5 Control/Signal Module.

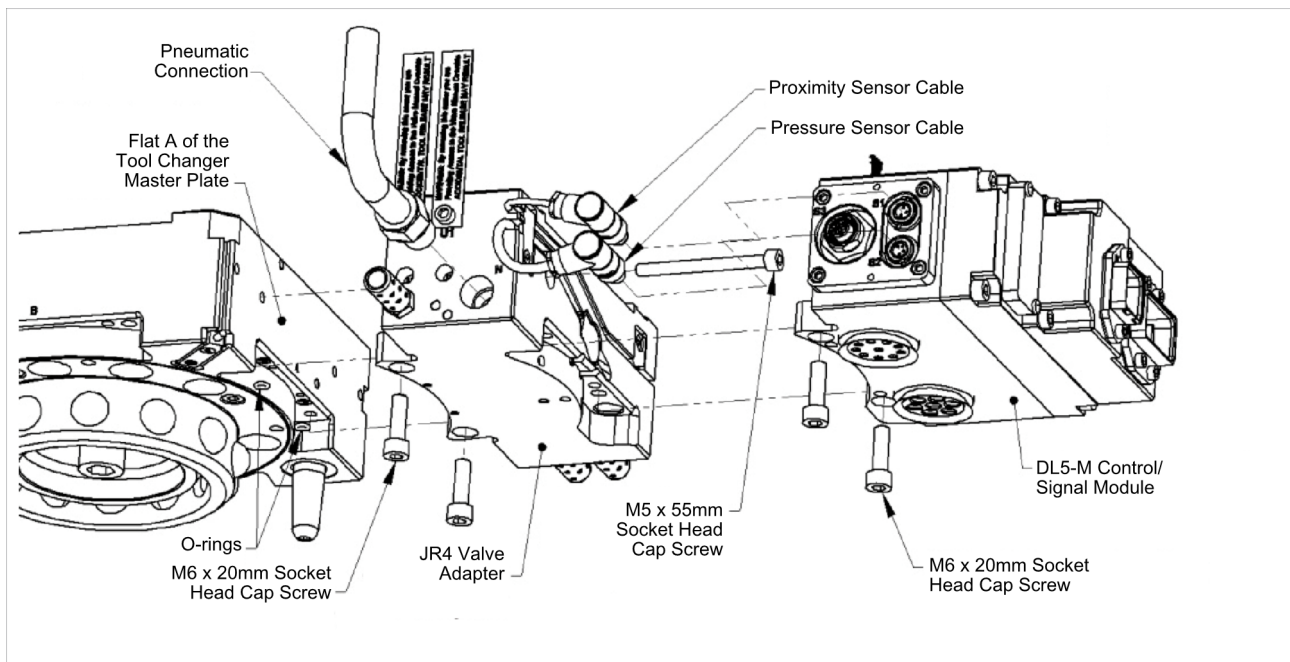


Fig. 4 Module Installation and Removal JR4 Valve adapter (DL5-M module shown)

## 2.2 Removing the JR4-M Valve Adapter

- 1 If there is a DL5-M Control/Signal Module piggy-backed on the Valve Adapter, it will need to be removed prior to removal of the Valve Adapter. Disconnect all electrical and pneumatic connections to the control/signal module and Valve Adapter as required. Also, proximity and pressure sensor and valve cables may or may not need to be disconnected.
- 2 Support the Control/Signal Module and remove the two M6 SHCS and lower the module until it clears the guide pin, set module aside .
- 3 Support the Valve Adapter and remove the mounting fasteners (two M6 SHCS's and one M5 SHCS's) and lower the adapter until it clears the guide pins, then pull the module off the Tool Changer.
- 4 Make sure that the O-rings are retained at the Tool Changer Master Plate mounting interface.

## 2.3 Electrical Connection

### 2.3.1 Solenoid Valves 4-Pin Pin Block

The valve adapter includes a 4-Pin integrated pin block providing the connection to the solenoid valves. The pin block interfaces with the DL5 Control/Signal module to provide latch and unlatch signals.

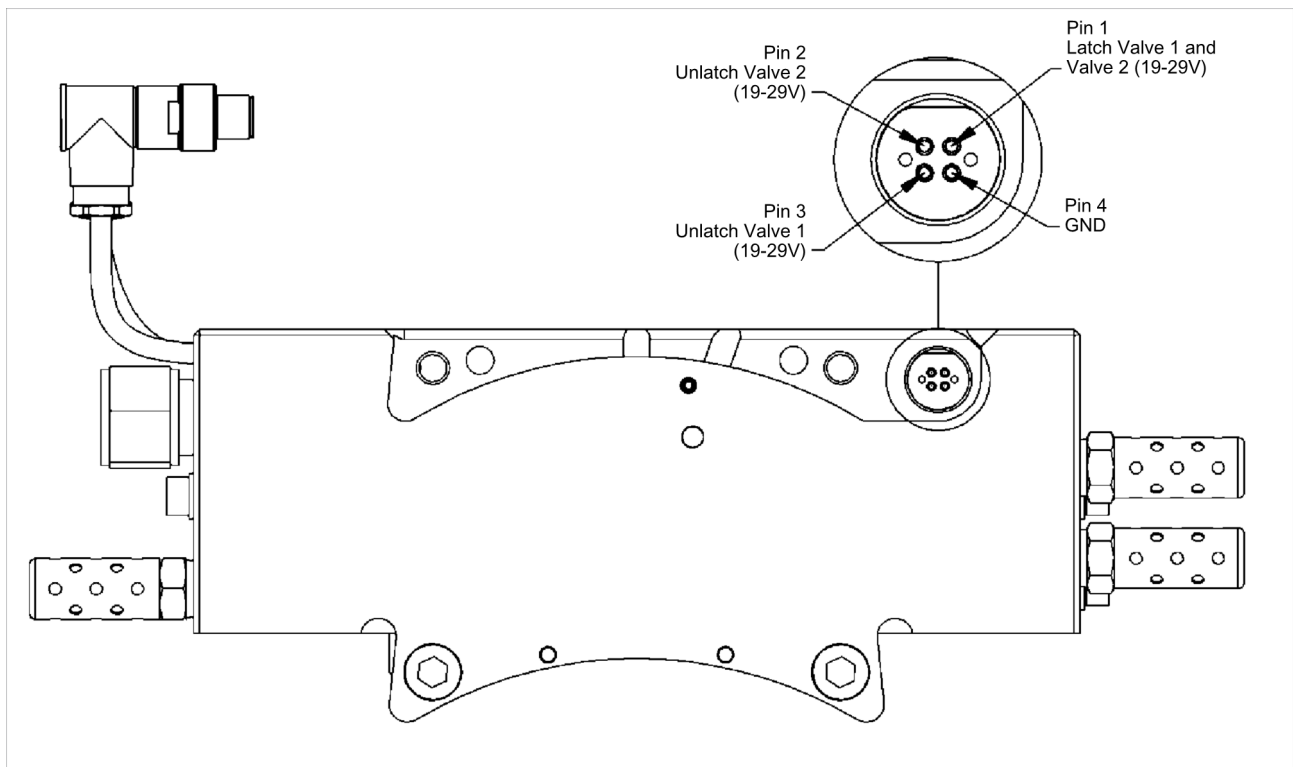


Fig. 5 Solenoid Valve 4-Pin Pin Block

4-Pin Pin Block Signals

Pin	Signal
1	Latch Valve 1 and Valve 2 (19-29 VDC)
2	Unlatch Valve 2 (19-29 VDC)
3	Unlatch Valve 1 (19-29 VDC)
4	GND

### 2.3.2 Pressure and Proximity Sensor Connections

The pressure and proximity sensor interface connectors provided signals to the DL5Control/Signal module to determine if it is safe to unlatch the Tool Changer. Both connectors are field wireable and IP67 rated. The pin-out for the connectors is shown in the figure below.

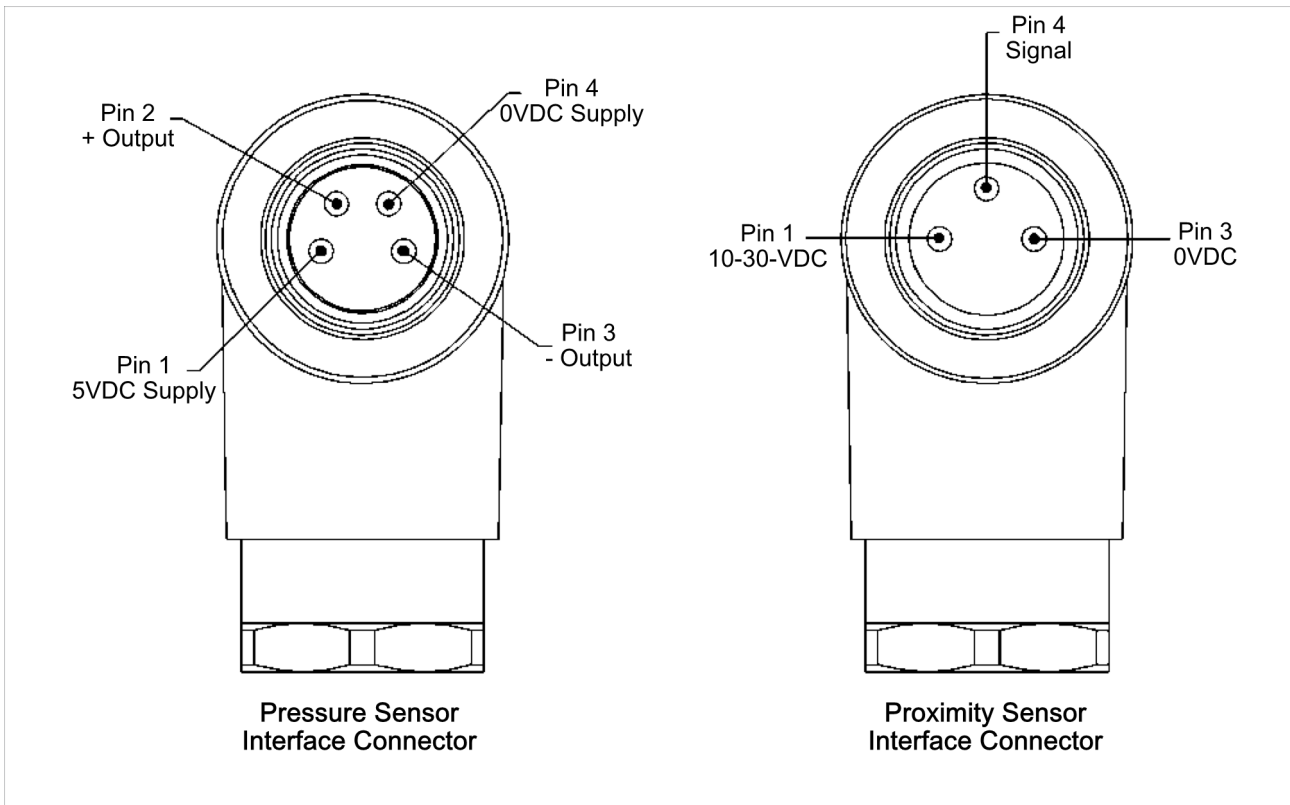


Fig. 6 Pressure and Proximity Sensor Connections

## 2.4 Pneumatic Connection

The customer is only required to supply the valve adapter with a single air supply. A clean, dry, non-lubricated air supplied between 4.5 and 6.9 bar and filtered at 50 microns or better is required. A ¼ G supply air port is provide on the valve adapter. An adapter fitting is required to accommodate G, BSPP, R, or other types of connections. The DL5 Control/Signal Module will not allow an Unlatch if the pressure is less than 4.5 or greater than 6.9 bar.



### CAUTION

**Do not exceed the pressure overload value (10,3 bar) of the pressure sensor.**

Exceeding the pressure overload value will damage the pressure sensor.

- Maintain the supply pressure between 4.5 and 6.9 bar.



### CAUTION

**Failure of some critical electrical and/or pneumatic lines to function properly may result in injury to personnel and equipment.**

All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of electrical and pneumatic lines must minimize the possibility of stress pullout, kinking, etc.

## 2.5 Installing the JR4 Spacer Module (9121-JR4-T)

- 1 It may be necessary to clean the mounting surface (flat A) on the Tool Changer Tool Plate prior to installing the module in order to remove any debris that may be present.
- 2 Using the ledge feature as a guide place the Spacer Module adjacent to flat A on the Tool Changer Tool Plate mounting surface. Align the Spacer with the Tool Changer using the dowels in the bottom of the ledge feature.
- 3 If fasteners do not have pre-applied adhesive, apply Loctite 242® to the supplied M6 SHCS fasteners. Install the two M6 socket head screws securing the Spacer to the Tool Changer and tighten to 40–70 in-lbs.

- 4 If the M5 fasteners do not have pre-applied adhesive, apply Loctite 222® to the supplied M5 SHCS fasteners. Install the two M5 socket head screws securing the Spacer to the Tool Changer and tighten to 45-55 in-lbs.

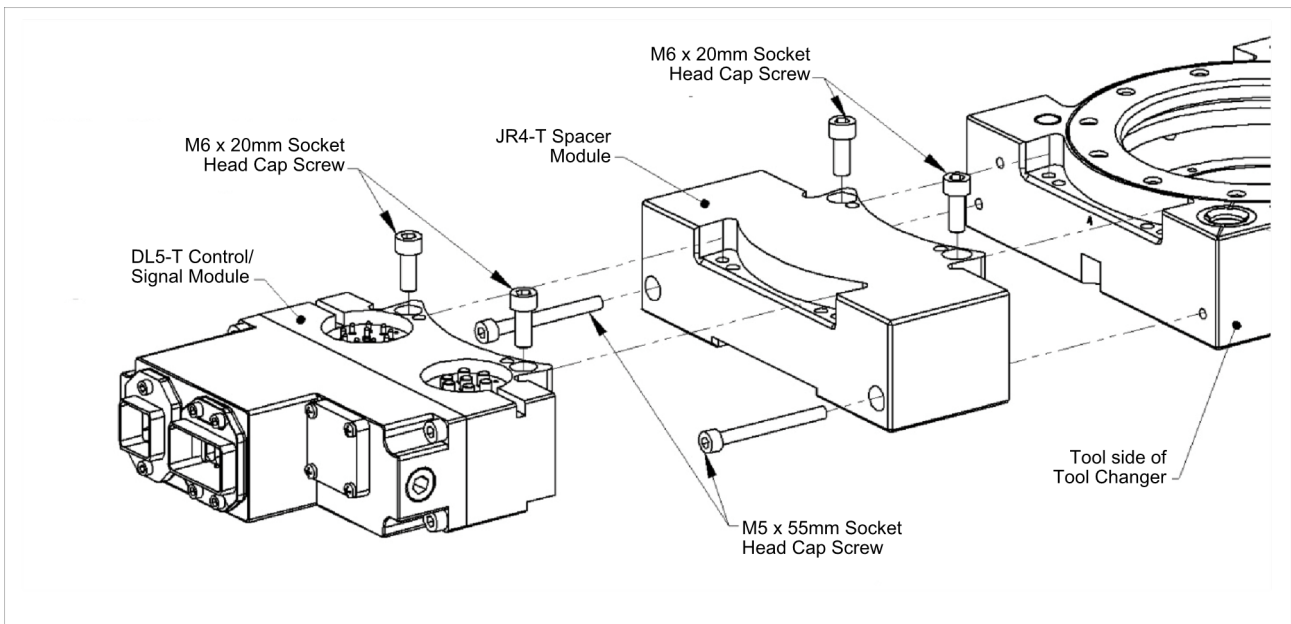


Fig. 7 Module Installation and Removal JR4 Spacer Module (DL5-T module shown)

## 2.6 Removing the JR4-T Spacer Module

- 1 If there is a DL5-T Control/Signal Module piggy-backed on the Spacer Module, it will need to be removed prior to removal of the Spacer. Disconnect all electrical and pneumatic connections to the control/signal module as required.
- 2 Remove the two M6 SHCS from the Control/signal module if applicable and lift up on module until it clears the guide pin, set module aside.
- 3 Remove the JR4-T Spacer mounting fasteners (two M6 SHCS's, and two M5 SHCS's) and lift up on Spacer until it clears the guide pins, then pull the module off the Tool Changer.

### 3 Operation

Valve adapters are supplied with the tool changer to provide a fully integrated solution. The customer is only required to supply the valve adapter with a single air supply. Again, it is important that clean, dry, non-lubricated air supplied between 4.5 and 6.9 bar and filtered at 50 microns or better is provided.

An electrical connection is provided for valve control as detailed in [\(7, Page 21\)](#) of this manual. In most cases, control of this valve is integrated with an SCHUNK-supplied control/signal module that is piggy-backed onto the valve adapter.

#### 3.1 Solenoid Valve Manual Override Procedure

Access to valve manual overrides are provided on the valve adapters. The dual double-solenoid valve adapters have two manual overrides. Both valve overrides must be actuated at the same time to unlatch the Master locking mechanism.

Use of the manual overrides should be restricted to contingency situations and only when the robot and tool are in the stand or storage location. Actuation of the Unlatch valve manual overrides will result in tool changer release.



#### DANGER

**Do not use the solenoid valve manual override if the tool is locked to the Master.**

Using the manual override will release the Tool and may cause bodily injury or damage to equipment.

- If the Tool is attached to the Master it must be secured in the tool stand or in a location where the tool weight is supported before using the manual override.



#### CAUTION

**The manual override is not intended for normal operations.**

- Manual override is to be used in situation where no other alternative is available to unlock the Master.

- 1 Remove the two M4 Socket Head Cap Screws, warning labels, and nylon washers from the (U1 and U2) manual unlock override holes in the valve adapter.
- 2 Insert two 2mm ball end Allen wrenches or similar blunt objects in the solenoid valve screw hole and manually depress both valve overrides simultaneously. Make sure locking mechanism is fully retracted.
- 3 Replace the two M4 Socket Head Cap Screws, warning labels, and nylon washers.
- 4 Tighten the screws to secure the warning labels.

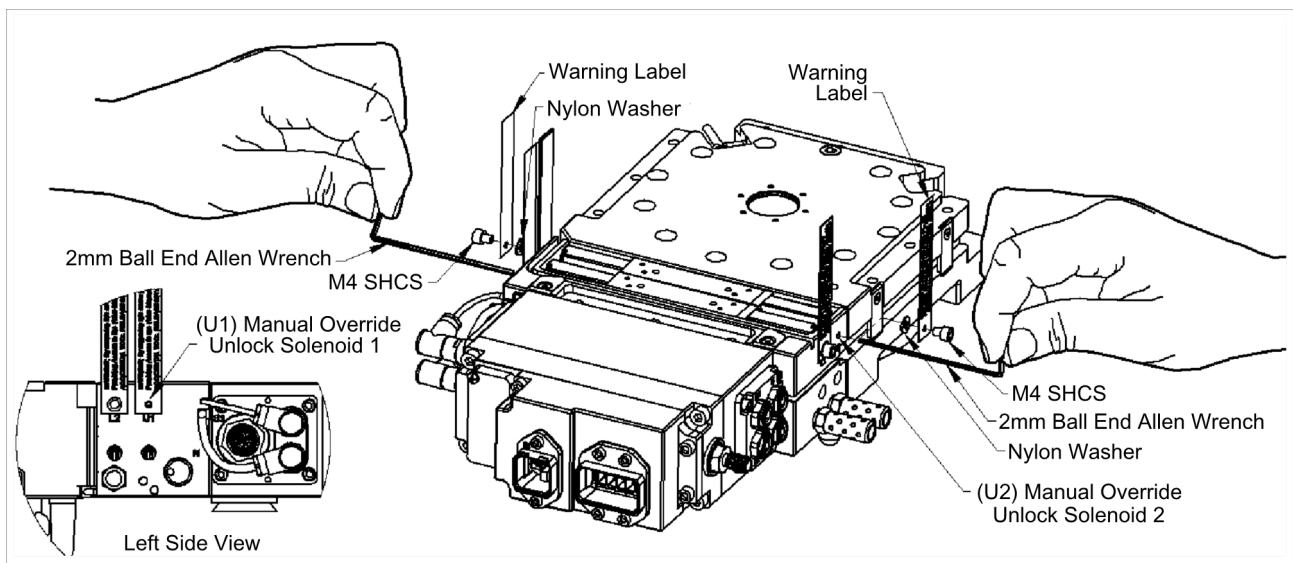



Fig. 8 Dual Solenoid Valve Manual Overrides

## 4 Maintenance and care

Little or no maintenance is required for the valve adapters, the only wear components are the solenoid valves and an exhaust muffler. Under normal operating conditions, the valve will last for millions of cycles. It is critical that the exhaust mufflers are not restricted. As a part of a preventative maintenance program the mufflers should be inspected and/or replaced periodically. Inspection and replacement should be more frequent in dirty environments.

	<p><b>! WARNING</b></p> <p><b>Do not perform maintenance or repair on Tool Changer or modules unless the tool is safely supported or docked in the tool stand and all energized circuits (e.g. electrical, air, water, etc.) have been turned off.</b></p> <p>Injury or equipment damage can occur with tool not docked and energized circuits on.</p> <ul style="list-style-type: none"> <li>• Dock the tool safely in the tool stand and turn off all energized circuits before performing maintenance or repair on Tool Changer or modules.</li> </ul>
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### 4.1 Pressure Sensor Replacement

The pressure sensor can be replaced if it is damaged or no longer functions properly.

- 1 Remove the pressure and proximity sensor cables from the DL5-M Control/Signal Module piggy-backed on the JR4 valve adapter.
- 2 Disconnect all cables (RJ45, 5-Pin power, safety switch, sensor (RT1, RT2, Lock, and Unlock)) from the DL5-M Control/Signal Module.
- 3 Support the Control/Signal Module and remove the two M6 SHCS and lower the module until it clears the guide pin, set module aside.
- 4 Remove the M3 SFHCS from the retaining tab and set the screw and retaining tab aside.
- 5 Loosen the 2.5mm Set Screw holding the pressure sensor in place, and pull out the pressure sensor and discard.
- 6 Apply Magnalube® to the O-ring on the new pressure sensor and insert into the body of the valve adapter making sure it is seated completely.

- 7 Apply Loctite 222® to the 2.5mm set screw and tighten to contact to secure the pressure sensor.
- 8 Route the pressure sensor cable through the channel and secure with the retaining tab and the M3 SFHCS, tighten to contact.
- 9 If M6 SHCS fasteners do not have pre-applied adhesive, apply Loctite 242® to the supplied M6 SHCS fasteners.
- 10 Using the ledge feature as a guide place the DL5-M Control/Signal Module to the JR4 valve adapter and secure with the two M6 SHCS's. Tighten to 40–70 in-lbs.
- 11 Connect all cables (RJ45, 5-Pin power, safety switch, sensor (RT1, RT2, Lock, and Unlock)) to the DL5-M Control/Signal Module.

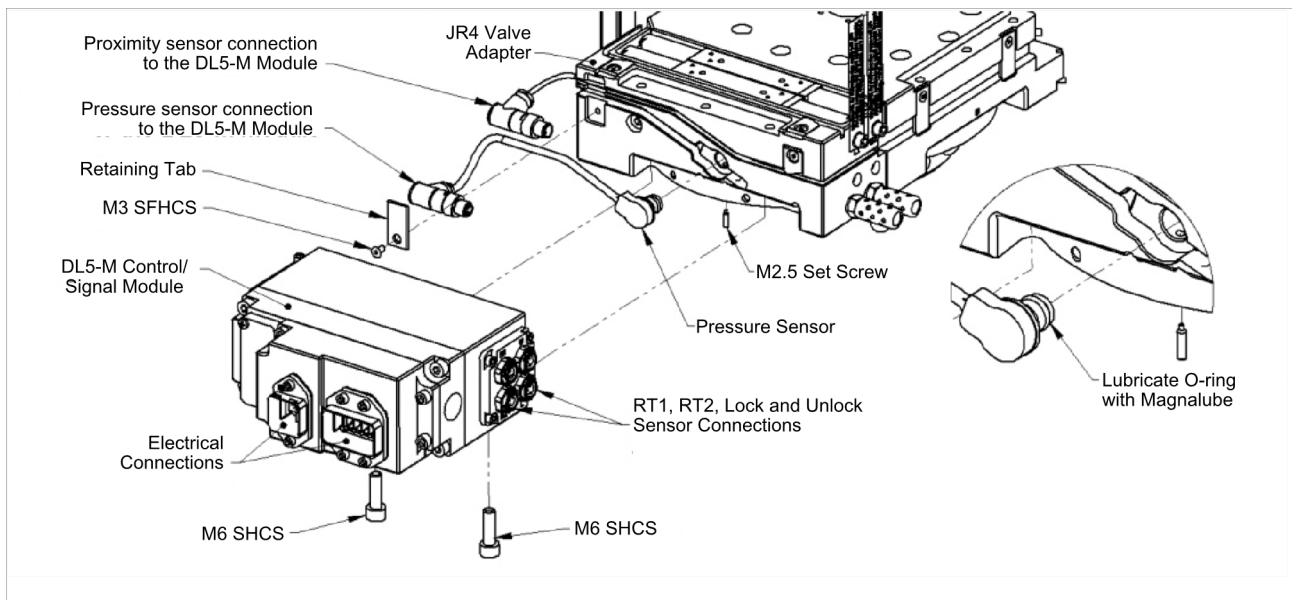


Fig. 9 Replace Pressure Sensor

## 5 Trouble shooting

Symptom	Possible Cause	Correction
Changer not locking/unlocking on command	Clogged Muffler	Inspect muffler for debris, if clogged or damaged replace.
	Air leaks	Check for missing or damaged O-rings, install or replace if needed. For installation and removal instruction refer to ( <a href="#">👉 2, Page 8</a> ).  Check pneumatic connections and lines for leaks, if lines leak or are damaged, repair or replace and secure properly.
	Air supply not to specifications	Ensure air supply meets specifications, see ( <a href="#">👉 6, Page 20</a> ).
	Electrical connection to solenoid valve damaged or no power supplied	Ensure air supply meets specifications, see Section 6—Specifications. Specifications
	Solenoid valve malfunctioning	Check valve function refer to ( <a href="#">👉 1.2, Page 7</a> ), and have valve adapter serviced or replaced as required.

## 6 Specifications

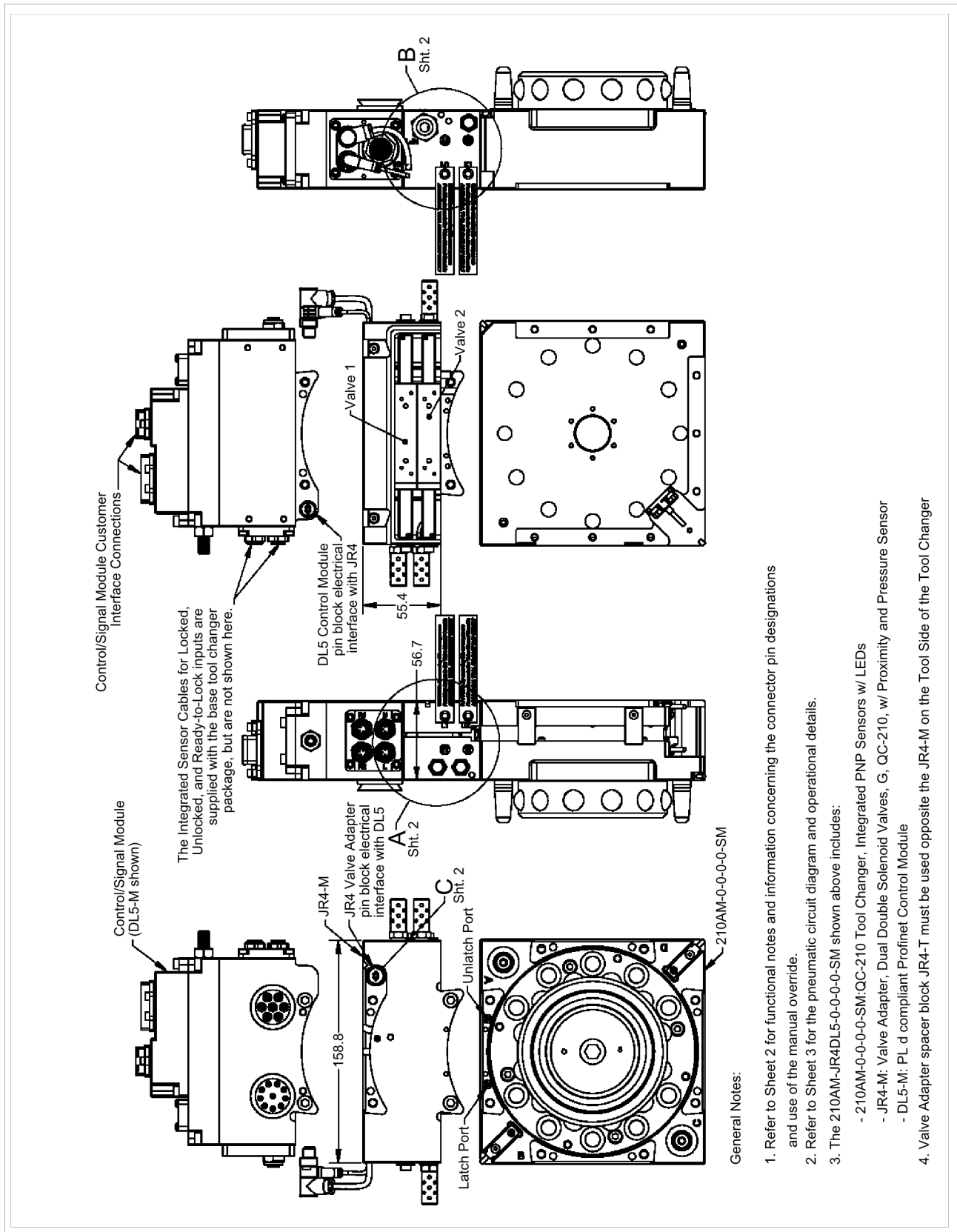
<b>Valve Adapters</b>	
Interface Connections	Integrated Solenoid Valve Connector: (4-Pin) Pin Block supporting Latch and Unlatch signals Integrated Proximity Sensor: M8, 3-Pin Male Connector Integrated Pressure Sensor: M8, 4-Pin Male Connector Air Supply Port: ¼ NPT (Adapter for G is available)
Electrical Rating	Solenoid Valves: 20-29 VDC Pressure Sensor: 5 VDC Proximity Sensor: 10-30 VDC
Air Pressure	4.5 – 6.9 bar clean, dry, non-lubricated air
Air Filtration	50 microns
Environmental Resistance	Dust and water resistant, but not water proof or IP67 compliant
Temperature Range	32° F to 120° F (0° to 49° C)*
Weight	JR4: TBD lbs (TBD kg)
<b>Solenoid Valves</b>	
Double-Solenoid Valve	MAC Series 48, DC Voltage, 6W Coil, Wash-down, separate pilot exhaust, 5 port, 2 position with air pilot assist, 250mA @ 19-30VDC
<b>Sensors</b>	
Pressure Sensor	Measurement Specialties, MSP100 Pressure Transducer, 0 to 100 psig, 5 VDC, 2mA, Pressure Overload-1.5X
Proximity Sensor	Baumer IFRM 04P15B1/KS35PL Inductive Proximity Switch, 10 to 30 VDC. 12 mA. PNP type.
*NOTE: Lower temperature limit based on MSP100 Pressure Sensor lower operating temperature limit of 32° F (0° C). Upper temperature limit based on MAC solenoid valve upper operating temperature limit of 120° F (49° C).	

## 7 Drawings

Available Valve Adapter Listing

Part Number	Description
9962847	Tool Side Spacer Assembly for Dual Double-Solenoid Valve Adapter
9962846	Valve Adapter, Dual Double-Solenoid Valves, G, SWS-210, SST Mounting Bolts

### 7.1 Integrated Tool Changer Valve Arrangement



The 9121-JR4-M is supplied with a 1/4 G Adapter Fitting (The thread in the Valve Adapter Housing is 1/4 NPT)

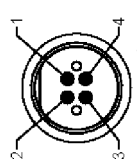
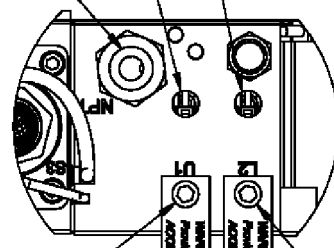


Table 1: Valve Connector Signals

Pin	Signal (Note 2)
1	Latch Valve 1 and Valve 2 (19-29 VDC)
2	Unlatch Valve 2 (19-29 VDC)
3	Unlatch Valve 1 (19-29 VDC)
4	GND

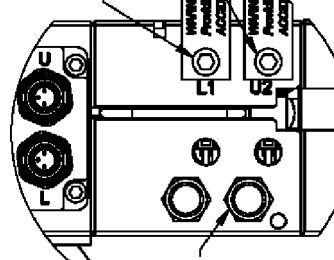


Valve 1 Manual Override Access Use to Unlock Valve 1 (Cover Screw and Warning Label are Supplied) See Note 1

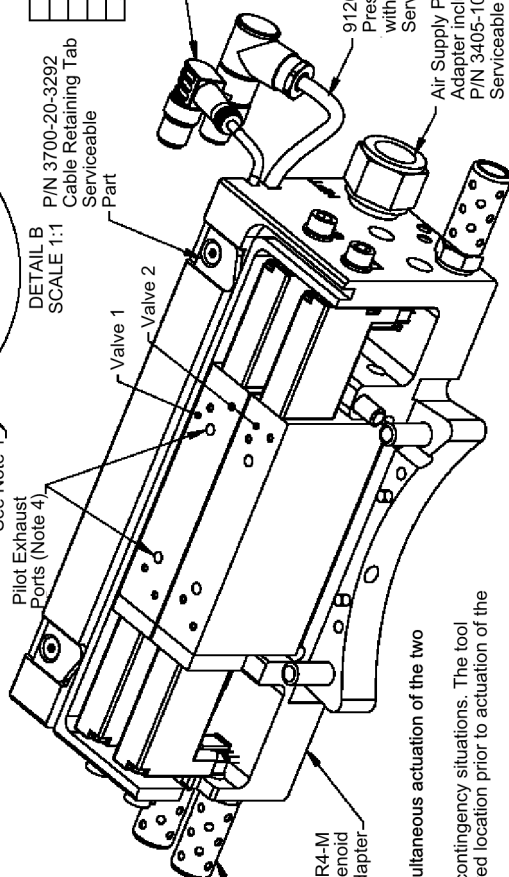
Valve 2 Manual Override Access Use to Lock Valve 2 (Cover Screw and Warning Label are Supplied) See Note 1

Valve 1 Manual Override Access Use to Lock Valve 1 (Cover Screw and Warning Label are Supplied) See Note 1

Valve 2 Manual Override Access Use to Unlock Valve 2 (Cover Screw and Warning Label are Supplied) See Note 1



3X Numatics M11MN Exhaust Mufflers P/N 3490-1010007-00 Serviceable Part



DETAIL B SCALE 1:1

DETAIL A SCALE 1:1

Pilot Exhaust Ports (Note 4)

9121-JR4-M Dual Double-Solenoid Valve Adapter

9120-C-MSP100-4PM90-0018 Pressure Sensor cable supplied with the Valve Adapter Serviceable Part

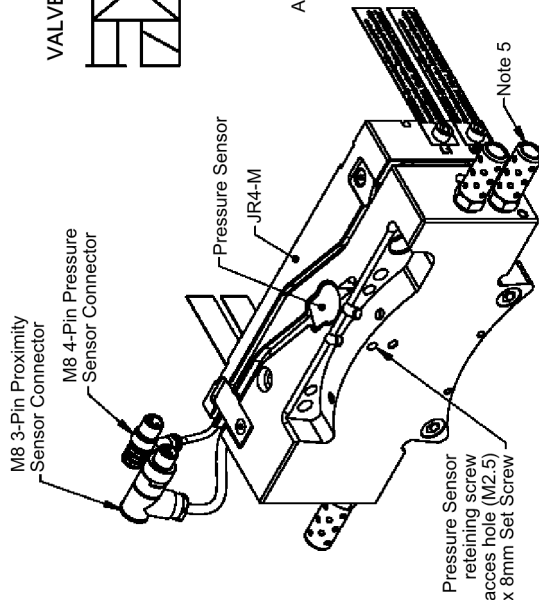
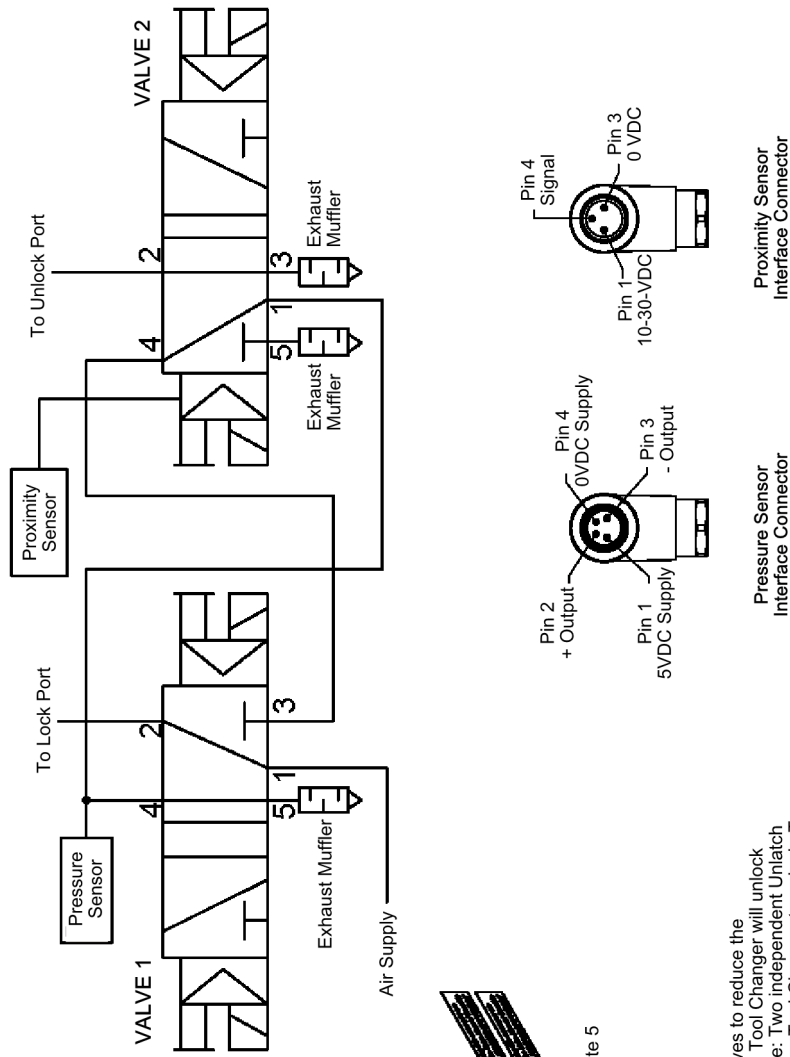
Air Supply Port (G-Port Adapter included with JR4) P/N 3405-1030005-01 Serviceable Part

Proximity Sensor and cable are supplied with the Valve Adapter but are NOT serviceable.

Notes:

- 1. WARNING: Tool Release Will Occur with the simultaneous actuation of the Unlatch Valve Manual Overrides (U1 and U2)**  
Use of the valve manual override is restricted to contingency situations. The tool changer and associated tool should be in a secured location prior to actuation of the manual override.  
Insert a ball-end 2mm hex key or similar blunt object in the two locations shown and manually depress both valve manual overrides (must be depressed simultaneously).
- 2. Signals are sourced from the Control Module via the 4-Pin Block. The JR4 is designed to operate with a Control Module generating two independent Unlatch signals (i.e. dual channel) such as the DL5-M\_PL d Compliant Profinet Module.**
- 3. The valve mounting access holes are to be used only in a valve replacement situation. A 3mm hex key is to be used to loosen the cone point set screws that retain the valve. Care should be taken to avoid damaging the valve solenoid connector during the valve removal process.**
- 4. To ensure proper valve operation, do not block or restrict the Pilot Exhaust ports.**

JR4-M PNEUMATIC CIRCUIT (Note 1)



Notes:

1. The JR4-M valve adapters pneumatically interlink two 5/2 valves to reduce the probability of an unintended tool unlock. With this design, the Tool Changer will unlock ONLY when BOTH valves are in the UNLATCH position. Note: Two independent Unlatch signals are required to energize the two valves and cause the Tool Changer to unlock. To lock the Tool Changer, a single Latch signal is provided to both valves.
2. The JR4-M Valve Adapter must be used with a Control Signal module that can support the pressure sensor and proximity sensor inputs generated by the JR4 (ex. DL5-M). Reference manual 9620-20-C-JR4 for detailed instructions on the operation of the JR4.
3. The valves require supply voltage between 19-29V, the pressure sensor requires 5V, and the proximity sensor 10-30V.
4. The valves must be supplied clean, dry, non-lubricated air at 4.1 to 6.9 bars and filtered at 50 microns or better. NOTE: The valves will NOT operate correctly if insufficient air pressure is supplied.
5. It is critical that the exhaust mufflers are not restricted. As part of a preventative maintenance program, periodically inspect and/or replace the exhaust mufflers.