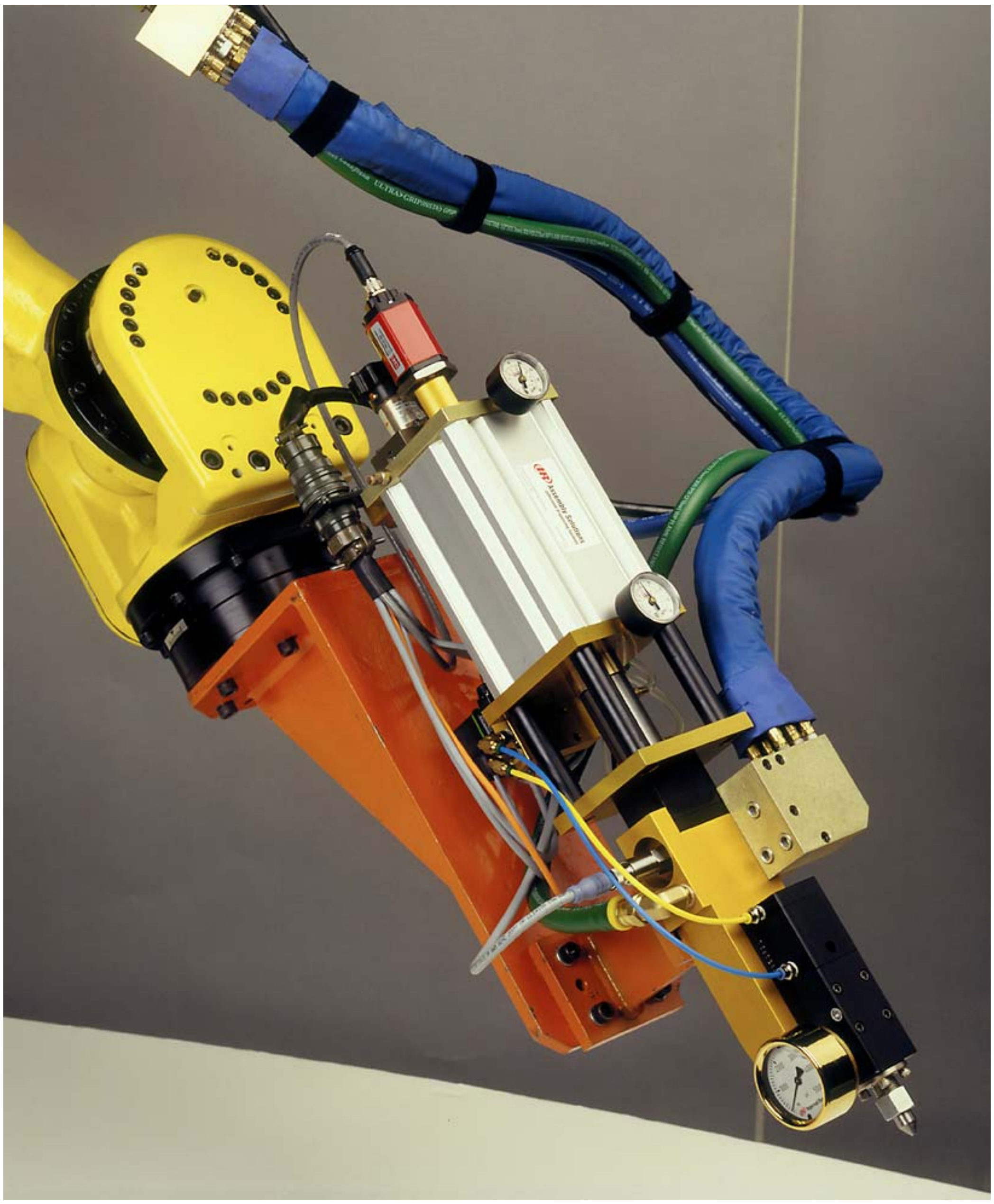
Fanuc Robots with Device Net

JDS402 – Robot Programming



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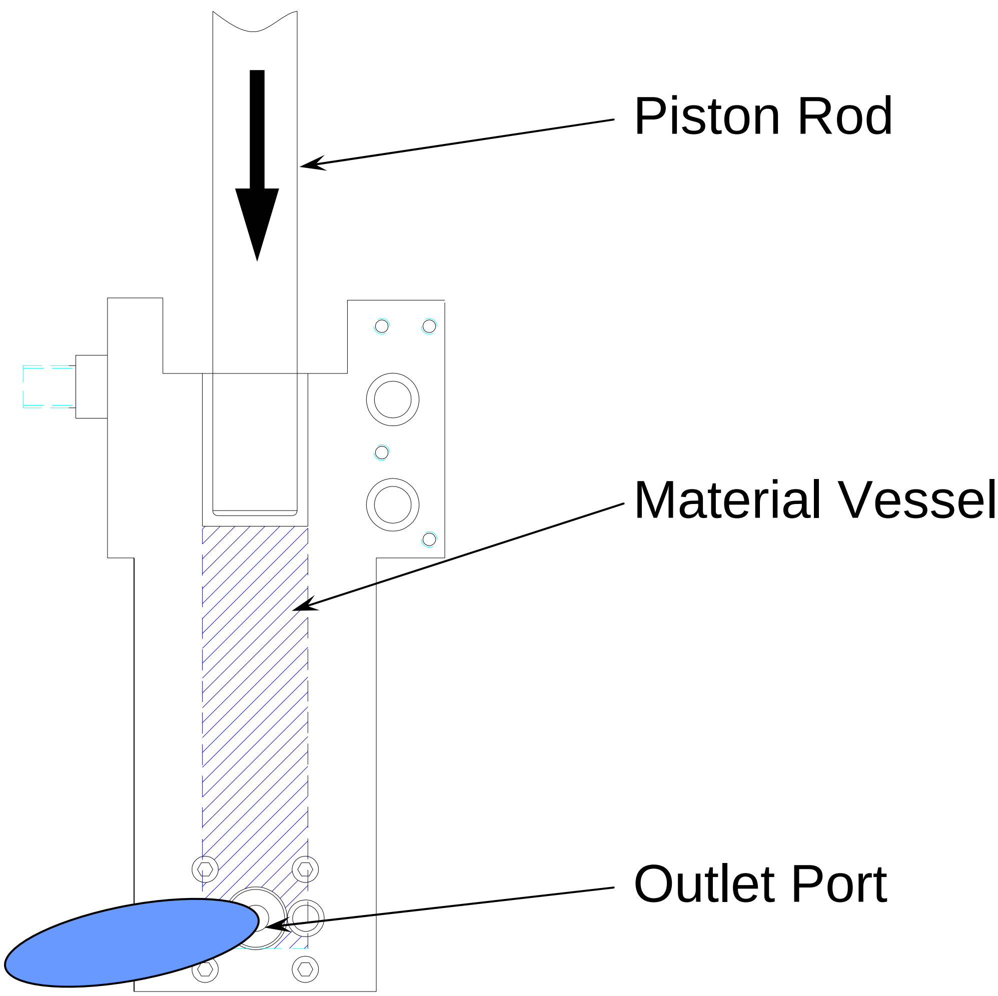
Page **Description**

The 1K systems use a shot meter as a metering device. The shot meter works by using displacement as a method of dispensing material.

The faster and harder the piston rod is moved into the material vessel, the more that the material pressure will increase causing the material to flow faster out of the material outlet port.



Main Components:

Linear Transducer MLDT

Electrical Connector

Air Servo Valve

Air Cylinder

Solenoid Valves

Piston Rod

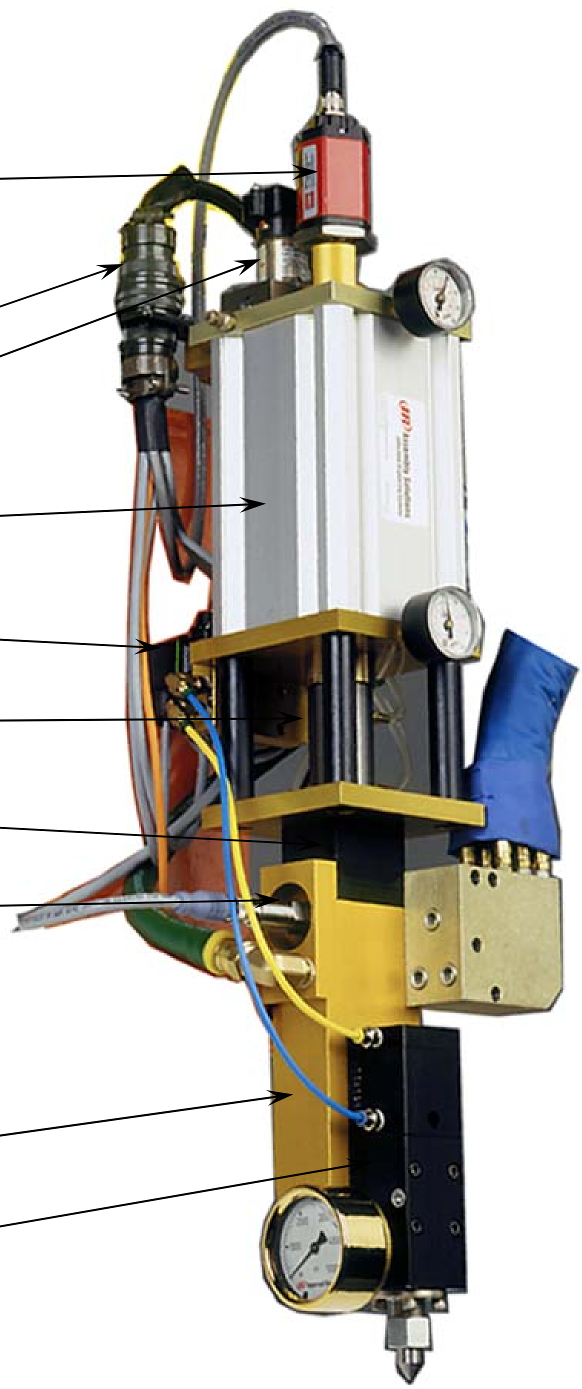
Seal Cartridge

PSI Transducer

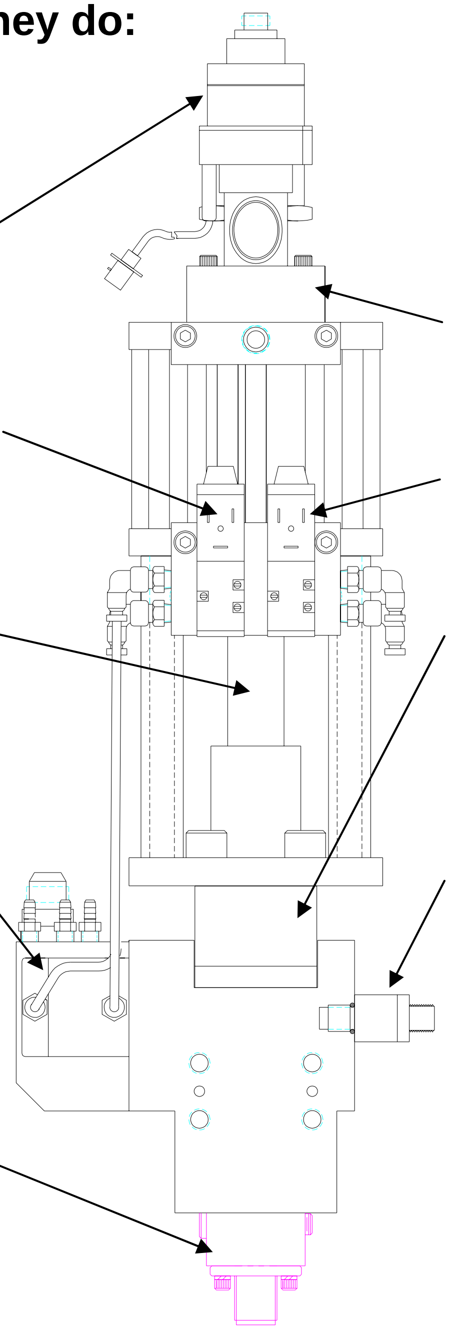
Refill Valve (behind material hose block)

Material Vessel

Dispense Valve



Devices and what they do:



Linear Transducer: Tells the system how much material has been dispensed.

Refill Solenoid Valve: When energized opens the refill valve.

Piston Rod: Used to displace the material in the dispense chamber.

Refill Valve: Uses air to operate. When open connects the pump pressure to the material used in refilling the material chamber.

Dispense Valve: Uses air to operate. When open allows the material to flow out of the Dispense chamber.

Air Servo Valve: Controls the up and down direction of the air cylinder.

Dispense Solenoid Valve: When energized opens the dispense valve.

Seal Cartridge: Has three seals and a scraper to prevent material from leaking out from the material chamber.

Pressure Transducer: Used to tell the PC how much pressure is in the dispense chamber.

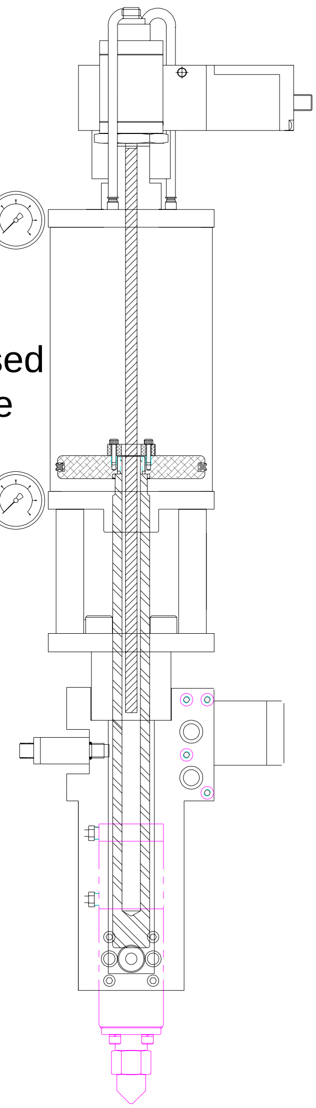
MLDT
Magnetostrictive Linear Displacement Transducer

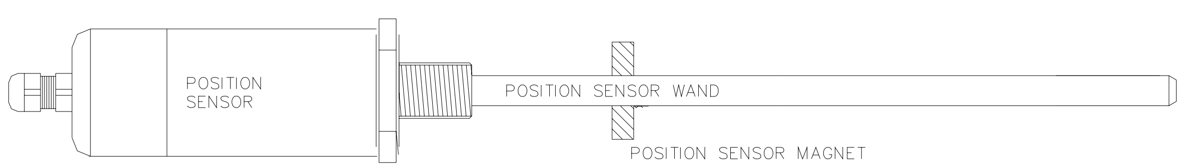
Voltage Range 0-10vdc

System Operation

At the start of the cycle the PC takes a voltage reading (style strobe) and then the system dispenses. The piston rod/magnet moves down – the voltage increases and when the robot sends the Dispense complete signal another voltage reading is taken. The first voltage is subtracted from the second voltage. Then it is multiplied by a kfactor to equal volume dispensed in CC.

Voltage fully dispensed is above 9vdc

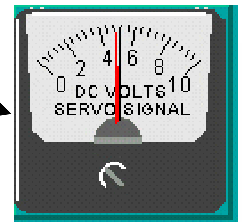


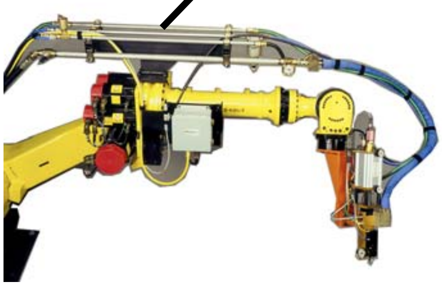


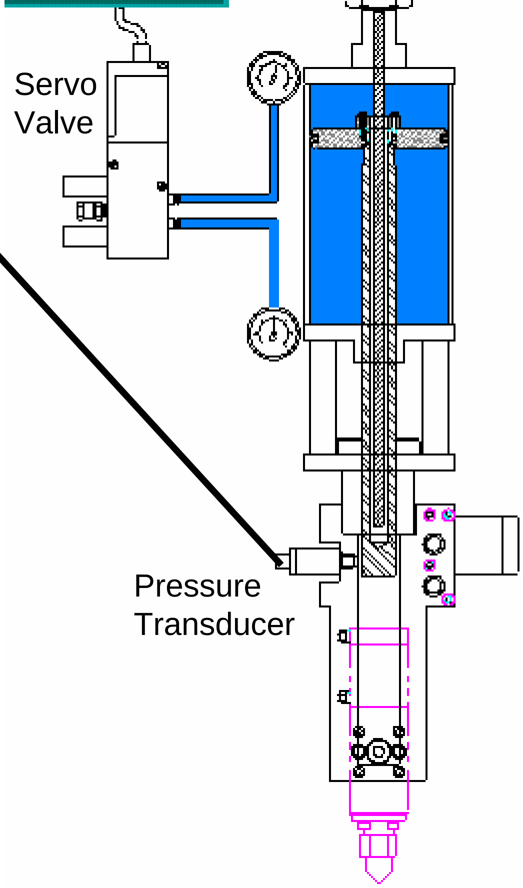
Trim adjustment screw

Pressure Transducer:
The pressure transducer tells the 1K system how much pressure is in the dispense chamber. It is designed so that it is flush mount. This prevents material from packing around it and giving inaccurate readings. The range of the transducer is 0-5000 PSI with a 1-10VDC output. 0psi = 1VDC.
To check the pressure transducer use the following formula.
(Pressure x .0018) +1 = Voltage
Example: 700psi x .0018 +1 = 2.26v

The Transducer has a new feature of an trim pot. To adjust, remove the screw cover on the zero trim adjustment and turn the trim screw until the voltage equals 1vdc with zero PSI on the pressure transducer. Replace the trim screw cover.





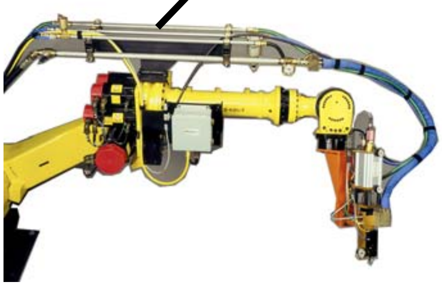


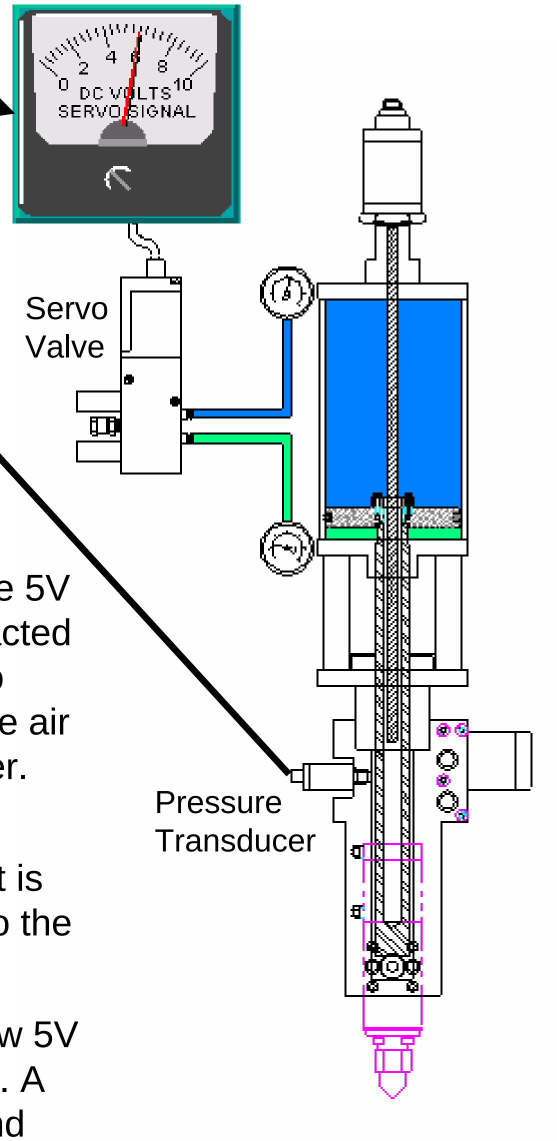
Air Servo Valve:
When the system is not in a dispense mode (Gun Off) the Servo signal will be at 5V. At 5v the same pressure should appear on both sides of the Air Cylinder (within 15 PSI of each other) preventing the piston from moving.

Above 5v, the material pressure increases by having more down pressure and exhausting the pressure below the piston.

Below 5v, The air pressure under the piston increases and decreases air pressure above the piston. This will send the piston up (home position). Material force on the piston rod also helps to send the rod up.

NOTE: The Servo signal does NOT reflect the incoming robot flow command.



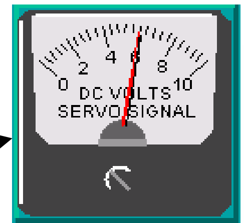


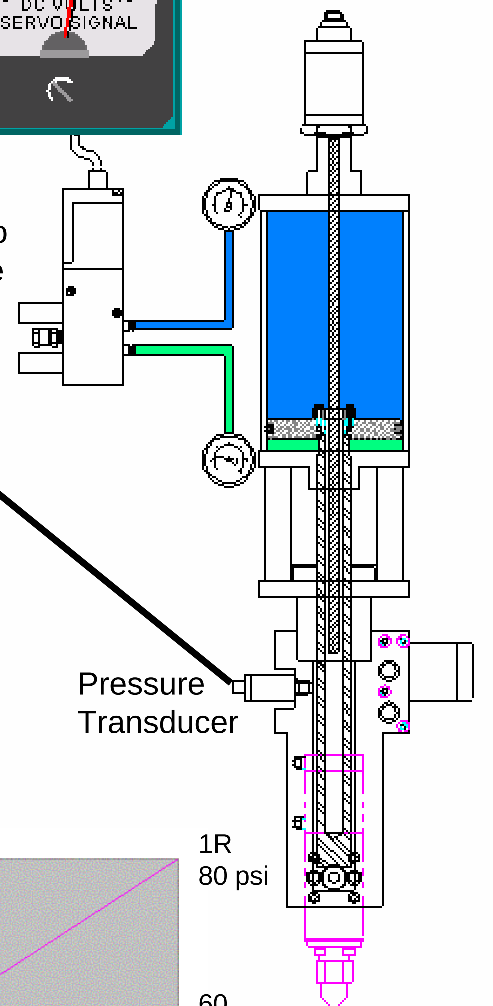
Pressure Loop:
If the robot velocity increases, the output is above 5V when the pressure transducer feedback is subtracted from it. A signal higher than 5V causes the Servo Valve to send maximum pressure to the top of the air cylinder and exhaust the bottom of the air cylinder. The material pressure will increase.

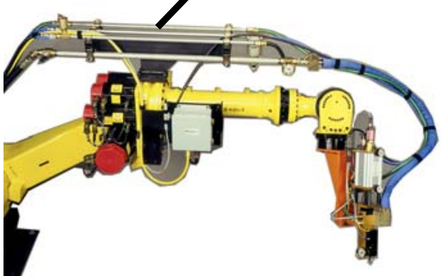
When the material pressure increases to where it is the same as the robot velocity input, the output to the Servo Valve is 5V at idle.

If the robot velocity decreases, the output is below 5V when the pressure feedback is subtracted from it. A signal lower than 5V causes the Servo Valve send maximum pressure to the bottom of the air cylinder and exhaust the top of the air cylinder, and material pressure decreases.

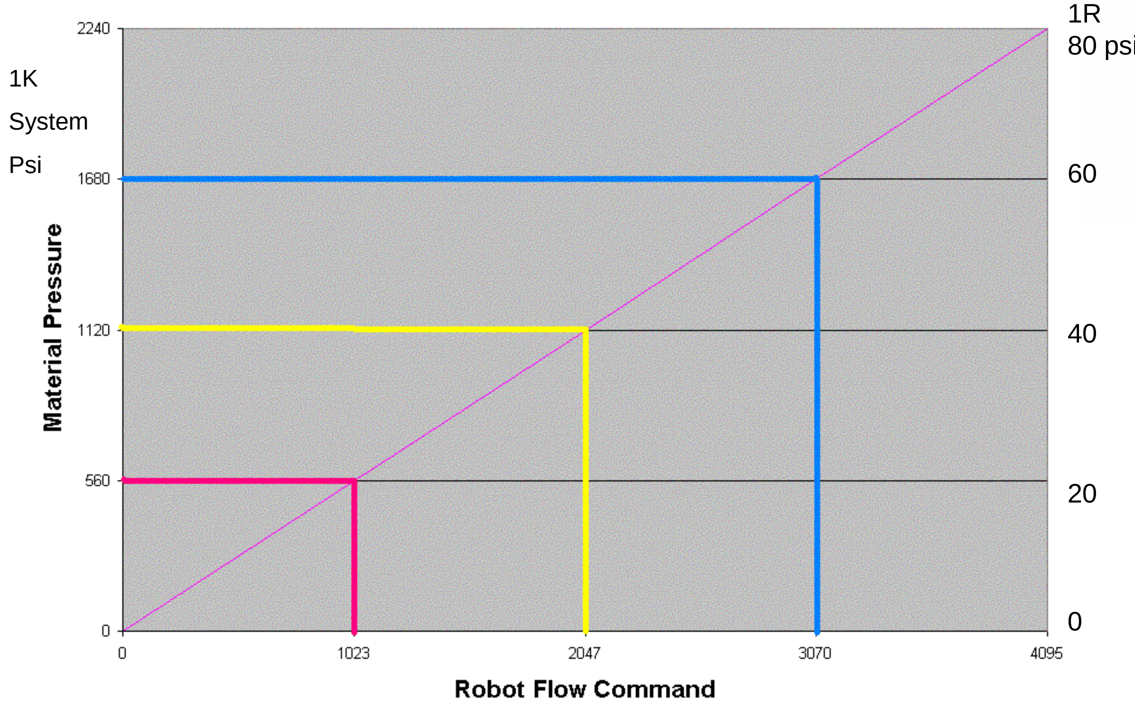
When the material pressure decreases to where it is the same as the robot velocity, the output to the Servo Valve is 5V at idle.



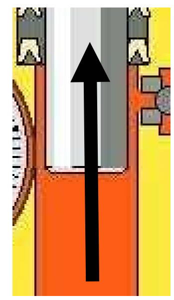




The Robot Flow Command signal will change the pressure in the dispense head. The range of the robot flow command signal is from 0-4095. The pressure capability of the dispense head is 2240 PSI = Ratio x Air pressure (16 x 140psi).

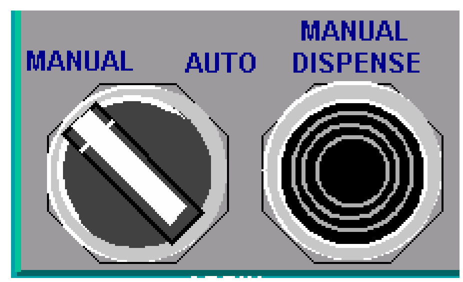


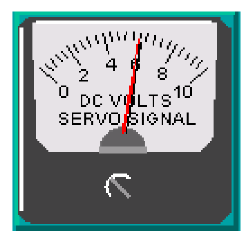
1K Dispense Head Sequence of Operation Manual Mode:

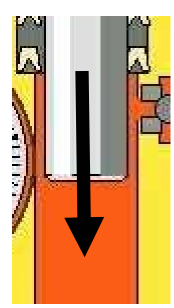


1. The Refill button is depressed and the PC goes into a refill mode.
2. The Refill Solenoid valve is energized and the Refill Valve opens. Pump pressure forces material into the material chamber. The dispense rod starts going in the up direction. The air servo is controlling the pressure in the material chamber to 200 PSI.

   When the MLDT voltage is less that 1 volt the Refill Solenoid de-energized and the Refill Valve closes. The air servo continues to raise the piston rod to a predetermined position, relieving the pressure in the material chamber.



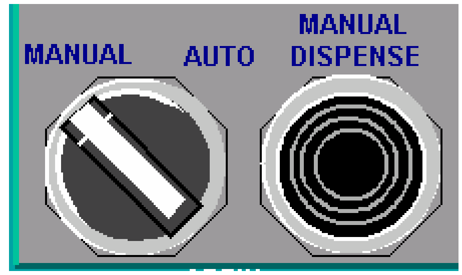




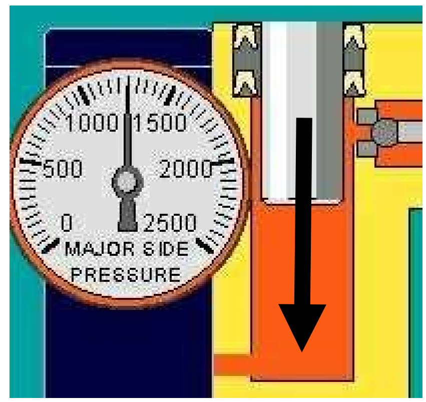
2. The higher the pump pressure is the faster the dispense head will refill.
3. The Manual Dispense button is depressed and the PC goes into a dispense mode.
4. A voltage reading is taken of the MLDT position.
5. A command voltage is sent to the servo valve driving it in the down direction and the dispense solenoid valve is energized and the dispense valve is opened.
6. The command voltage uses feedback from the pressure transducer to determine how much voltage/ force needs to be generated so that the voltage vs. pressure match. The piston rod travels down.
7. After dispensing the Refill button is depressed and the voltage reading is taken of the MLDT and the cc per dispense is calculated. Then step 2 is repeated.

1K Dispense Head checking procedure:

This Procedure test the Dispense valve, Refill valve, MLDT, Servo Valve and Pressure Transducer.

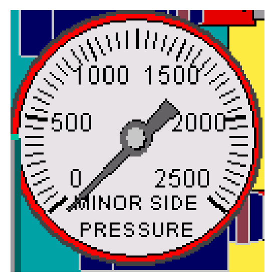


1. On the Production screen put the system into the manual mode. By pressing to Manual Auto button until the Manual dispense button appears. Press the Refill button and verify that NO material is coming out of the dispense valve – if it is replace the valve.

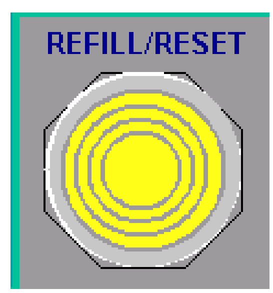


2. Depress the Manual Dispense button until the dispense head has fully depleted all of the material.

3. Continue holding the Dispense button in for 15 seconds. If the pressure on the gauge is within + or - 150 psi of zero the pressure transducer is calibrated. If not replace or calibrate the transducer

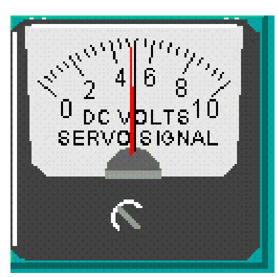


4. Let go of the button and wait for another 15 seconds. If the gauge starts to increase the refill valve could be leaking. Replace the refill valve if the pressure starts to increase.



5. Depress the Refill/Reset button. The head should refill without a fault. If it faults increase the pump pressure or refill time.

6. After refilling the servo output voltage will be 5 volts. Both of the air cylinder pressure gauges should be within 15 psi if not replace the servo valve.

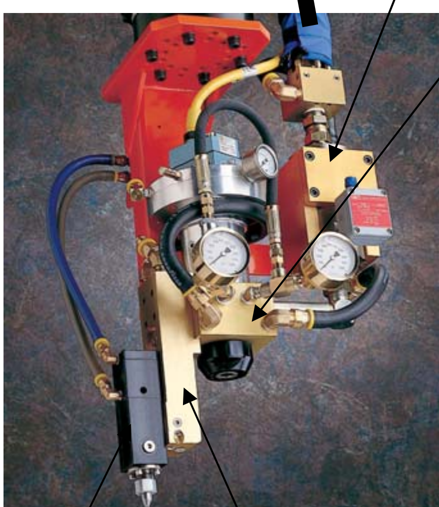


7. If there was not a volume displayed and the piston rod did not move check the MLDT.

The Autostream 1R system includes a proportional material regulator as a pressure control device. The output pressure of this pneumatically operated valve is adjusted by changing the control air pressure applied to it. The changes can be achieved by manual adjustment of the air pressure, or by changing the strength of the electronic flow rate signal
(0 to 10v DC or 0 to 4095 Dnet). The 1R system can dispense from 5cc to 55 gallons of material in one job.

The Pump station Consists of a single or dual (automatic crossover) pump that supplies the material to the 1R Material regulator

The Flow monitor measures the material volume for each job. The volume is calculated and matched to a body style table to determine if the correct amount of material was put on the job – if not a fault will occur stopping production.



The Proportional Material Regulator uses the incoming (pump) pressure as a base to regulate the output pressure. Air pressure is used to control the outlet pressure.

Examples:

Material Inlet	Air PSI	=	Outlet PSI
2000 PSI	50 PSI		1000 PSI
3000 PSI	0 PSI		0 PSI
3000 PSI	25 PSI		750 PSI
3000 PSI	50 PSI		1500 PSI
3000 PSI	75 PSI		2250 PSI
4000 PSI	50 PSI		2000 PSI

A transition block or dispense (traced) hose is used to supply regulated material to the dispense valve. Systems using a transition block are called closed coupled and have a quicker reaction time then system using a hose.

The dispense valve is pneumatically controlled by a 24vdc spring return solenoid valve. If the valve is energized the valve is opened. If the Gun On signal goes low (de-energized) the solenoid valve will spring return and the dispense valve will close.

The Proportional Material Regulator uses an air servo regulator to convert the electrical command signal (0 to 10vdc) to an air pressure. The servo regulator pressure range is 0 to 10vdc and 0 to 80 PSI.

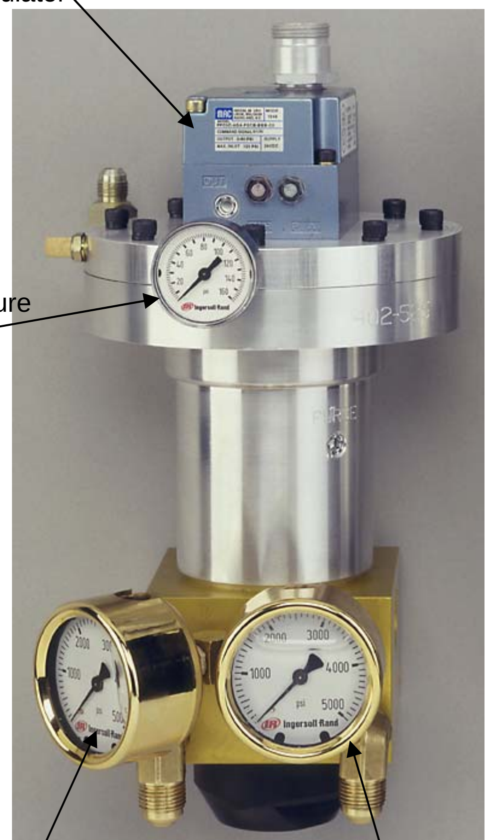
Example

Flow Command	Voltage	Air Pressure
0	0 v	0 PSI
1024	2.5v	20 PSI
2047	5v	40 PSI
3071	7.5v	60 PSI
4095	10v	80 PSI

The air servo regulator is the interface between the electrical signals and the mechanical or outlet pressure of the valves.

The Material has three gauges that are very handy in trouble-shooting.

1. Air pressure gauge
2. Material inlet pressure gauge (pump)
3. Material outlet pressure gauge (dispense valve)

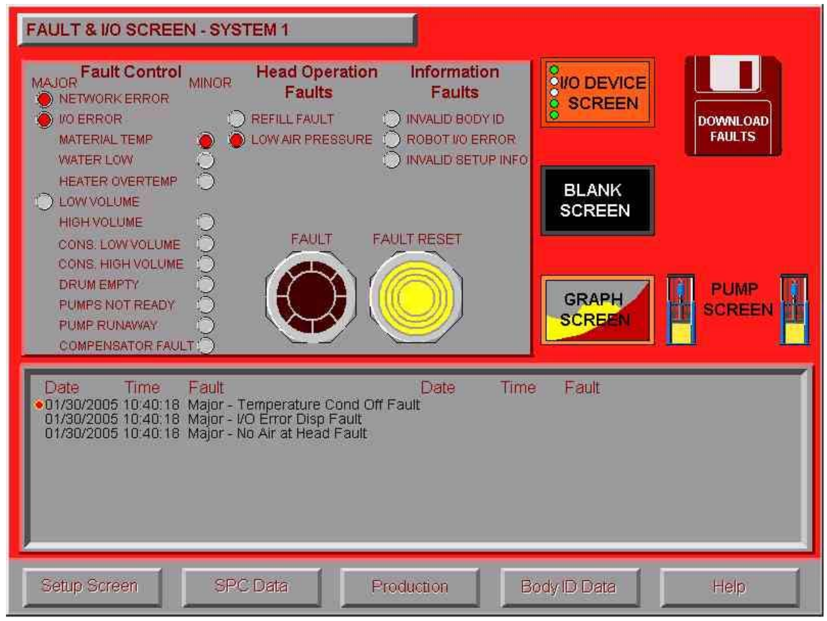


The regulator runs best when setup to run in the mid range. There should be 500 to 1000 PSI more pressure on the inlet gauge than the outlet gauge when the system is dispensing. To adjust for this several factors come in effect – Pump Pressure – Temperature – Nozzle size – Robot speed. The regulator can be purchased with three different size valve seat combinations. "A" .281in. - "B" .312in. – "C" .375in. The housing are stamped with an A, B or C to identify them. The A size is normally used for small beads and the C version is used with very thick viscosities and large beads.

If a fault is on it will be shown with a red light. The setup screen determines if the fault is a Major or Minor

Note this picture shows 4 faults 3 Major and 1 Minor.

This a record of the faults that has a date/time log. The most recent fault has a red dot next to it.



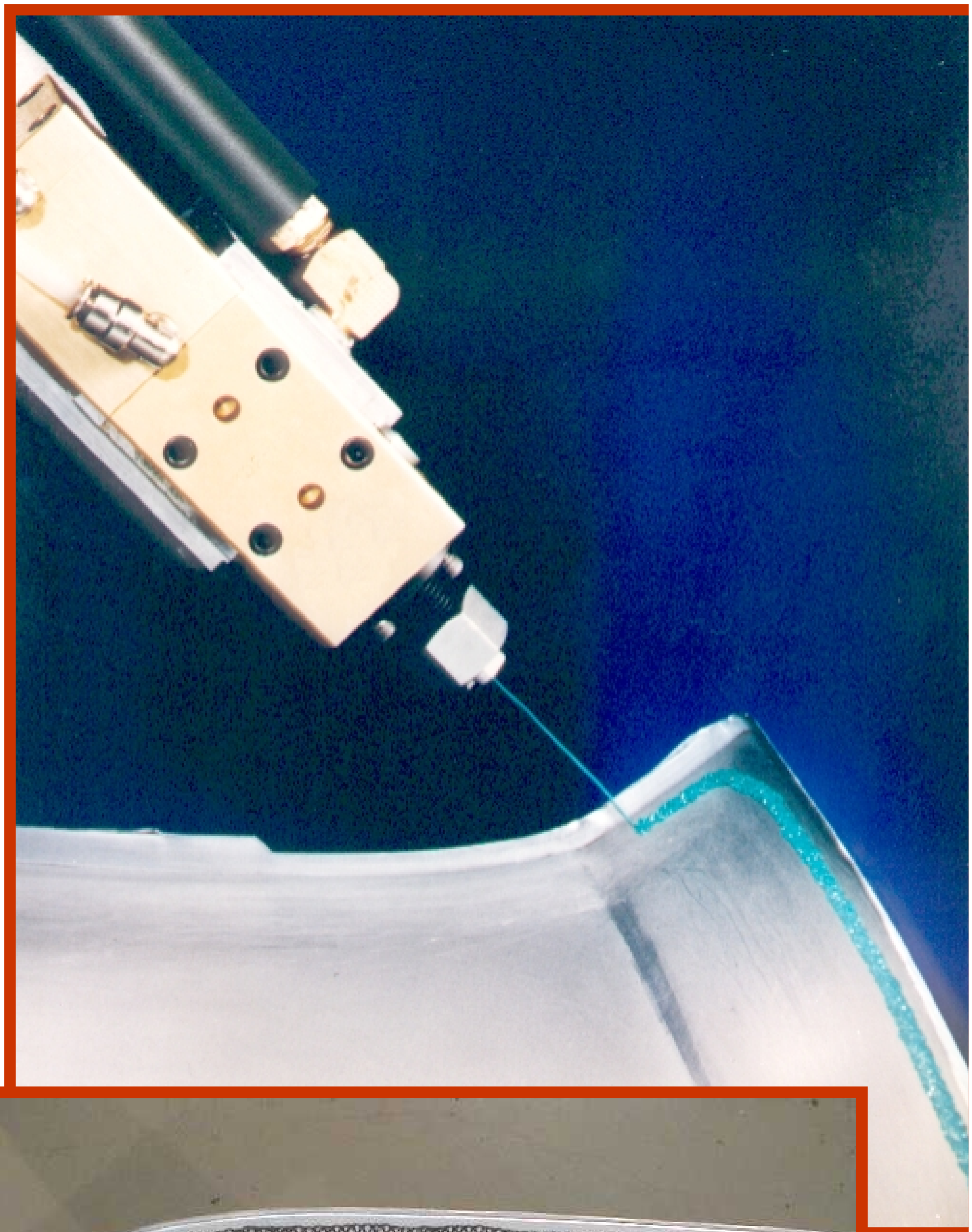
Fault	Problem	Solution
1R & 1K Low Volume Visually Verified not enough material. 1K only	1. Plugged tip 2. Expired Material 3. Low Dispense Pressures. 4. Plugged Material Filter. 5. Pump Pressure to Low 6. Plug in material path 7. Material not at temperature 8. Air Intensifier not working. 9. Scaling or Compensation out of range. 10. Body ID target changed. 11. Flow monitor not working. 12. Dispense head not working (regulator or Shotmeter). 13, Robot Command signals to Low.	1. Replace tip and Purge. 2, Change Material and Purge 3, Check operation of Dispense head. 4. Change Material Filter Element. 5. Reset Pump PSI to Specifications. 6. Use pressure gauges to locate pressure drop in system. 7. Check Temperature system. 8. Check operation of Intensifier tank PSI= 150 Outlet =140 PSI 9. Reset Scaling or Batch Compensation. 10. Reset Body ID Target. 11. Replace Flow Monitor. 12. Check operation of dispense head (Plugged Regulator or Seized shotmeter) check solenoid valves 13. Check Robot Varibales.
1R & 1K Low Volume Visually Verified Good Bead	1. 1K - MLDT Linear transducer not functioning correctly 2. 1R – Flow Monitor or sensor not working. 3. 1R- Flow Monitor K factor not set correctly	1. Replace MLDT and check wiring. 2, Check Flow Sensor, Monitor and check wiring. 3, Reset the Flow Monitor K factor in the set up screen.

Fault	Problem	Solution
1R & 1K High Volume Visually Verified too much material 1R only 1K only	1. Worn or not tip 2. Material too thin 3. Pump pressure to high 4. Material temperature to High. 5. Global Scaling or Batch compensation to high. 6. Robot Command Voltage to High 7. Body ID target value inaccurate. 8. Regulator Seat passing 9. Refill Valve passing.	1. Replace tip and Purge. 2, Change Material and Purge 3, Check and reset pump pressure 4. Check Temperature system and reset the material temperature. 5. Reset Scaling and Batch compensation to 1. 6. Reset Variables in robot controller. 7. Reset body ID target value. 8. Replace Material Regulator. 9. Replace refill valve or Solenoid valve.
1R & 1K High Volume Visually Verified Good Bead	1. Worn or not tip 2. Material too thin 3. Pump pressure to high 4. Material temperature to High. 5. Global Scaling or Batch compensation to high. 6. Robot Command Voltage to High or speed to slow. 7. Body ID target value inaccurate.	1. Replace tip and Purge. 2, Change Material and Purge 3, Check and reset pump pressure 4. Check Temperature system and reset the material temperature. 5. Reset Scaling and Batch compensation to 1. 6. Reset Variables in robot controller. 7. Reset body ID target value.
Refill Fault 1K only	1. Plugged material filters 2, Air pressure not on. 3. Pump Pressure to low. 3. Temperature system not on and up to temp. 5. Refill Solenoid/Valve not working. 6. Pressure transducer not reading. 7. MLDT not working 8. Dispense head seized. 9. Refill time set to short.	1. Change Material Filters 2. Turn on Air pressure to dispense head. 3. Check pump PSI and reset to specifications. 4. Start temp system and wait for pumps to pressurize. 5. Replace Refill Solenoid Valve. 6. Replace pressure transducer. 7. Replace MLDT. 8. Replace dispense head. 9. Reset the Refill time in the setup screen.
Network Error NOTE: Robot Controller must be on before starting Autostream controller..	1. Communication has stopped between the robot and Autostream system 2. Controller/Robot locked up. 3. Device net card not working	1. Check for 24V at the device net terminals and reset robot controller and Autostream panel. 2. Reboot robot then Autostream Controller. 3. Replace device net card.

Fault	Problem	Solution
I/O Error Autostream Panel Error	1, One of the device net nodes is not working correctly. 2. Cable or wiring disconnected 3. Node not reading correctly. Does not have 3 green lights.	1. Look at the I/O device screen to see if all of the nodes are operating. Press fault reset button to clear. 2. Check for 24VDC and nodes and check the cables, tees and terminators. 3. Reboot system if not working replace buss coupler.
No Material Dispensed NO Fault	1. The robot did not send the Robot Style bit and the Job was Ignored.	1. Autostream software is operating correctly. The robot needs to send the robot Style bit.

Ingersoll-Rand specializes in delivering effective solutions for high viscosity industrial Adhesive, Sealing, and Lubrication Applications.

Through the years, Ingersoll-Rand has developed solutions for a wide variety of applications and has refined them into a flexible and innovative collection of processes.



Applications:

Ingersoll-Rand Systems expertise crosses industrial and international boundaries to provide the highest levels of technology and reliability to customers who have a desire to improve value throughout the life of their product.

Hem Adhesive Bead
Adheres joints where the workpiece is crimped (hemmed) over the adjoining piece

Hem Adhesive Ribbon
Provides a low, wide profile when the workpiece is dimensionally inconsistent

Lap Joint Adhesive Bead
Adheres joints where the metal is welded or simply held in place by the adhesive

Lap Joint Adhesive Ribbon
Provides a low, wide profile when the workpiece is dimensionally inconsistent

After Hem Sealer
Seals a joint that has been crimped (hemmed) over

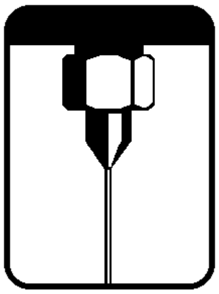
Joint Sealer
Penetrates and seals a joint

Shaped Bead
Beads are shaped for gasketing, workpiece inconsistency, or vibration dampening as well as for special applications

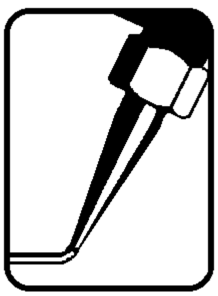
Patches and Coatings
Sprayed patches can replace hand applied patches in Body Panel Reinforcement, Sound Deadening, and Weatherproofing

Processes

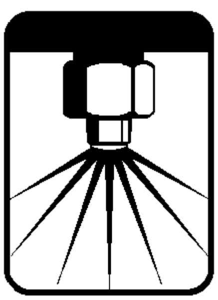
Ingersoll-Rand Systems utilizes award winning technology and state-of-the-art controls to provide the most effective and reliable processes available.



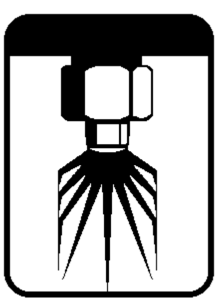
Streaming
Material is applied to the workpiece by a thin jet so that the process is not affected by inconsistencies in the workpiece



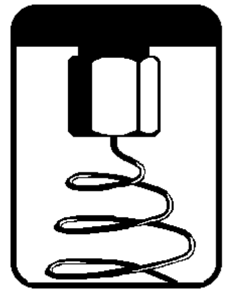
Extrusion
Material is deposited onto the workpiece directly where bead shape is critical to its performance



Spraying
Airless application of materials in a wide pattern of consistent thickness



Clip Fan (Precision) Spraying
Application of materials in a pattern of tightly controlled width



String Dispersion
Provides a wide application pattern without atomizing the material

Nozzles

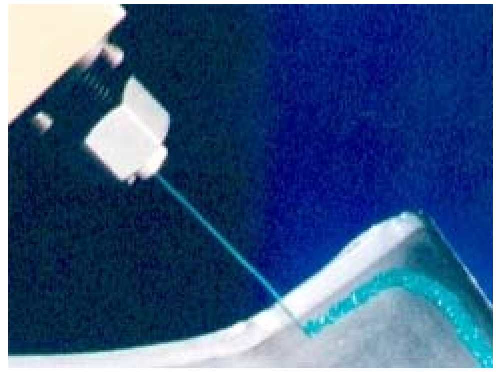
Ingersoll-Rand uses a wide variety of nozzles to dispense a array of different materials in different applications. Specialty nozzles can be made.

Shown are String dispersion, tip orientation, specialty, extrusion

Horse hair brushes and robotic teach tips

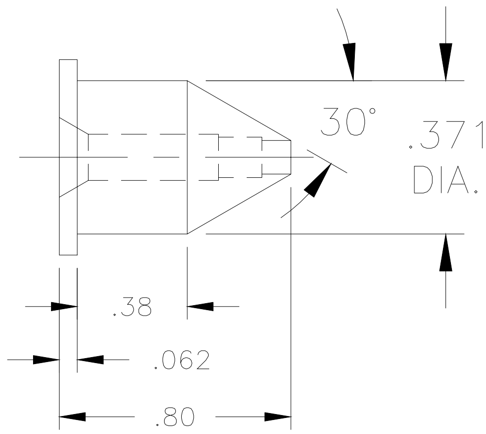
Cone tip streaming, HV style streaming, spraying tips.

Streaming vs Extruding



Streaming involves faster robot speeds (500-1500mm/s) and higher pressures the extruding. The dispense system creates a pressure behind a small orifice. The material is forced out of the nozzle in the form of a small stream. The larger the nozzle the less force the stream has and the closer the nozzle needs to be programmed to the part. Streaming can works if the work piece is horizontal, vertical or overhead. Streaming is the preferred method of dispensing.

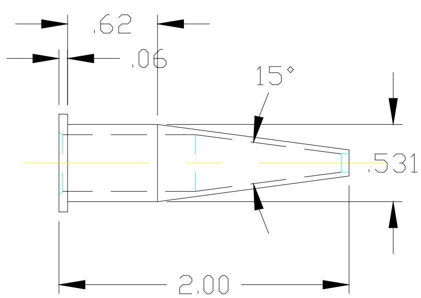
PART No.	DESCRIPTION	ORIFICE
362-853	STREAM TIP W/ INSERT	.030
362-853A	STREAM TIP W/ INSERT	.035
362-853B	STREAM TIP W/ INSERT	.040
362-853C	STREAM TIP W/ INSERT	.045
362-853D	STREAM TIP W/ INSERT	.050
362-853E	STREAM TIP W/ INSERT	.060
362-853F	STREAM TIP W/ INSERT	.018
362-853G	STREAM TIP W/ INSERT	.021
362-853H	STREAM TIP W/ INSERT	.026
362-853L	STREAM TIP W/ INSERT	.075
364-224	STREAM TIP W/ INSERT	.187



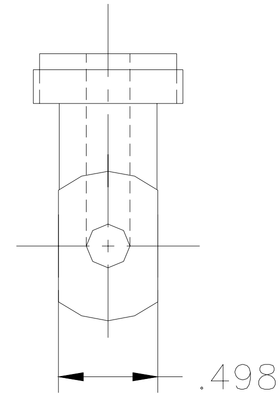
Extruding Nozzle Selection

When using a extruding nozzle the bead size in normally larger (10mm) then streaming. To create a 10-20mm bead with a streaming tip it would take slow robot speeds and very high pressures. With the extruding nozzle the robot speeds can increase, but the bead can only be dispensed in a horizontal (down) direction. There are many ways to misuse an extrude nozzle so we will use the following statement as our guide. The diameter of the opening of the nozzle is equal to the diameter of the bead that you want to apply.

PART No.	DESCRIPTION	ORIFICE
400-723	EXTRUDING TIP	.093
400-724	EXTRUDING TIP	.125
400-725	EXTRUDING TIP	.187
400-726	EXTRUDING TIP	.250

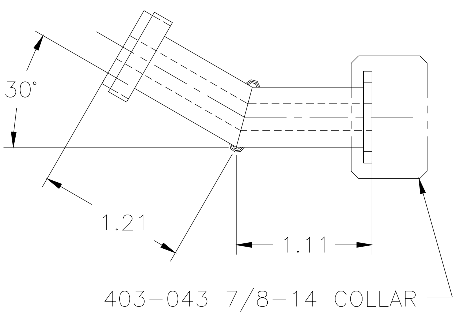


Adaptors

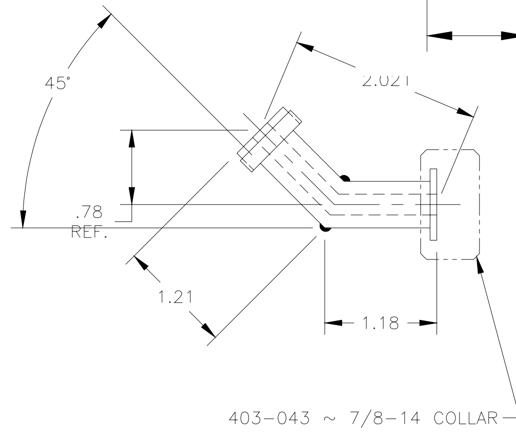


Sometimes it is necessary to install an angle offset adaptor to help make the programming easier. All of the angle adaptors have tip orientations so that they can be installed on the dispense valve in 90 deg. Rotations.

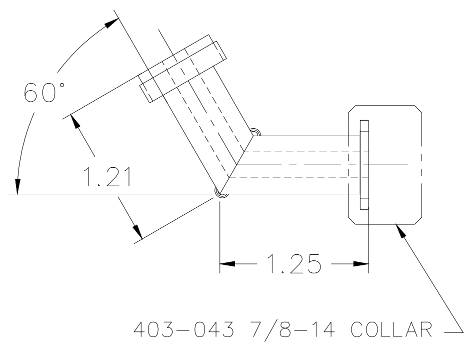
Adaptors can only be install on special dispense valves Such as a 105B038D dispense valve or a 105B038xD 4 or 6 inch extended dispense valve.



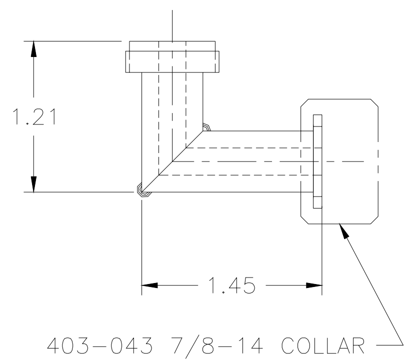
403-114-30



403-114-45A

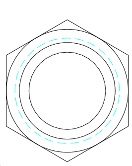


403-114A

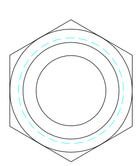


403-114-90B

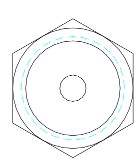
COLLARS



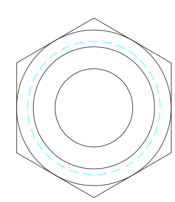
400-667
3/4 in. x 16 thd. .550 opening
Used with Extrusion Nozzles



400-667A
3/4 in. x 16 thd. .494 opening
Used with Standard Spray Tips



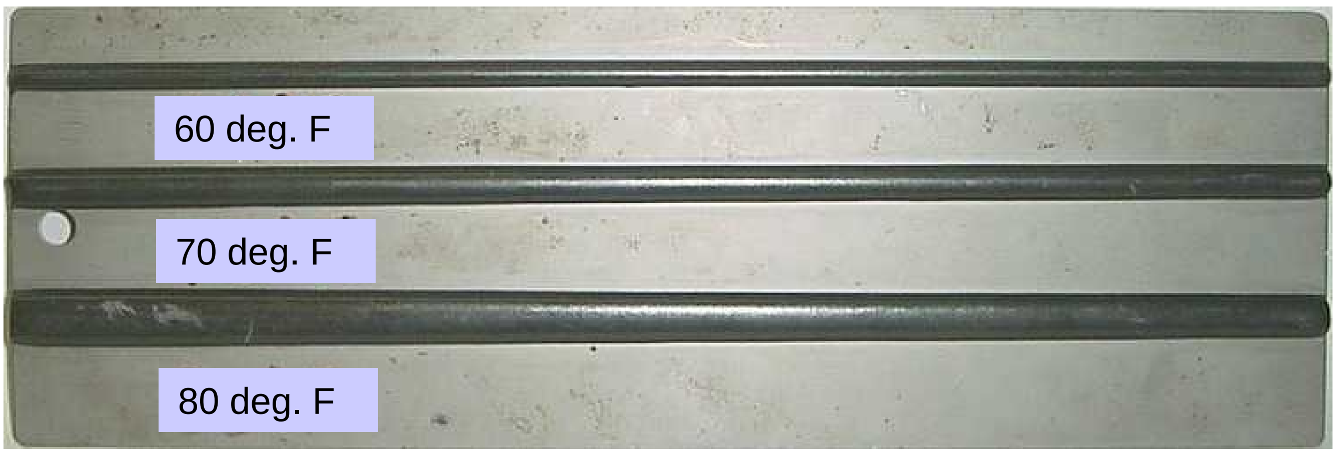
403-132
3/4 in. x 16 thd. .191 opening
Used with HV Type Spray Tips



403-043
7/8 in. x 14 thd. .500 opening
Used with Orientated Spray Tips.

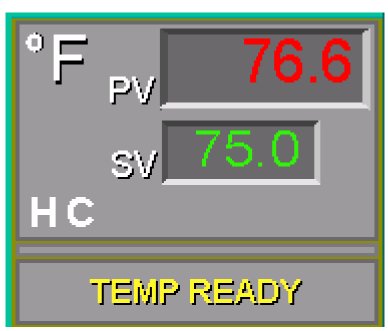
Temperature

Temperature conditioning is used to create a stable environment so that the viscosity of a material remains constant throughout the day. This will improve the job to job quality of a bead. Temperature can be used to make a high viscosity material dispensable without using excessive pump pressure. Some materials can adhere to a oily panel better if the temperature is elevated. Ingersoll-Rand uses water as a medium to condition the material. A closed loop system pumps water through the dispense valve (point of application), dispense head, conditioned hoses and header. The system has an electric heater and a chiller to condition the water. A RTD resistive thermal detector is used to measure the material as close to the nozzle as possible. The RTD feeds back to the PC which in turn controls the temperature of the water.



This example show the difference temperature can make. The dispense pressure and robot speed is the same only the temperature has been changed.

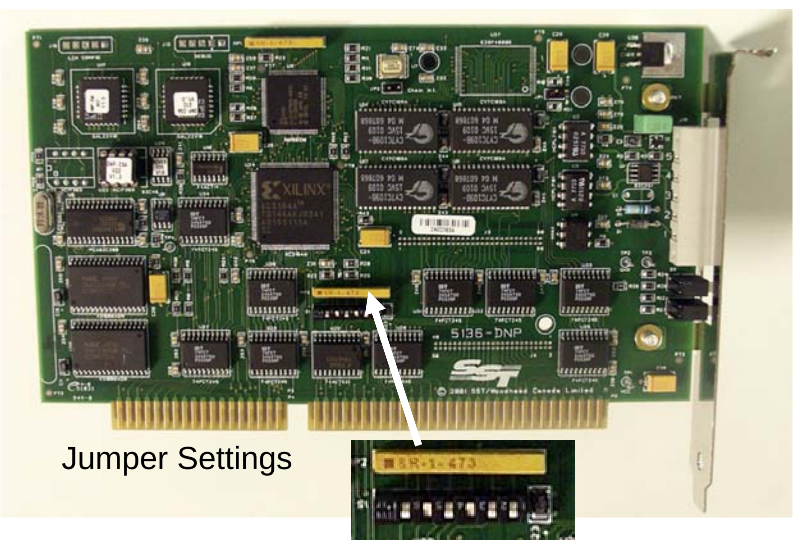
The 100 ohm platinum bulb RTD



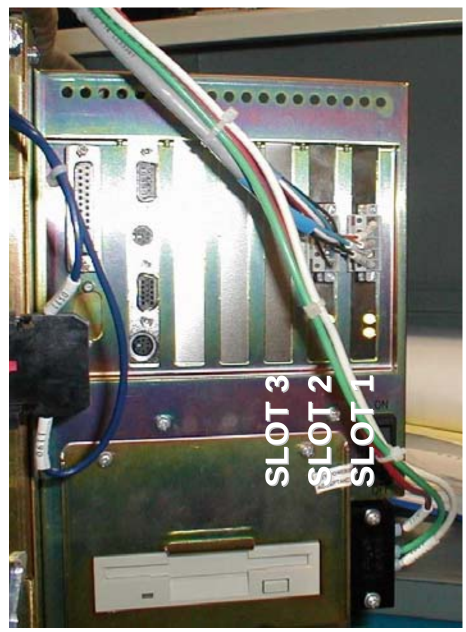
Shown is the PC temperature window which can be displayed in Celsius or Fahrenheit

Device Net

Ingersoll-Rand use device net as a way of communicating from the robot to the PC – The robot is the master and the PC is the slave. Also the communication from the PC to the Robot / Pedestal mount Junction box is device net – PC is the master and the J-box nodes are the slaves. Device net uses a 5 wire connector that contains a 24vdc power, a high – low CAN signal and a shield (similar to a PLC cable). The cables are all shielded twisted pair wiring that resists noise. The PC has communication cards installed – one for each network. The communication between the robot and the PC is configured to have 64 inputs and 64 outputs.



364-207 Device Net Communications Card (DNP)



The dip switches set the address to match correct card to the equipment in the PC software. If a card is removed the DIP SWITCHES must be set.

NOTE: IF the PC is started up without 24vcd power on communications the device net software will not load and the PC screen will show a device net error.

DEVICENET PC CARD DIPSWITCH SETTINGS		DEVICE NET SETTINGS
SLOT	SWITCH SETTINGS 1 = ON 0 = OFF	
1 (AT REAR)	5136–DN 5136–DNP INTERNAL NETWORK	DISPENSER NETWORK 250 K BAUD
2	ROBOT SYSTEM 1	EQUIPMENT 1 MAC ID 10 500 K BAUD
3	ROBOT SYSTEM 2	EQUIPMENT 2 MAC ID 12 500 K BAUD

PC Nodes

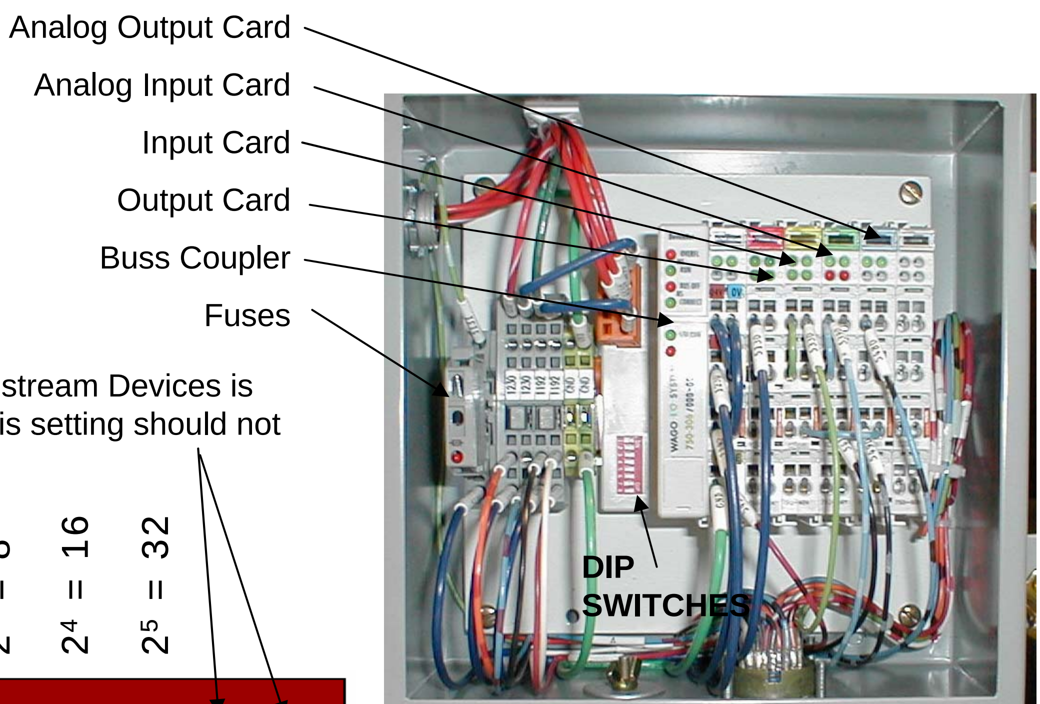
The PC uses several nodes to send inputs and outputs. The main control cabinet, each dispense J-box and pump J-box will have a node. The node consists of a buss coupler, which communicates with the controller card. Attached to the buss coupler an array of I/O cards can be attached to it. Examples are 24vdc Input – 24vdc Output – Analog Input 0-10vdc – Analog Output 0-10vdc.

Node Addressing in the Wago Blocks

DeviceNet recognizes each Wago Block by its Node Address. Every device on a DeviceNet network **must** have a unique (different) Node Address.

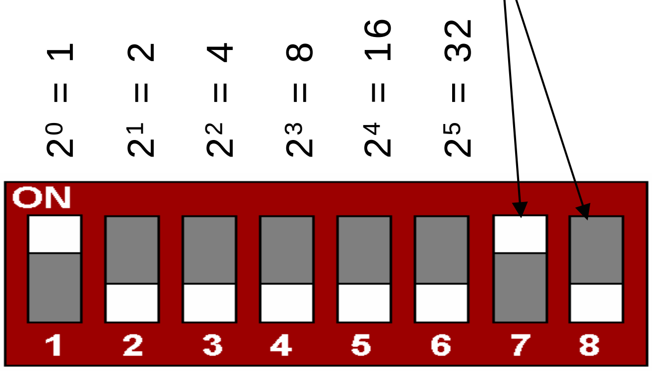
DeviceNet's communication speed is determined by its Baud Rate. Every device on a DeviceNet network **must** be set at the same Baud Rate. The Dispenser baud Rate should be set to 250 baud.

Node Addresses and Baud Rates are set by DIP (Digital Input) Switch on the Wago Blocks.



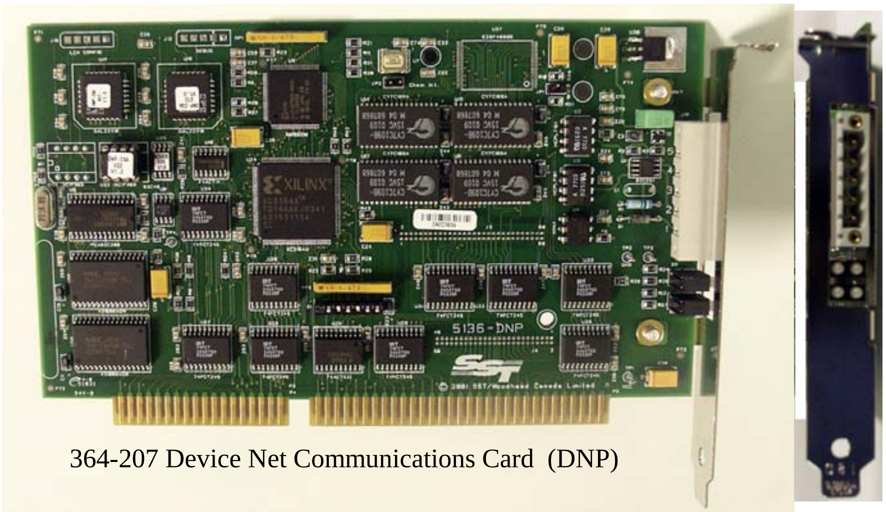
This picture shows a dispense J-box node.

Baud Rate on Autostream Devices is ALWAYS 250k. This setting should not change



The Node Addresses is the sum of the switches that are turned "ON". Address #1 is shown.
Address #3 would have switches 1 & 2 "ON" since 1 + 2 = 3
Address #13 would have switches 1, 3, & 4 "ON" since 1 + 4 + 8 = 13

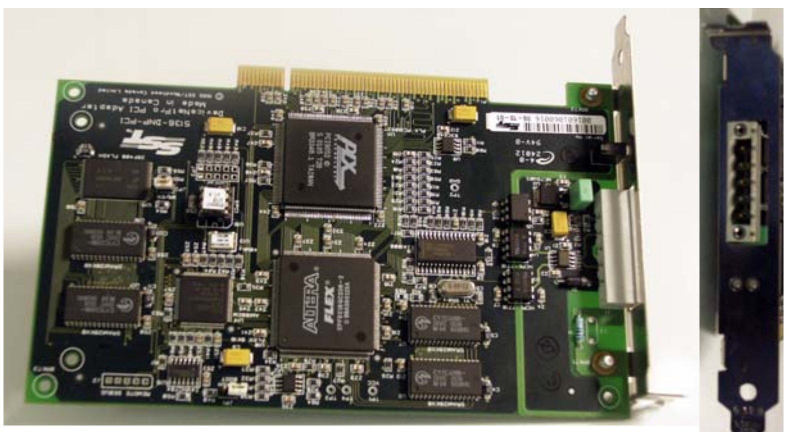
Device Net Card Identification and Settings



364-207 Device Net Communications Card (DNP)

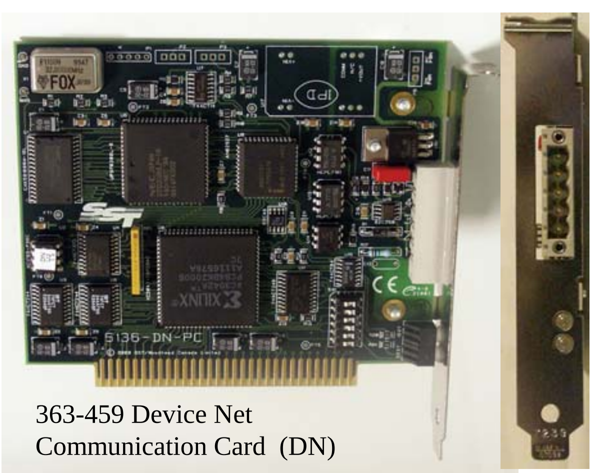
Jumper Settings

DEVICENET PC CARD DIPSWITCH SETTINGS		
SLOT	SWITCH SETTINGS 1 = ON 0 = OFF	
1 (AT REAR)	5136-DNP	DISPENSE NETWORK
2		ROBOT SYSTEM 1
3		ROBOT SYSTEM 2



363-871 PCI Device Net Communication Card

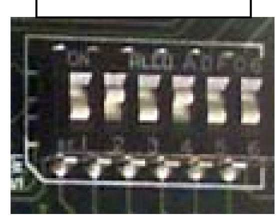
No Jumper Settings



363-459 Device Net Communication Card (DN)

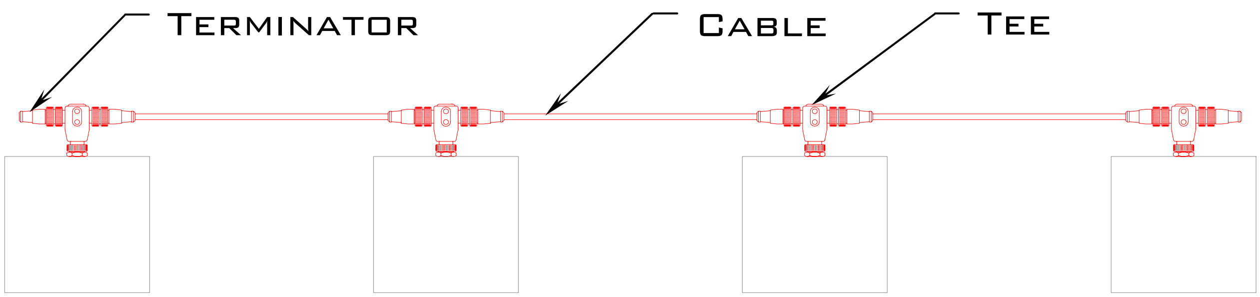
DEVICENET PC CARD DIPSWITCH SETTINGS		
SLOT	SWITCH SETTINGS 1 = ON 0 = OFF	
1 (AT REAR)	5136-DN	DISPENSE NETWORK
2		ROBOT SYSTEM #1 NETWORK
3		ROBOT SYSTEM #1 NETWORK

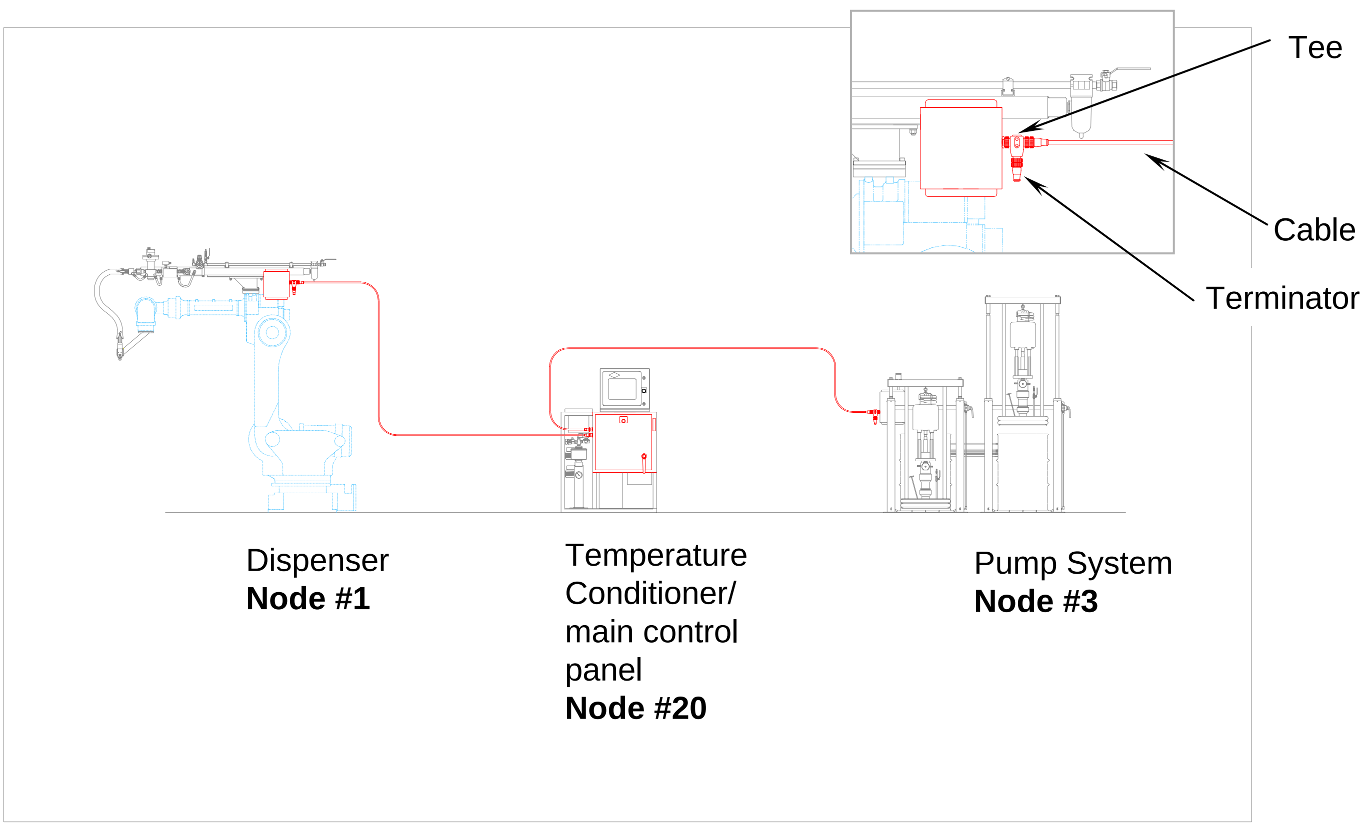
Jumper Setting



Physical DeviceNet Layout

Each DeviceNet network (bus) **must** be set up as a “single-file” string of devices (trunk) connected by special DeviceNet cable.
Each DeviceNet network **must** have terminating resistors (Terminators) at each end.
Devices are dropped off the trunk by Tees and smaller cables (branches).
DeviceNet cable is available in Thick and Thin. Maximum trunk (bus) length for Johnstone equipment is 250m for Thick cable and 100m for Thin cable. Johnstone uses Thin cable as a standard because it is much more flexible and compact than Thick.
Maximum branch length for Johnstone is 6m. Johnstone equipment is always attached to the trunk line, so this constraint does not matter.





Device Net Variables to PC

These Values should be entered so that the Robot can talk to the PC.
Communication Setup (Menu/I-O/TYPE{F1}/0{next page}/DEVICE NET
Rack 81 = PLC Controller Rack 82 = Ingersoll-Rand PC

In rack 82 board the detail values are:

Mac ID: GM	Equipment #1 = 10	Equipment #2 = 12	At 500 Baud
CAMI	Equipment #1 = 20	Equipment #2 = 22	At 500 Baud
Daimler Chrysler	Equipment #1 = 15	Equipment #2 = 16	At 125 Baud

Baud Rate = 500K or 125K for Daimler Chrysler specs
Board auto restart = ON
Input resume state = LAST
Size of output from master = 0
Size of input from master = 0

Setting the Device net I/O assignment:
1 Device name = Ingersoll-Rand 2 Comment = PC
3 Vendor ID = 8
4 Device Type = 12
5 Product code = 0
6 Polled I/O = default yes
Digital input = 64
Digital output = 64
Analog input = 0
Analog output = 0
Strobed = default no
Rest of the values are no or 0

Under the Rack 82 the Ingersoll-Rand definitions are added.
Device name = Ingersoll-Rand (device created above)
A dual system will have 2 Mac ID's set up.

After the I/O have been set up the robot need to reboot and the device networks need to be put online

Fanuc Information

3. DeviceNet Board Setup and Configuration

3.1. Configuring and Connecting the DeviceNet Interface Daughterboards

Before you can connect the DeviceNet Interface daughterboards to devices on the DeviceNet network, you must configure them properly. Use Procedure 3.1. to configure the daughterboards.

When you configure DeviceNet Interface daughterboards, you use two screens: the I/O DeviceNet Board List screen and the I/O DeviceNet Board Detail screen. Refer to Table 3.1. and Table 3.2. for a listing and description of each of the items on these screens.

Table 3.1. DeviceNet Board List Screen Items

ITEM	DESCRIPTION
Board	This is the number of the DeviceNet Interface daughterboard, 1-4.
Comment	This is text you enter to describe the daughterboard. A comment is not required.
Rack	This is the I/O rack that will be used to configure the I/O used with the daughterboard on the controller. DeviceNet Interface daughterboards must use racks 81 through 84: Rack 81 - Daughterboard 1 Rack 82 - Daughterboard 2 Rack 83 - Daughterboard 3 Rack 84 - Daughterboard 4 **You cannot change the rack number of a daughterboard.**
Status	This is the current state of the DeviceNet Interface daughterboard. **ONLINE** indicates the board is presently active. Information to and from devices configured on this network is being updated. **OFFLINE** indicates that no data is being transferred to or from devices connected to the board. Scanning of devices connected to this board will not start at power up. **ERROR** indicates that an error has been detected. The board is effectively off-line, but scanning will be attempted after power up.

Table 3.2. DeviceNet Board Detail Screen Items

ITEM	DESCRIPTION
Board	This displays the number of the selected daughterboard.
Status	This displays the status of the selected daughterboard: ONLINE, OFFLINE, ERROR.
Scanner Type	The model of scanner represented by this daughterboard. Currently two kinds are supported: SST 5136-DN and SST 5136-DNP.
Motherboard	The type of motherboard used with the daughterboard. Currently there are two kinds: "full-slot" and "wide-mini."
MAC-Id	This is the Media Access Control ID used by the daughterboard. It must have a value of from 0 to 63. The MAC-Id must be different from the MAC-Ids of all other devices on the network.
Baud Rate	This specifies the data rate used in transfers between the DeviceNet Interface board and the devices on the network. Specify one of the following baud rates: 125 KB 250 KB 500 KB
Board Auto-restart	When this is set to ON, the board will automatically restart communication with the DeviceNet network after a board or network error has occurred and the error situation has been resolved. Setting this value to OFF turns off board auto-restart. The default value is OFF.
Input resume state	The two valid values for this setting are LAST and ZERO, and this setting affects all input I/O ports (digital, analog, group, and so forth) which have an assigned rack value equal to the board's rack number. When the input resume state is set to LAST, these input ports will retain their last known values if the port goes offline. When the input resume state is set to ZERO, the port values are set to zero. The default value is LAST.
Slave Status	Slave status indicates the status of the slave connection of this DeviceNet board. If the slave connection is not enabled (if size of output from master and size of input to master are 0), this field displays OFFLINE. If it is enabled and the remote master has not yet connected, this field indicates IDLE and error DNET-125 is posted. If the remote master is connected, this field displays ONLINE. This field is display only.
Slave Error Severity	This sets the error severity level of the error DNET-125 that indicates the slave connection is idle. Select WARN, STOP or PAUSE as required.
Slave Operation: Size of output from master	For slave operation, in which the R-J3*i*B controller acts as a slave to an external master, this specifies the size of the output **from** the master **to** the daughterboard, in bytes. See Figure 3.1..
Slave Operation: Size of input to master	For slave operation, in which the R-J3*i*B controller acts a slave to an external master, this specifies the size of the input **to** the master **from** the daughterboard, in bytes. See Figure 3.1..

Procedure 3.1. Configuring and Connecting DeviceNet Interface Daughterboards

1.Press MENUS.
2.Select I/O.
3.Press F1, [TYPE].
4.Select DeviceNet. You will see a screen similar to the following.

```
Board List                    1/4
Board   Comment        Rack  Status
1   [           ]   81      OFFLINE
2   [ Ingersoll]   82      OFFLINE
3   [           ]   83      OFFLINE
4   [           ]   84      OFFLINE
```

1.To configure each daughterboard, move the cursor to the daughterboard you want to configure and press F4, DETAIL. You will see a screen similar to the following.

```
Board Detai
lBoard: 1                Status: OFFLINE
Scanner type:
SST 5136-DN-104
Motherboard:  Full-slot
1  MAC-ID:                  0
2  Baud-rate:             500 KB
3  Board auto-restart:     ON
4  Input resume state (rack 82): LAST
5  SLAVE Error Severity:       WARN
6  Size of output from master:   0 Bytes
7  Size of input to master:      0 bytes
```

1.Move the cursor to MAC-Id and type the MAC-Id. This must be a value from 0 to 63 and must be different from the MAC-Id of any other device in the network. (choose 0)
2.Move the cursor to Baud-rate, and press the function key that corresponds to the baud rate you want to use:
For 125 KB, press F2.
For 250 KB, press F3.
For 500 KB, press F4.
3.Move the cursor to Board auto-restart to set the board auto-restart state:
To turn it on, press F2.
4.Move the cursor to input resume state to set the input resume state for the board:
If inputs are to retain their last state, press F2.

GM RS4 I/O: Dispense controller digital inputs (Channel 82 node 10 / 12)

Robot input E1 / E2	Description	Signal name	Node address
In 65 / 129	Dispense #/ Ready	diSL#Ready	N10 / 12: I01
In 66 / 130	Dispense # In Process	diSL#InProcess	N10 / 12: I02
In 67 / 131	Dispense # Volume OK	diSL#VolumeOK	N10 / 12: I03
In 68 / 132	Dispense # Major Fault	DiSL#MajorFault	N10 / 12: I04
In 69 / 133	Dispense # Minor Fault	diSL#MinorFault	N10 / 12: I05
In 70 / 134	Dispense # Remote Start In Progress	diSL3RmtStartInp	N10 / 12: I06
In 71 / 135	Dispense # Automatic Mode	diSL#AutoMode	N10 / 12: I07
In 72 / 136	Dispense # Manual Mode	diSL#ManMode	N10 / 12: I08
In 73 / 137	Dispense # De-Pressurized	diSL#DePrsized	N10 / 12: I09
In 74 / 138	Dispense # Drum Empty	diSL#DrumEmpty	N10 / 12: I10
In 75 / 139	Dispense # Flow Meter bypassed	diSLMBypassed	N10 / 12: I11
In 76 / 140	*(Reserved)*	*(Reserved)*	N10 / 12: I12
In 77 / 141	Dispense # meter Full	diSL#MeterFull	N10 / 12: I13
In 78 / 142	Dispense # meter Empty	diSL#MeterEmpty	N10 / 12: I14
In 79 / 143	Dispense # meter Pressurized	diSL#MeterPrsized	N10 / 12: I15
In 80 / 144	Dispense # meter Near Empty	diSL#MeterNrEmty	N10 / 12: I16
In 81 / 145	*(Reserved)*	*(Reserved)*	N10 / 12: I17
In 82 / 146	Dispense # Felt Advanced	diSL#FeltAdvanced	N10 / 12: I18
In 83 / 147	Dispense # Primer Check Passed	diSL#PrimeChkPass	N10 / 12: I19
In 84 / 148	Dispense 1 Primer Check Failed	diSL#PrimeChkFail	N10 / 12: I20
In 85 / 149	Change Primer Brush	diSL#ChangePBrush	N10 / 12: I21
In 86 / 150	*(Reserved)*	*(Reserved)*	N10 / 12: I22
In 87 / 151	*(Reserved)*	*(Reserved)*	N10 / 12: I23
In 88 / 152	Dispense # Purge Request	diSL#PurgeReq	N10 / 12: I24
In 89 / 153	Dispense 1 Purge in Process	diSL#PurgeInProcess	N10 / 12: I25
In 90 / 154	*(Reserved)*	*(Reserved)*	N10 / 12: I26
In 91 / 155	Volume # Dispensed Data Bit 1	diSL#VolDatBit1	N10 / 12: I27
In 92 / 156	Volume # Dispensed Data Bit 2	diSL#VolDatBit2	N10 / 12: I28
In 93 / 157	Volume # Dispensed Data Bit 3	diSL#VolDatBit3	N10 / 12: I29
In 94 / 158	Volume # Dispensed Data Bit 4	diSL#VolDatBit4	N10 / 12: I30
In 95 / 159	Volume # Dispensed Data Bit 5	diSL#VolDatBit5	N10 / 12: I31
In 96 / 160	Volume # Dispensed Data Bit 6	diSL#VolDatBit6	N10 / 12: I32
In 97 / 161	Volume # Dispensed Data Bit 7	diSL#VolDatBit7	N10 / 12: I33
In 98 / 162	Volume # Dispensed Data Bit 8	diSL#VolDatBit8	N10 / 12: I34
In 99 / 163	Volume # Dispensed Data Bit 9	diSL#VolDatBit9	N10 / 12: I35
In 100 / 164	Volume # Dispensed Data Bit 10	diSL#VolDatBit10	N10 / 12: I36
In 101 / 165	Volume # Dispensed Data Bit 11	diSL#VolDatBit11	N10 / 12: I37
In 102 / 166	Volume # Dispensed Data Bit 12	diSL#VolDatBit12	N10 / 12: I38
In 103 / 167	*(Reserved)*	*(Reserved)*	N10 / 12: I39
In 104 / 168	Dispense # Fault Data Bit 1	diSL#FaultBit1	N10 / 12: I40
In 105 / 169	Dispense # Fault Data Bit 2	diSL3FaultBit2	N10 / 12: I41
In 106 / 170	Dispense # Fault Data Bit 3	diSL3FaultBit3	N10 / 12: I42
In 107 / 171	Dispense # Fault Data Bit 4	diSL3FaultBit4	N10 / 12: I43
In 108 / 172	Dispense # Fault Data Bit 5	diSL#FaultBit5	N10 / 12: I44
In 109 / 173	Dispense # Fault Data Bit 6	diSL#FaultBit6	N10 / 12: I45
In 110 / 174	Dispense # Fault Data Bit 7	diSL3FaultBit7	N10 / 12: I46
In 111 / 175	Dispense # Fault Data Bit 8	diSL3FaultBit8	N10 / 12: I47
In 112 / 176	*(Reserved)*	*(Reserved)*	N10 / 12 : I48
In 113 / 177	Dispense # Ejection Valve(s) Ready	DiSL#EjValveRdy	N10 / 12: I49
In 114 / 178	*(Reserved)*	*(Reserved)*	N10 / 12: I50
In 115 / 179	*(Reserved)*	*(Reserved)*	N10 / 12: I51
In 116 / 180	*(Reserved)*	*(Reserved)*	N10 / 12: I52

GM RS4 I/O: Dispense controller digital inputs (Channel 82 node 10 / 12) continued:

Robot Input E1 / E2	Description	Signal Name	Node Address
In 117 / 181	*(Reserved)*	*(Reserved)*	N10 / 12: I53
In 118 / 182	Dispense # Ejection Complete	diSL#EjectCmpl	N10 / 12: I54
In 119 / 183	*(Reserved)*	*(Reserved)*	N10 / 12: I55
In 120 / 184	*(Reserved)*	*(Reserved)*	N10 / 12: I56
In 121 / 185	*(Reserved)*	*(Reserved)*	N10 / 12: I57
In 122 / 186	*(Reserved)*	*(Reserved)*	N10 / 12: I58
In 123 / 187	*(Reserved)*	*(Reserved)*	N10 / 12: I59
In 124 / 188	*(Reserved)*	*(Reserved)*	N10 / 12: I60
In 125 / 189	*(Reserved)*	*(Reserved)*	N10 / 12: I61
In 126 / 190	*(Reserved)*	*(Reserved)*	N10 / 12: I62
In 127 / 191	*(Reserved)*	*(Reserved)*	N10 / 12: I63
In 128 / 192	*(Reserved)*	*(Reserved)*	N10 / 12: I64

GM RS4 I/O: Dispense controller digital outputs (Channel 82 node 10 / 12)

Robot Output E1 / E2	Description	Signal Name	Node Address
Out 65 / 129	Dispense # Style Bit 1	doSL#StyleBit1	N10 / 12: O01
Out 66 / 130	Dispense # Style Bit 2	doSL#StyleBit2	N10 / 12: O02
Out 67 / 131	Dispense # Style Bit 3	doSL#StyleBit3	N10 / 12: O03
Out 68 / 132	Dispense # Style Bit 4	doSL#StyleBit4	N10 / 12: O04
Out 69 / 133	Dispense # Style Bit 5	doSL#StyleBit5	N10 / 12: O05
Out 70 / 134	Dispense # Style Bit 6	doSL#StyleBit6	N10 / 12: O06
Out 71 / 135	Dispense # Style Bit 7	doSL#StyleBit7	N10 / 12: O07
Out 72 / 136	Dispense # Style Bit 8	doSL#StyleBit8	N10 / 12: O08
Out 73 / 137	Dispense # Robot in Style	doSL#RbInStyle	N10 / 12: O09
Out 74 / 138	Dispense # Style Strobe	doSL#StyleStrobe	N10 / 12: O10
Out 75 / 139	Dispense # Gun 1 On	doSL#Gun1On	N10 / 12: O11
Out 76 / 140	Dispense # Gun 2 On	doSL#Gun2On	N10 / 12: O12
Out 77 / 141	Dispense # Gun 3 On	doSL#Gun3On	N10 / 12: O13
Out 78 / 142	Dispense # Gun 4 On	doSL#Gun4On	N10 / 12: O14
Out 79 / 143	Dispense # Gun 5 On	doSL#Gun5On	N10 / 12: O15
Out 80 / 144	*(Reserved)*	*(Reserved)*	N10 / 12: O16
Out 81 / 145	Dispense # Dispense Complete	doSL#DispenseCmplt	N10 / 12: O17
Out 82 / 146	Dispense # Remote Start	doSL#RemoteStart	N10 / 12: O18
Out 83 / 147	*(Reserved)*	*(Reserved)*	N10 / 12: O19
Out 84 / 148	Dispense # Pre-Pressure meter	doSL#PrePressure	N10 / 12: O20
Out 85 / 149	Dispense # Reload meter	doSL#ReloadMeter	N10 / 12: O21
Out 86 / 150	Dispense # De-pressure meter	doSL#DepressMeter	N10 / 12: O22
Out 87 / 151	*(Reserved)*	*(Reserved)*	N10 / 12: O23
Out 88 / 152	Dispense # Clear Primer Complete	doSL#ClrPrimerCmplt	N10 / 12: O24
Out 89 / 153	Dispense # Black Primer Complete	doSL#BlckPrimerCmplt	N10 / 12: O25
Out 90 / 154	Dispense # Urethane Complete	doSL#UrethaneCmplt	N10 / 12: O26
Out 91 / 155	(Reserved)	(Reserved)	N10 / 12: O27
Out 92 / 156	Dispense # Advance Felt	doSL#AdvanceFelt	N10 / 12: O28
Out 93 / 157	Dispense # Waiting for Primer Data	doSL#WaitPrimer	N10 / 12: O29
Out 94 / 158	Dispense # Primer Brush Change Compete	doSL#PrimerBrChCmplt	N10 / 12: O30
Out 95 / 159	(Reserved)	(Reserved)	N10 / 12: O31
Out 96 / 160	Dispense # OK to Purge	doSL#OKToPurge	N10 / 12: O32
Out 97 / 161	Dispense # Material Flow Command Bit 1	aoSL#MatFlowBit1	N10 / 12: O33
Out 98 / 162	Dispense # Material Flow Command Bit 2	aoSL3MatFlowBit2	N10 / 12: O34
Out 99 / 163	Dispense # Material Flow Command Bit 3	aoSL#MatFlowBit3	N10 / 12: O35
Out 100 / 164	Dispense # Material Flow Command Bit 4	aoSL#MatFlowBit4	N10 / 12: O36
Out 101 / 165	Dispense # Material Flow Command Bit 5	aoSL#MatFlowBit5	N10 / 12: O37
Out 102 / 166	Dispense # Material Flow Command Bit 6	aoSL#MatFlowBit6	N10 / 12: O38
Out 103 / 167	Dispense # Material Flow Command Bit 7	aoSL#MatFlowBit7	N10 / 12: O39
Out 104 / 168	Dispense # Material Flow Command Bit 8	aoSL#MatFlowBit8	N10 / 12: O40
Out 105 / 169	Dispense # Material Flow Command Bit 9	aoSL#MatFlowBit9	N10 / 12: O41
Out 106 / 170	Dispense # Material Flow Command Bit 10	aoSL#MatFlowBit10	N10 / 12: O42
Out 107 / 171	Dispense 1 Material Flow Command Bit 11	aoSL#MatFlowBit11	N10 / 12: O43
Out 108 / 172	Dispense 1 Material Flow Command Bit 12	aoSL#MatFlowBit12	N10 / 12: O44
Out 109 / 173	*(Reserved)*	*(Reserved)*	N10 / 12: O45
Out 110 / 174	*(Reserved)*	*(Reserved)*	N10 / 12: O46
Out 111 / 175	*(Reserved)*	*(Reserved)*	N10 / 12: O47
Out 112 / 176	*(Reserved)*	*(Reserved)*	N10 / 12: O48
Out 113 / 177	Dispense # Bead Shaping Command (bit 1)	aoSL#BeadShp (Bit 1)	N10 / 12: O49
Out 114 / 178	Dispense # Bead Shaping Command (bit 2)	aoSL#BeadShp (Bit 2)	N10 / 12: O50
Out 115 / 179	Dispense # Bead Shaping Command (bit 3)	aoSL#BeadShp (Bit 3)	N10 / 12: O51
Out 116 / 180	Dispense # Bead Shaping Command (bit 4)	aoSL#BeadShp (Bit 4)	N10 / 12: O52

GM RS4 I/O: Dispense controller digital outputs (Channel 82 node 10 / 12) continued:

Robot Output E1 / E2	Description	Signal Name	Node Address
Out 117 / 181	Dispense # Bead Shaping Command (bit 5)	aoSL#BeadShp (Bit 5)	N10 / 12: O53
Out 118 / 182	Dispense # Bead Shaping Command (bit 6)	aoSL#BeadShp (Bit 6)	N10 / 12: O54
Out 119 / 183	Dispense # Bead Shaping Command (bit 7)	aoSL#BeadShp (Bit 7)	N10 / 12: O55
Out 120 / 184	Dispense # Bead Shaping Command (bit 8)	aoSL#BeadShp (Bit 8)	N10 / 12: O56
Out 121 / 185	Dispense # Bead Shaping Command (bit 9)	aoSL#BeadShp (Bit 9)	N10 / 12: O57
Out 122 / 186	Dispense # Bead Shaping Command (bit 10)	aoSL#BeadShp (Bit 10)	N10 / 12: O58
Out 123 / 187	Dispense # Bead Shaping Command (bit 11)	aoSL#BeadShp (Bit 11)	N10 / 12: O59
Out 124 / 188	Dispense # Bead Shaping Command (bit 12)	aoSL#BeadShp (Bit 12)	N10 / 12: O60
Out 125 / 189	*(Reserved)*	*(Reserved)*	N10 / 12: O61
Out 126 / 190	*(Reserved)*	*(Reserved)*	N10 / 12: O62
Out 127 / 191	*(Reserved)*	*(Reserved)*	N10 / 12: O63
Out 128 / 192	*(Reserved)*	*(Reserved)*	N10 / 12: O64

The Analog Values are set up as a Group BCDB bit.

Menu/ IO/Group

The style bits are set up using a six group selection

The Analog bits are set up using a 12 group selection

Fanuc new software will have this set up for you.

Create a group from the Digital outputs rack 82 Mack ID 20 or 22 starting point N:33 for 12 Nodes

Reference range 0-4096 where 10V is equal to 4095 Style bits are set up as a group BDCB bit .

The Body Styles are set up as a Group BCDB bit.

Create a group from the Digital Output Rack 82 Mack ID 20 or 22 Starting Point N:1 for 8 Nodes

Range is 0-255 different style bits

Robot Automatic Sequence of Operations:

1. PC Sends Signal IN PROCESS off
   This signal verifies that the dispense head has been reset from the last job (refilled) and is not in a purge mode.

2. PC to Robot - No Dispense Fault (Major)- Dispense Ready High – Do not look at Volume OK condition at the beginning of a job, this bit can be low or high depending if the last job was good or bad.

3. Robot Sends Body Style 1-255 (0 body style is a purge routine –NO Volume Limits). Sent as a 8 bit Group Output. The style can be put into the program two ways.
   a. The style bit can be inserted in the path program.
   b. The style bit can be inserted in the DETAILS of a JOB in the PART ID if the job is configured for the disperser to be true. A separate job is required for each body style and the style strobe is automatically sent if the job is run.

4. Robot Sends a Style Strobe (pulsed bit locks in body style 250ms) Body style appears in PC Watch Window.
   a. The style bit can be turned off.
   b. The InProcess bit goes high and the Volume OK bit goes Low. The system is in a Dispensing Mode (if precharge value is enabled)

5. Robot Sends a 12 bit Group Flow Command signal (0-4095 Max) and the Gun On signal to start dispensing. The Gun On can go on and off.

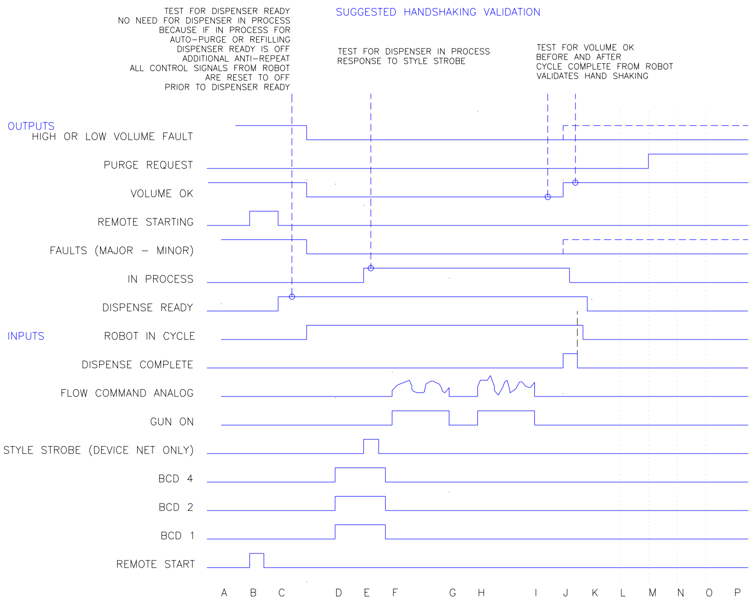
6. When the robot is done dispensing for 250ms (gun=off) check for the Volume OK signal to be LOW. If it is high the device network could be lock up (not responding) and the robot should fault out.

7. Robot pulses Dispense complete signal. Min. 250 ms.
   a. The volume fault table will be looked at and Dispense Volume and recorded (SPC data)
   b. If the volume is out of range a Major fault will occur and the dispense ready signal will go low.
   c. Start the refill sequence on a K device.
   d. The InProcess will stay high until the refill is complete.

8. If there were no faults the Volume OK signal will go High and the dispense ready signal will stay high.

9. Ready for the Next Job.

NEW GM INTERFACE AUTOSTREAM VERSION 3.X63



A DISCONNECT POWER ON
B MAIN POWER ON OR REMOTE START
C ROBOT CHECK FOR DISPENSE READY AND IN PROCESS OR PURGE IN PROCESS
D ROBOT IDENTIFY PART (BODY ID)
E ROBOT START MOTION
F ROBOT TURN GUN ON
G ROBOT TURN GUN OFF MULTI DISP
H ROBOT TURN GUN ON
I ROBOT TURN GUN OFF LAST DISP
J ROBOT TURN ON DISP COMPLETE (START PURGE TIME)
K END OF REFILL CYCLE (1K 2K)
L END OF DISPENSE CYCLE
M PURGE TIME OUT

PULSES SHALL BE 100MSEC MINIMUM

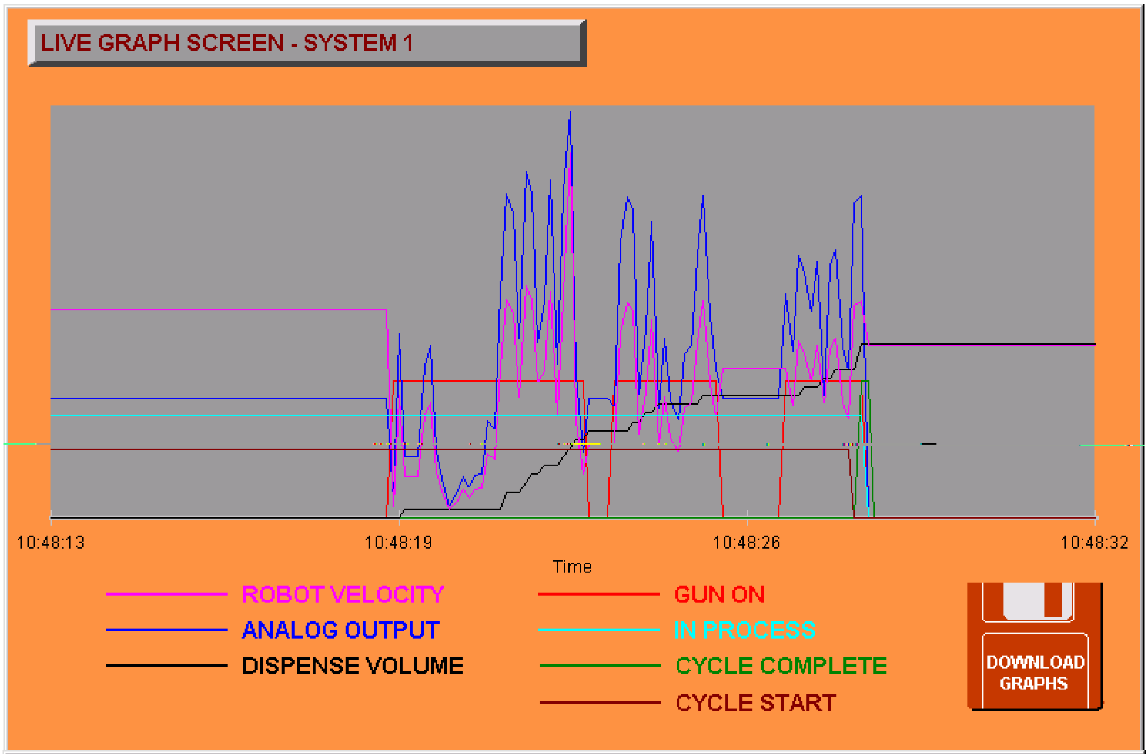
THIS LISTING SHOWS ONLY BASIC AND REQUIRED I/O
ADDITIONAL I/O AVAILABLE FOR DIAGNOSTICS

HAND SHAKING

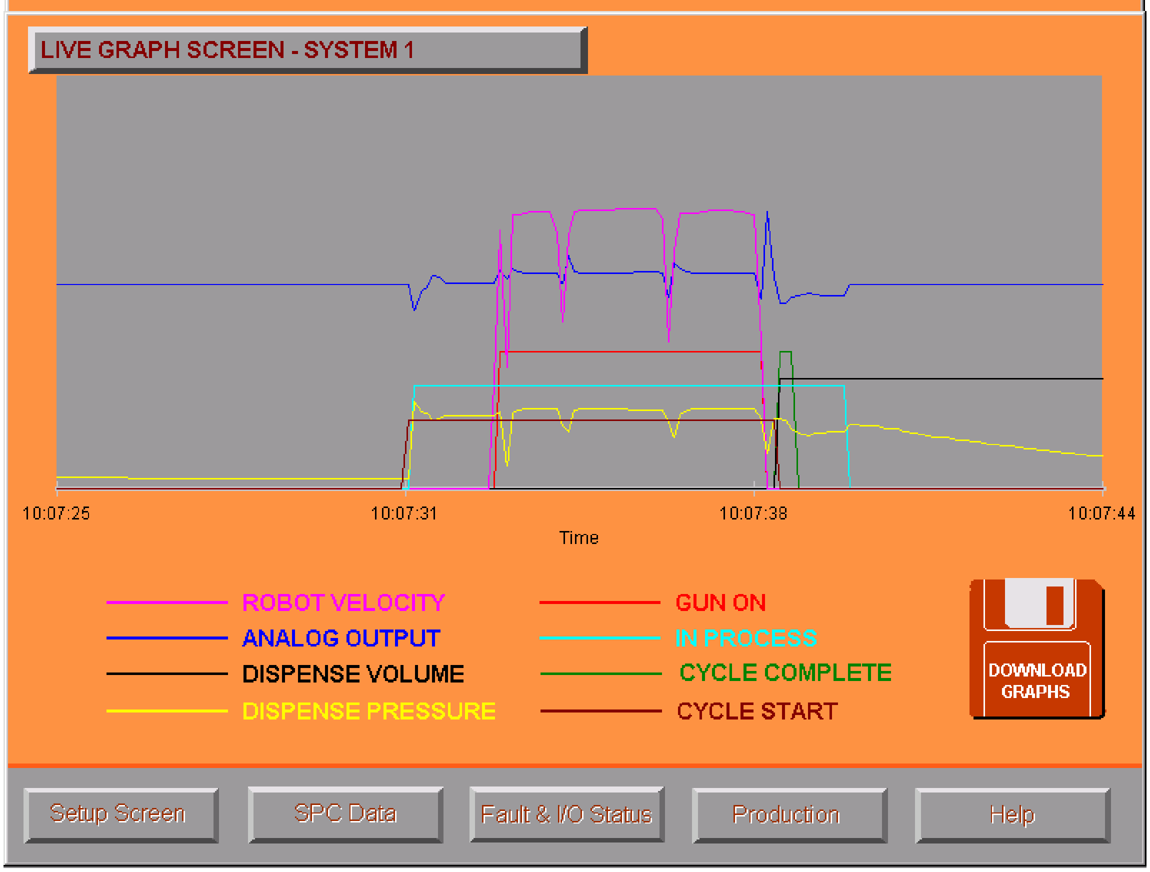
ROBOT OUTPUT	DISPENSER RESPONSE	RESETS
REMOTE START	REMOTE STARTING ON FAULTS ARE RESET	WHEN DISPENSE J-BOX IS OPERATIONAL
BCD ID	NO RESPONSE	
ROBOT IN CYCLE	ON IS DISPENSE WET VOLUME OK - OFF VOLUME FAULTS - OFF OFF IS DISPENSE DRY	IF TURNED OFF DURING DISPENSE CYCLE, CURRENT PROCESS IS ABORTED, NO FAULTS GENERATED
STYLE STROBE (MUST TURN OFF BEFORE END OF CYCLE)	IN PROCESS GOES ON START OF DISPENSE CYCLE READ AND STORE BODY ID (BCD) PRECHARGE DISPENSER	IF CYCLE COMPLETE GOES ON ABORT DISPENSE IF ROBOT IN CYCLE GOES OFF ABORT DISPENSE
DISPENSE GUN ON	READ AND FOLLOW ANALOG IF CONFIGURED PURGE REQUEST GOES OFF PURGE IN PROGRESS GOES OFF	
DISPENSE COMPLETE (AT END OF CYCLE, DISPENSE GUN MUST BE OFF) RISING EDGE	FAULTS TURN ON IF EXIST VOLUME OK ON IF EXIST PURGE TIMER STARTS AUTO DEPRESSURIZE TIMER STARTS	INPUT MUST TURN OFF FOR NEW CYCLE
DISPENSE COMPLETE (ANY OTHER TIME)	IF IN DISPENSE CYCLE PRIOR TO GUN ON, ENDS DISPENSE CYCLE AND FAULTS ARE GENERATED IF DISPENSE CYCLE NOT STARTED, NO ACTION PULSE AT BEGINNING OF CYCLE - OPTIONAL, PURPOSE IS TO RESET PREVIOUSLY ABORTED DISPENSE CYCLE THAT DISPENSER DOES NOT KNOW WAS ABORTED. MUST TURN ON AND OFF PRIOR TO NEW DISPENSE CYCLE STARTING (STYLE STROBE).	
DISPENSE COMPLETE (FALLING EDGE)	DISPENSER READY GOES OFF	DISPENSER READY GOES ON WHEN REFILLING IS COMPLETE AND ALL ROBOT CONTROL SIGNALS ARE OFF

1. Change the style select macros (there is one for E1 & E2) and add a wait statement for the "INPROCESS" signal to equal OFF at the start of the process.
   Equipment #1 In process is DI 162 and Equipment #2 is DI 226
   a. Add a fault time out across the wait statement for about 2 seconds.
2. Change the dispense complete macro (there is one for E1 and E2) to check the Volume OK signal.
   Equipment 1 Volume OK is DI 163 and E2 is DI 227.
   a. At the beginning of the macro and a wait statement for Volume OK to equal OFF.
   b. After the Dispense Complete Signal E1 DO 177 or E2 DO 241add another wait statement .
   c. Wait for Volume OK E1 DI 163 or E2 DI 227 to equal ON.
   d. Add a fault time out across the wait statements for about 2 seconds.
      The fault time out across the wait statement prevents the robot from sitting for extended periods without showing a fault.

This Graph shows bad TCPP Programming



This Graph shows a normal TCPP Programming. Can you find the glitch?



TCPP or NOT to TCPP that is a very good Question.

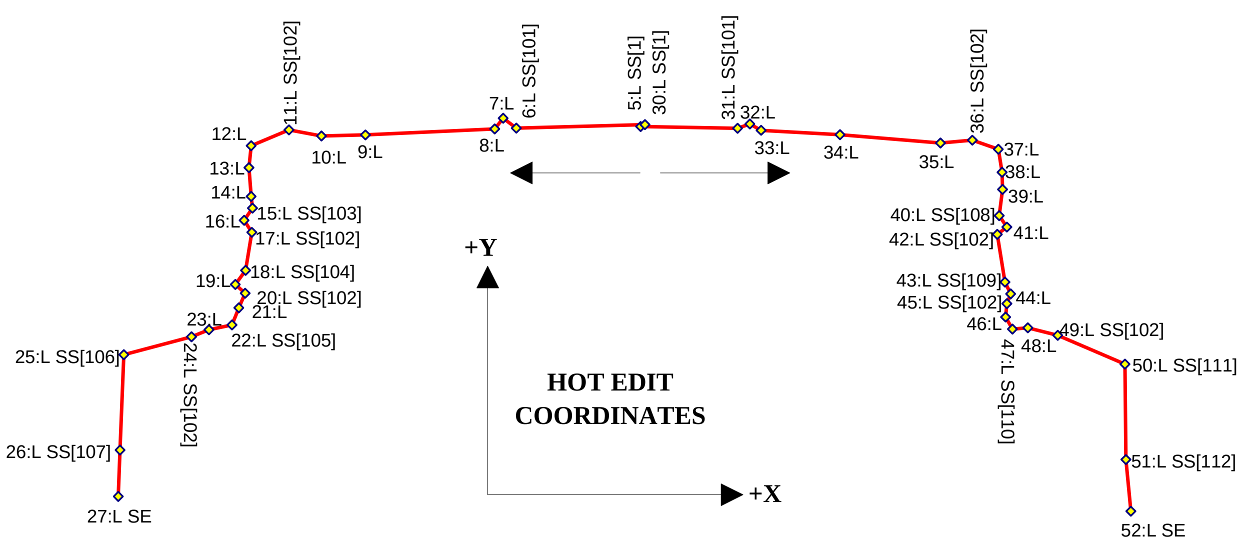
Non - TCP Proportional Approach (Direct Voltage):

This approach is used when the application allows for robot speeds to be constant and so the dispenser flow rates can be constant. Constant speeds can be maintained by the robot if the motion is straight. However, if the robot speeds are kept slow enough it will maintain a relatively constant speed though a complex path. If the robot speeds very greatly or motion is complex the method of programming becomes quite difficult requiring the programmer to adjust the material flow at a point where the robot speed changes.

Seal Start (SS) 300mm/s 3m bead @ 3v=1228 Seal End (SE)

Seal Start (SS) 300mm/s 6m bead @ 6v=2457 Seal End (SE)

If the dispense path is very simple and straight direct voltage is normally used. Any voltage from 0-10v (0-4095) can be used to achieve the bead size. However if the dispense path is more complicated (see diagraph below) TCPP is normally used. Direct Voltage is easier to setup then TCPP

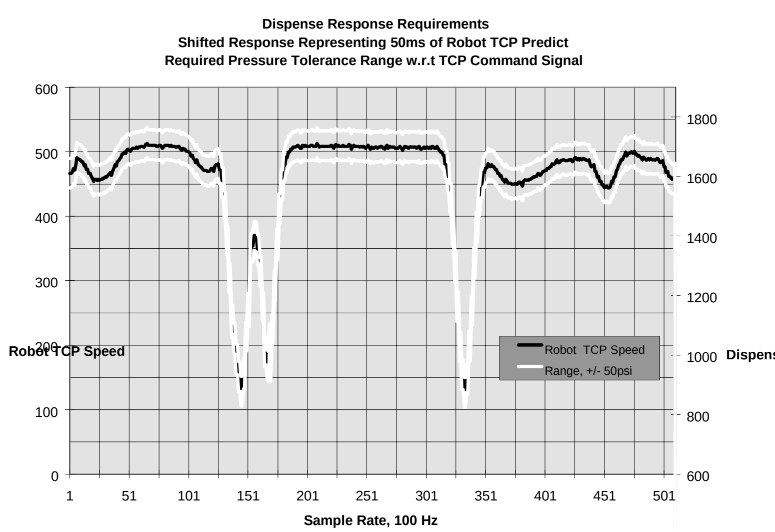


TCPP Tool Center Point Predict

This approach requires the most complex and costly equipment but has paid for itself by making dispense robot programming less of an art. This approach was developed solely for the purpose of reducing programming complexity in conjunction with improvements in bead control. This method is interchangeable for Extruding or streaming, however, extruding adds more complexity for the robot programmer. The basic intent is to have dispensing flow control tied directly to the speed of the robot in such a fashion that the robot programmer can change robot speeds as required to address the specific application without having to adjust flow control commands to the dispensing equipment. Bead quality should not be effected when robot speed varies. This involved three basic concepts to make this a reality;

1. The flow control signal from the robot to the dispenser must be sent before it is actually required (equipment delay).
2. The flow control signal must be scaled so that at various robot speeds the signal received by the dispensing equipment is correct for that robot speed.
3. The dispensing equipment must be responsive enough to match the accel/decel changes of the robot. The Robot/Dispense combination for these three items is as follows;
1. The Robot controller accurately predicts the TCP (tool center point) velocity which is adjustable up to 200ms in advance of any programmed point.
2. The scaling of the signal will be determined during Bead Width Calibration during set up which is a Bead width (volume) vs. voltage relation.
3. The flow control shot meter is directly coupled to the dispensing gun providing response of about 50 ms which is matched to the time when the TCP (Tool Center Point) velocity is provided.

This graph shows the robot Flow command TCPP response. The dispense path is the p panel with two corners one sharper than the other



End of Arm Tool TCP

End-of-arm tool TCP must be set up prior to dispensing material, the tool center point must be moved from the sixth axis faceplate to the tip of the tool. Use the most accurate method provided by the robot manufacturer to teach the robot TCP. Put a 1 " teach tip in place of the nozzle and teach the TCP at the pedestal stand. However, through the use of simulation or physical studies it may have been deemed necessary to extend the TCP to a length that makes sense for the individual applications. Always verify the TCP is correct by selecting the robots tool coordinate motion and align the teach tip pointer with the registration stand pointer and then rotate about all axes, the teach tip should remain fixed on the registration stand pointer. If the teach tip does not stay fixed verify that the manufacturers procedures have been correctly followed and retry. If you cannot teach an accurate TCP contact the Manufacturer for assistance.

It is recommended that when installing the Tool Center Point the that the six point method is used.

USER FRAME / Work Object Frames

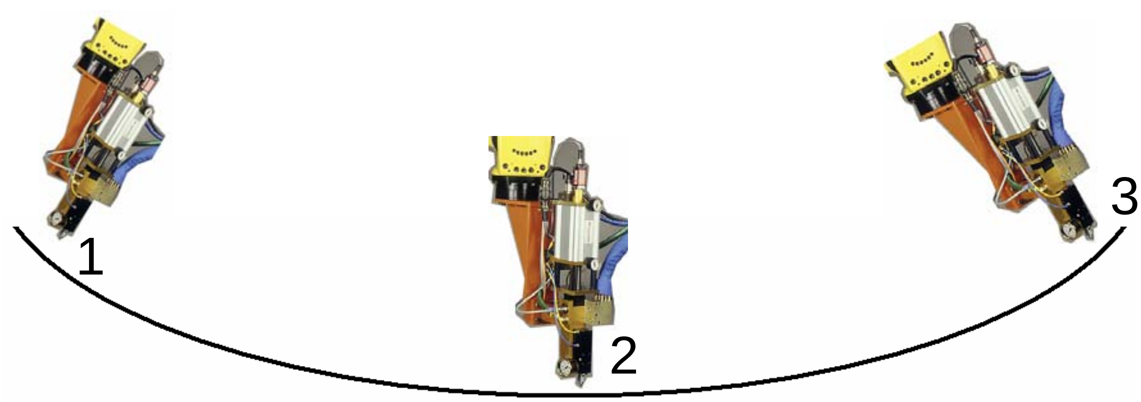
The User Frame or work object frame is set up using the right hand rule so that (+) positive X is the same direction as the flow of the line or part. This is a practical way to set up the work object frame so as to spend little time discovering the Cartesian coordinate directions when manipulating path positional data. The most efficient way to select an origin for a work object frame for a single robot application is to chose a point that it is equidistant form all the points in a path and securely in the robot work envelope. In the cases where multiple robots are working on the same part in the same coordinate system it would make more sense or select the center of gravity of the work object to accommodate global offsets as in the case of vision. The origin can be found by moving the robot to the desired point in space and writing down the X,Y,Z coordinates. These coordinates should be rounded off to the nearest ones place and then manually entered into the X,Y,Z coordinates of the work object frame. At this point W,P,R should all be zero which indicates that the frame is in line with the robot world frame. Next, determine the amount of rotation, in 90º increments, needed to alien the world frame of the robot so that its (+) X direction points in the direction of the flow of the part. For a Fanuc robot enter that number in the R coordinate of the work object frame. For an ABB robot enter the correct number for the quaternians. Record the numbers to the documentation accompanying the robot controller under setup information.

NOTE: A user frame must be used if the program is using RTCP (Remote Tool Center Point)

Motion Planning

It is very important to correctly program the path if TCPP is being used. The motion should be smooth and not jerky. Try to use the 4th, 5th and 6th axes as Little as possible. When these axes are moved they accelerate the flow command signal. The signal in no longer stable and starts to oscillate. Try to do most of the motion with the 1st, 2nd and 3rd axes. The following are some programming rules that help create better dispense beads:

1. Do – program the path in Linear motion not Joint or circular.
2. Do Not – change the coordinate system during dispensing. This include leading in and leading out.
3. Do – A lead in and lead out point is required before a SS or SE. Normally the point is 4 inches before the bead start or end.
4. Do No run the dispense equipment if the command voltage is over 80% of the signal. The system will not repeat.
5. Try to run the equipment in the 40 to 60% command voltage range.
6. Do Not run an adhesive over 100ºF. It will accelerate the curing of the material.
7. Have batch compensation OFF and the Global Scaling at 100% and the Offset at 0 when programming.
8. Do not use fine points when programming

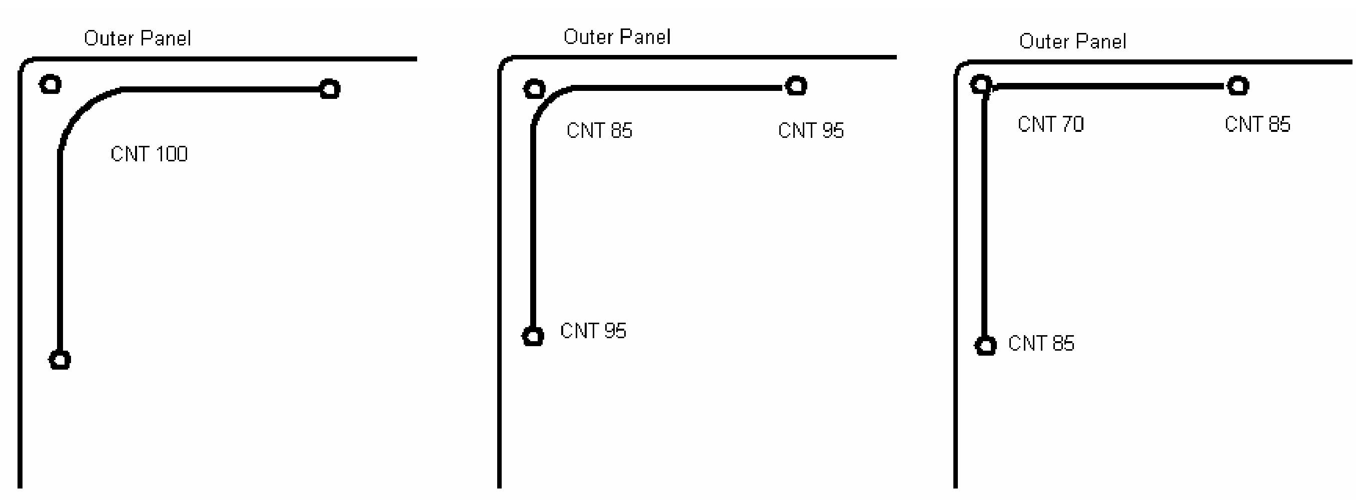


Most panels are not flat and the preferred dispense orientation is perpendicular from the panel (see diagram above). When the dispense head is re-orientated the 4th, 5th and 6th axes must be used. To do this it is best to use the motion of the robot. Start at point #1 and insert a node perpendicular to the panel. Move the robot to point #3 and insert another node. Move the robot from node 3 to node 1 at a slow speed. Stop the robot halfway and only use the first 3 axes to move the robot to point #2. If more points are needed so that the arc is smooth add them in the same manner. When finished the robot will have a smooth motion and a gradual change in the flow command signal.

Motion Planning

The Process of doing a corner is very simple with TCPP. Just put a point in the corner and a lead in and lead out point about 1.5 inches (3.81 centimeter) from the corner point. The normal robot motion will round the corner with 100 CNT. To make the corner sharper lower the CNT values in the corner until the sharpness of the corner is obtained. See Example below. Notice that the lower the CNT value are set the sharper the corner are. The robot will slow down in the corners and the command voltage will drop automatically – otherwise the corners will have extra material in them. If direct voltage is used the voltage needs to be changed at all three points of the corner.

NOTE: DO NOT USE A CNT VALUE BELOW 50.



When teaching the robot path program. It is very important to try to keep the nozzle perpendicular from the panel. It is not always possible to do this – if the nozzle needs to be angled try to have the bead follow instead of leading. This will effect the look of the bead. It is very important to find the robot speed Before TCPP values are adjusted.

Ideally keep the nozzle perpendicular

Have the bead follow the nozzle

Last choice have the bead lead.

Robot Direction

Setting Up Dispenser I/O.

The next step is understanding the associated data fields in the Fanuc controller that are associated with dispensing.

a. The Menu-/1/O-(type) dispenser.
b. The Inputs and outputs that are related to the dispenser must be assigned. If a SS - SE (seal start or seal end) is entered into the path program the device net digital signal must correspond. This links the device net I/O to the SS & SE commands.
c. Without this information when a SS1 is commanded nothing will happen.
d. If the robot has two equipments set up there will be a screen for E1 and E2. press next and select equipment number to see the other equipment.
e. Refer to the robot I/O to set this information.

NOTE The number of the currently selected equipment is displayed in the middle of the title line on every screen. The currently selected equipment for the screens in this procedure is equipment 1, E1. Also your screen will differ depending on options.

I/O Sealing In E1
Dispensing Equipment

NAME	IN	PT	SIM	VALUE
1 Dispenser Ready:	DI	[1]	U	OFF
2 In-Process:	DI	[2]	U	OFF
3 Volume Fault:	DI	[3]	U	OFF
4 Major Fault:	DI	[4]	U	OFF
5 Minor Fault:	DI	[5]	U	OFF
6 Automatic Mode:	DI	[6]	U	OFF
7 Manual Mode	DI	[7]	U	OFF

To change between the input and output screens , press F3, IN/OUT. You will see a screen similar to the following.

I/O Sealing Out E1
Dispensing Equipment

NAME	OUT	PT	SIM	VALUE
1 Open gun:	DO	[1]	U	OFF
2 Flow Command:	GO	[1]	U	0
3 Style Bits:	GO	[2]	U	0
4 Style Strobe:	DO	[2]	U	OFF
5 Dispense Complete:	DO	[1]	U	0
6 Remote Start:	GO	[2]	U	0

Note: This screen is very handy to use – The outputs can be fired and the inputs can be monitored.

Tuning the dispense equipment

1. The first step in this process it to complete the path program. It is essential to know the robot speed. All of the adjustments for TCPP must be done at the normal run speed of the robot. The robot path program is normally taught first so that the cycle time can be established. If the cycle time is not met the path may need to taught faster.

2. Create a path that is a straight line with a SS and SE that is 1 Foot or 30 centimeters long.

3. Using the Setup Page select constant voltage and set it to 5V.

4. Run the path program and note the bead size. The bead size will not normally be the size you need. It will need to be adjusted.

5. To adjust the bead size the following options may be used.
   a. Raise or lower the voltage. If the voltage becomes above 7.5 volts or below 2 volts. Another variable will need to be changed.
   b. Adjust the material temperature – Higher will increase the bead size and lower will decrease the bead size.
   c. Change the nozzle size. - Larger will increase the bead size, however the velocity of the stream will decrease – the robot path may need to be closer to the panel.
   d. A small nozzle will make the velocity of the stream increase (shoot farther) but increase the chance for a tip plug.

6. The Dispense system needs to run in the mid range before TCPP calibrations are attempted. If the equipment is running a 2 or 9 volts flow command the system will not be able to alter the flow command enough to effectively make TCPP work.

SS Robot Speed same as path program SE

Use the voltage in the Constant / Manual Setup screen to setup desired flow rate. (5v = 2045)

Seal Schedules

1. The Seal Schedules can be accessed by depressing the DATA button and then F1 Seal Schedules.

2. This is where the system can be set up for direct voltage or TCPP Bead Width calibration. There are 30 seal schedules for each equipment. More than one seal schedule or type (TCPP or Direct Voltage) can be used in a path program. A signal path program can consist of direct voltage and TCPP Bead Width Variables.
   a. An example of using both variables in one program would be if there was an area of the panel that needed to be filled. If BW was chosen and the robot was not moving the command signal would be 0.

•**1** Press DATA.
•**2** Press F1, [TYPE].
•**3** Select Seal Sched. If the following screen is not displayed, press F2, LISTING. You will see a screen similar to the following.
NOTE The number of the currently selected equipment is displayed in the middle of the title line on every screen. The currently selected equipment for the screens in this procedure is equipment 1, E1.

DATA Seal Sched
E1Variable Orifice System

Schd	Value	Flow Type	Comment
1	10.0 mm	BW TCPP	FOUR DOOR LR
2	0.0 mm	BW TCPP	
3	4 V	Volts	
4	0.0 mm	BW TCPP	
5	0.0 mm	BW TCPP	
6	0.0 mm	BW TCPP	
7	0.0 mm	BW TCPP	
8	0.0 mm	BW TCPP	
9	0.0 mm	BW TCPP	

•**4** Set the values for each schedule as appropriate.
• **5 To display more information about a single schedule,** press F2, DETAIL. You will see a screen similar to the following.

Seal Schedules

1. Under The dispense style depress F2 for the LISTINGS of the body styles. Another screen will show some of the specific adjustable information for each individual body styles.

DATA Seal Sched	E1
Variable Orifice System	
1 Schedule # 1	
2 Flow type:	TCPP Bead Width
3 Flow model:	LINEAR
4 Flow rate:	3.00 mm
5 Guns used:	1--***
6 Equip. ant-time:	0 ms
7 Eq. additn. ant-time:	0 ms
8 Gun on ant-time:	0 ms
9 Gun off ant-time:	0 ms
10 Bead shaping (BS):	0.0 psi
11 BS on ant-time:	0 ms
12 BS off ant-time:	0 ms
13 Pre-pressure time:	0 ms
14 De-pressure time:	0 ms
15 Correction factor:	1.0
16 Correction bias:	0v
17 SS time offset:	0ms
18 SE time offset:	0ms

- **To return to the LISTING screen** , press F2, LISTING.

2. The information that we will normally use is:
   a. (2) Use TCPP Bead Width or Volts (direct voltage).
   b. (3) Linear should be used in all configurations.
   c. (4) Flow rate should be the size bead that is required or if direct voltage is used a voltage number 0-10v can be inserted.
   d. (5) Guns used normally set to 1
   e. (6) Equipment. Ant-Time is the equipment delay. This variable sends the flow command before the robot actually gets to the node. Without this variable set correctly TCPP will not work. This is the reaction time of the mechanical equipment.
   f. (7) Gun on ant-time This item indicates the anticipation time between when the robot reaches the destination position and when the gun is turned on. If you want the gun to turn on before the robot reaches the destination position, set ***Gun on ant-time*** to a negative number. If you want the gun to turn on after the robot reaches the destination position, set ***Gun on ant-time*** to a positive number.

Seal Schedules

Continued:

```
DATA Seal Sched        E1
Variable Orifice System
1 Schedule #  1
2 Flow type:                  TCPP Bead Width
3 Flow model:                  LINEAR
4 Flow rate:                  3.00 mm
5 Guns used:                    1--***
6 Equip. ant-time:             0 ms
7 Eq. additn. ant-time:       0 ms
8 Gun on ant-time:            0 ms
9 Gun off ant-time:           0 ms
10 Bead shaping (BS):         0.0 psi
11 BS on ant-time:            0 ms
12 BS off ant-time:           0 ms
13 Pre-pressure time:          0 ms
14 De-pressure time:           0 ms
15 Correction factor:         1.0
16 Correction bias:           0v
17 SS time offset:            0ms
18 SE time offset:            0ms
```

- **To return to the LISTING screen** , press F2, LISTING.

g. (9) Gun off Ant:time. This item indicates the anticipation time between when the robot reaches the destination position and when the gun is turned off. If you want the gun to turn off before the robot reaches the destination position, set ***Gun off ant-time*** to a negative number. If you want the gun to turn off after the robot reaches the destination position, set ***Gun off ant-time*** to a positive number.

h. (10) Bead shaping is normally not used. The BPR system uses bead shaping and calls out a GO = xxxx directly from the path program.

I. (15) The Corrector Factor should always be set to 1.0 this value multiplies the flow command by a percentage (1.0 = 100%).

j. (16) Correction bias should always be set to 0v this value adds or subtracts direct voltage to the flow command.

The rest of the values are not mentioned and are normally not used:

NOTE: If multiple seal schedules are used the specific information for each body must be duplicated in each seal schedule. If the values are entered in one schedule they are NOT entered in all schedules.

Dispense Equipment TCPP Setup

This screen is under MENU/SETUP/DISPENSOR
These set of variables Setup the TCPP bead size requirements.
Some of the newer fields will ask for the robot speed. This would be the normal speed of the dispense path.

EQ SL Setup	D1
R-J3 Vari. Orifice Dispense System	
Flow Rate Calibration	
Calibration status:	DEFAULT
Seal sched in MOV_SEAM:	30
1 Flow rate type:	TCPP Bead Width
2 Desired flow rate:	3.0 mm
3 Sample program:	[MOV_SEAM]
4 Home program:	[MOV_HOME]
5 TCPP BW scale factor:	1.000

Seal Schedule in Mov_seam is the default calibration seal schedule when running the automatic calibration program (Not Recommended to run).

1. Desired flow rate indicates the target flow rate that will be used for this calibration. Set this to the flow rate that will be used most often in your process. Editing this item is the same as editing Flow rate type in the specified sealing schedule, which is sealing schedule 30. If one equipment is dispensing 2 bead sizes such as a 3mm and 5mm. An in-between size should be chosen - 4mm. This is one of the values that the command signal (0-4095) uses to scale itself.
2. TCPP BW scale Factor should be set to 1.000. This is an internal factor not easily changed. Do not run the sample programs as the will alter this scale factor.

Dispense Equipment TCPP Setup

These set of variables tune the TCPP variables into the dispense equipment. These are calibrations variables used to tune the dispense bead into the required bead size.

Setup Scaling	D1	
R-J3 Vari. Orifice Dispense System		
1	Material Factor	1.00
2	Flow Rate Bias	0.00v
3	Minimum Flow Command	0.00v
4	Flow command AOUT type	Volts
5	Use Default ACC:	Disable
6	Default ACC	20
CALIBRATIONS		
8	Meter Max Speed	Complete
9	Flow Rate Control	

- **To return to the LISTING screen** , press F2, LISTING.

1 Before starting verify that the (8) Meter Max Speed calibration has been completed. If not follow these steps.
   a. Move the curser until COMPLETE is highlighted.
   b. Press (F3) Start on the teach pendent
   c. Verify the Maximum voltage is 10.00v
   d. Verify the voltage step is 0.10v
   e. Continue without moving the robot and the calibration will be complete.

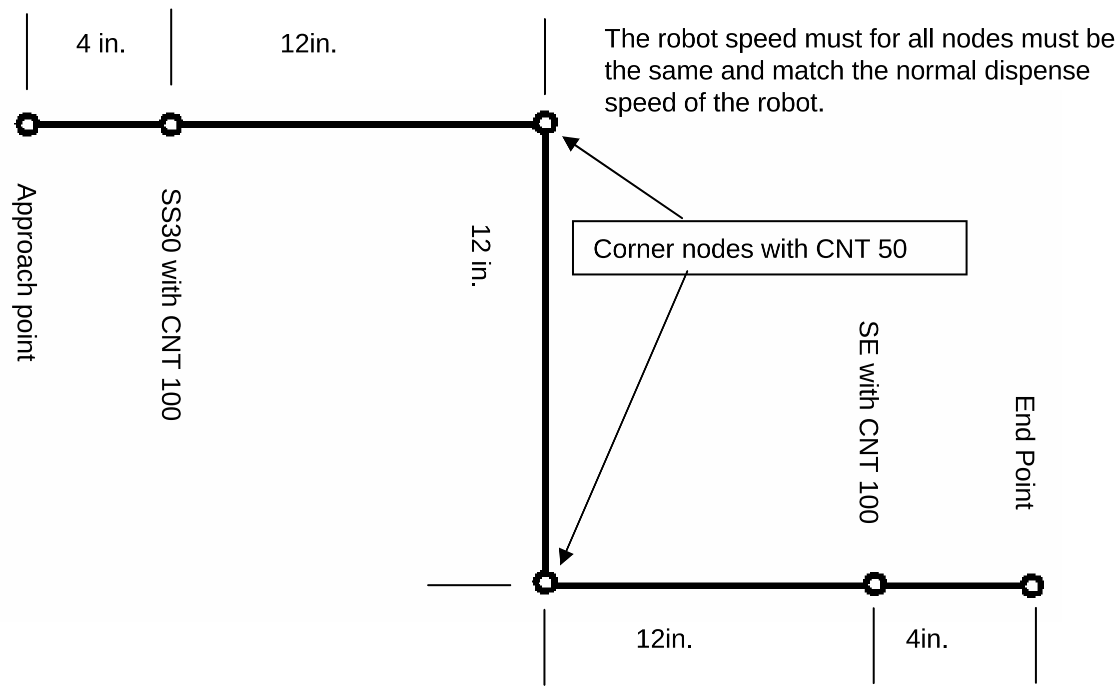
2. Material Factor is a multiplying scale factor of the bead. This factor sets the major size of the bead. Mostly controls the large size of the bead in the straight away. This is when the command signals are the greatest.
3. Flow Rate Bias adds or subtracts voltage to the command signal. This factor sets the minor size of the bead. When the robot goes through a corner the material factor command signal can go to zero. If this happens the corners will not have any material. To offset this voltage is added to the signal to make the corners the correct size.

Finding the Equipment Delay.

One of the first requirements of dispensing is to find the equipment delay. The only way that this can be achieved it to run a specific program and change the equipment anti-time variable listed in the DATA variables.

ZIGZAG

ZIGZAG is a program that is used to establish the equipment delay. This program MUST be run at the same speed that is in the normal run dispense path program. Follow the example below as a path program.



Create the program on the dispense part or something strong enough that one can scrap off the material. Mark the seal start and the seal end positions. Use seal schedule 30 to set up the bead size.

Finding the Equipment Delay.

Use seal schedule #30 and verify that the correct be size is set up in the DATA/ Seal Schedule and that the flow type is TCPP bead width.

In MENU/SETUP/DISPENSER make the following adjustments to the bead size..

1. Increase the Material factor to 5.0. This will give a very high scaling factor which will make the large part (straight away) part of the bead very big. The bead size is not important at this time – the equipment delay is.

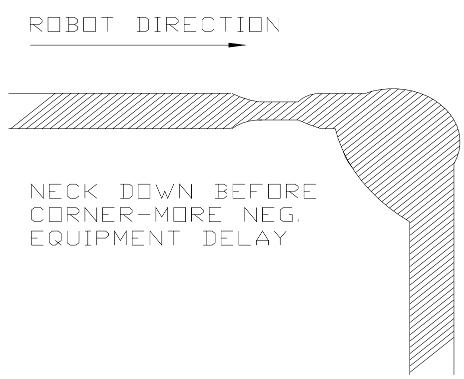
2. Decrease the Offset Bias to -1.5v. This will make the smaller part of the bead (corners) look like they almost have no material.

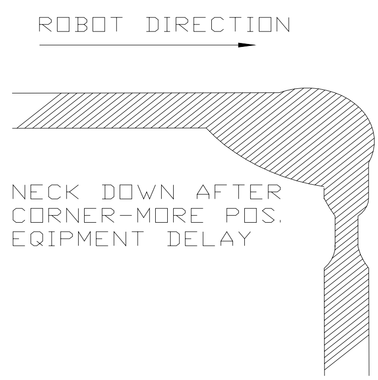
3. Run the bead path – Make sure that a style bit and strobe is sent otherwise the system will run in manual voltage.
   a. The straight away should look heavy.
   b. The corners should have too much material.
   c. There should be a neck down in the bead after the corners.

4. The neck down in the bead after the corners is the actual equipment delay. The robot is sending the flow command signal at the actual time it approaches the node. It take a few milliseconds for the dispenser to respond.

5. Adjust the equipment delay in the DATA SEAL SCHEDULE menu.
   a. Normally a 1K system running 500mm/s will have a equipment delay of 50ms.
   b. Keep adjusting the equipment delay until the neck down area is directly in the corners.

6. Transfer the equipment delay to all of the seal schedules that the program will use.





NOTE: WHEN RUNNING THE BEAD PATHS THEY MUST BE RUN A 100% SPEED

Adjusting the Gun On-Off Delay

Use seal schedule #30 and verify that the correct be size is set up in the DATA/ Seal Schedule and that the flow type is TCPP bead width.

1. Verify that the equipment delay is in the seal schedule that is being used. The equipment delay will effect the gun on and gun off anti time.

2. Run the path and the bead should start slightly after the node is programmed for the SS (Gun On).
   a. This item indicates the anticipation time between when the robot reaches the destination position and when the gun is turned on. If you want the gun to turn on before the robot reaches the destination position, set ***Gun on ant-time*** to a negative number. If you want the gun to turn on after the robot reaches the destination position, set ***Gun on ant-time*** to a positive number.
   b. Adjust the Gun On ant-time until the bead start is directly on the SS node.

3. Run the path and the bead should end slightly after the node is programmed for the SE (Gun Off).
   a. This item indicates the anticipation time between when the robot reaches the destination position and when the gun is turned off. If you want the gun to turn off before the robot reaches the destination position, set ***Gun off ant-time*** to a negative number. If you want the gun to turn off after the robot reaches the destination position, set ***Gun off ant-time*** to a positive number.
   b. Adjust the Gun Off ant-time until the bead ends directly on the SE node.

Adjust the bead size.

1. Run the bead path and adjust the Material Factor in the MENU/SETUP/DISPENSOR screen until the correct bead size is achieved.

2. The corners should be undersize. Adjust the Offset Bias in the MENU/SETUP/DISPENSOR screen until the correct bead size is achieved.
   a. When the Offset Bias is increased the bead size on the straight away will increase. Just lower the Material Factor to compensate.

3. Adjusting the Material Factor and Offset Bias are set by trial and error method. Trying to use the formula rarely works and is a waste of time.

NOTE: WHEN RUNNING THE BEAD PATHS THEY MUST BE RUN A 100% SPEED

Running the Dispense path

The TCPP variables have been defined. They just need to be transferred to the seal schedule that is being used for the dispense bead path.

a. Go to the listing for seal schedule 30.
b. Copy the seal schedule and paste the values in the seal schedule that is being use for the dispense path.

Run the dispense path that was programmed earlier. Some of the corners might need to be adjusted by adjusting the CNT percentage values.
If the bead size is not correct slight adjustments can be made to the MENU/ SETUP/DISPENSER Scaling Factor variable.

NOTE: There is a MENU/SETUP/DISPENSER set up screen for equipment #1 and another screen for equipment #2. If the robot is using 2 equipment. It is very easy to get these mixed up.

YOU HAVE JUST SET UP YOUR FIRST TCPP BEAD WIDTH CALILBRATION.

Robot Motion

If the robot motion is not smooth some additional settings may be required.
Listed below are some variables that have helped programmers set up the robots and tune in the TCPP values. The variables are located under Menu/System/(type/Variables).
The robot payload from Fanuc is set to the maximum value of 120.000 . If the payload is lighter and the robot program is running faster than 500 mm/s the corner of the program could bounce. To fix this change the variable
$GROUP - UPR_T/enter/enter/enter/$PAYLOAD (item 22).
Pounds X 2.2 = Kilo. The variable is in Kilo's.
Below are some standard weight and mass variables for a single system.