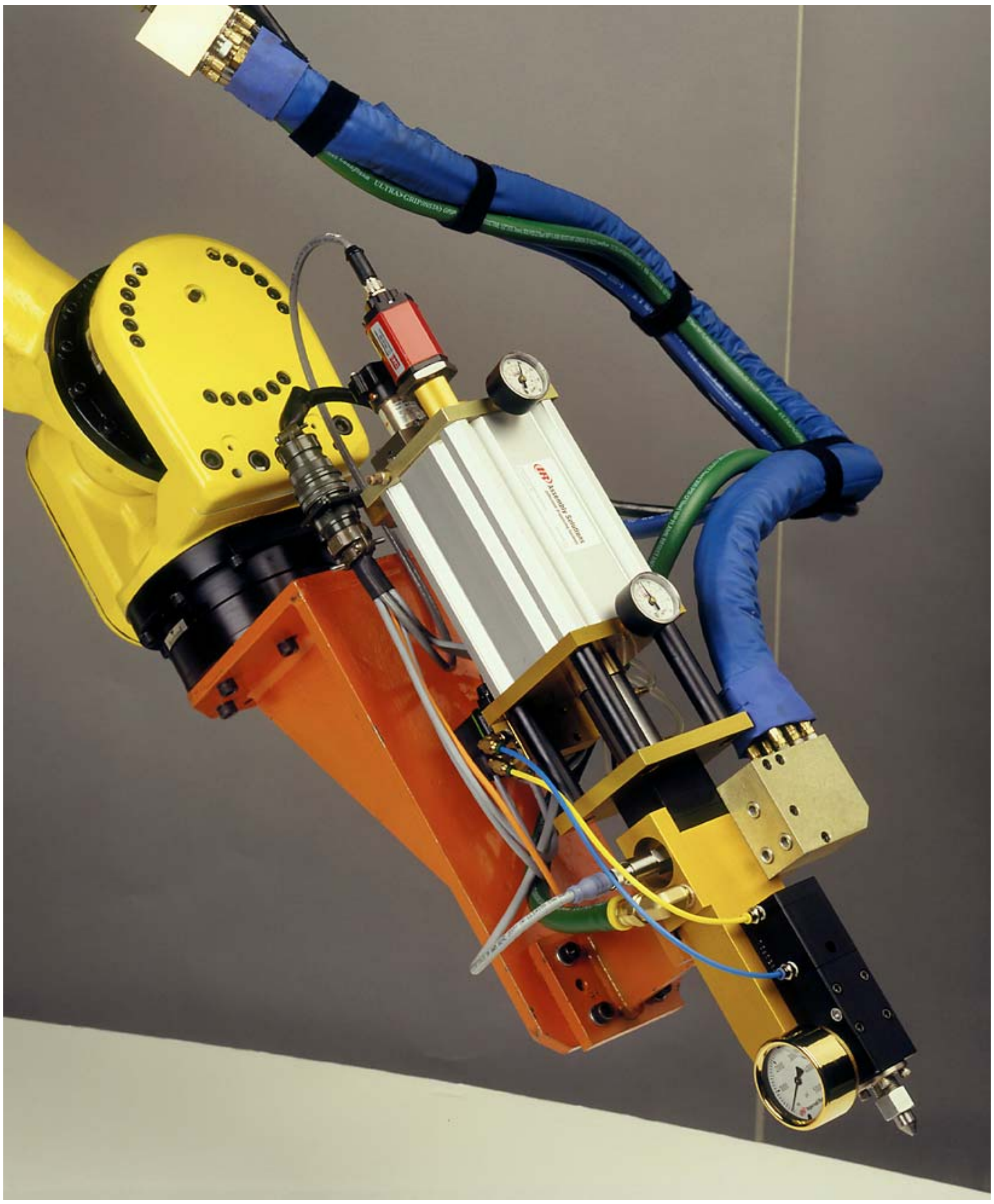
Assembly Solutions
Application Services

1R – 1K Basics with Device Net

JDS Basics



Assembly Solutions
Application Services

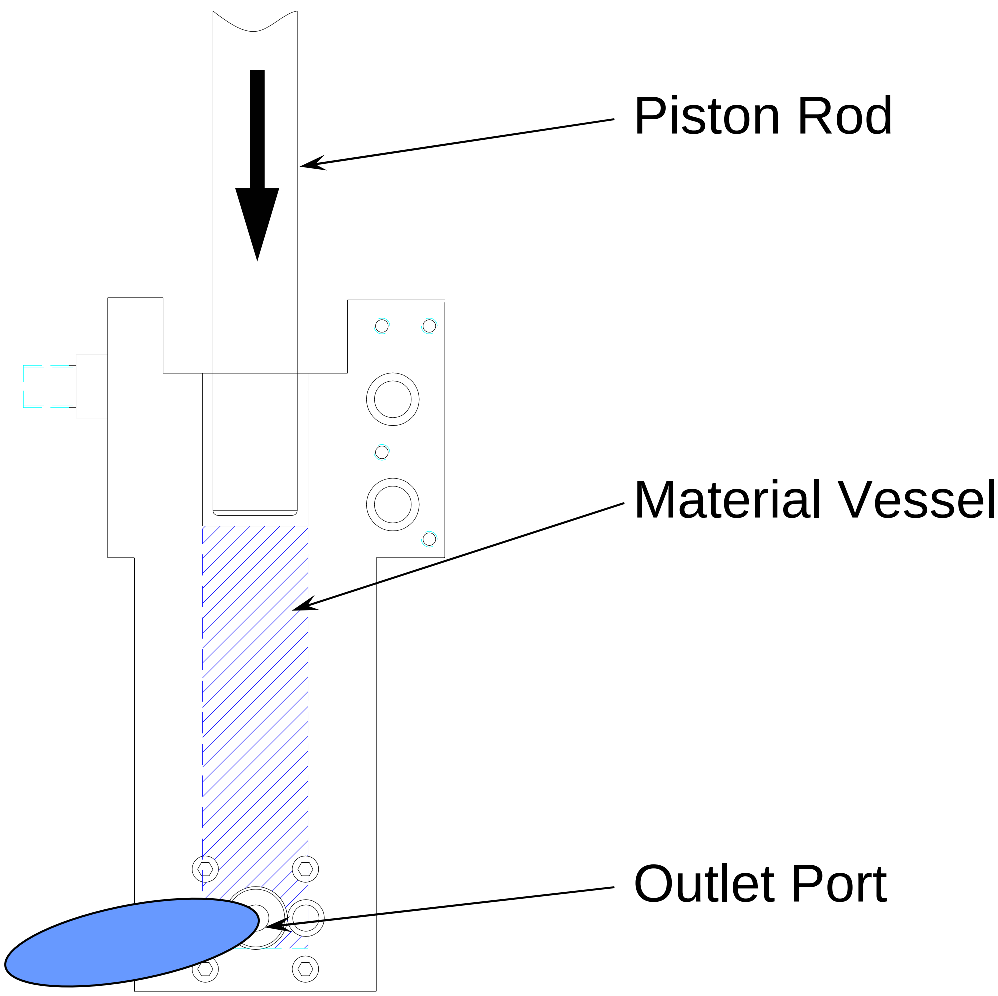
Table of Contents

Page **Description**

3. 1K Systems overview
12. 1K System Dispense Head Checking Procedure
13. 1R Systems
15. Dispensing Methods
18. Nozzle Selecting
21. Temperature conditioning
22. Device Net
25. Automatic Sequence of Operations
29. Robot Programming
32. Tuning The Dispense Equipment

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

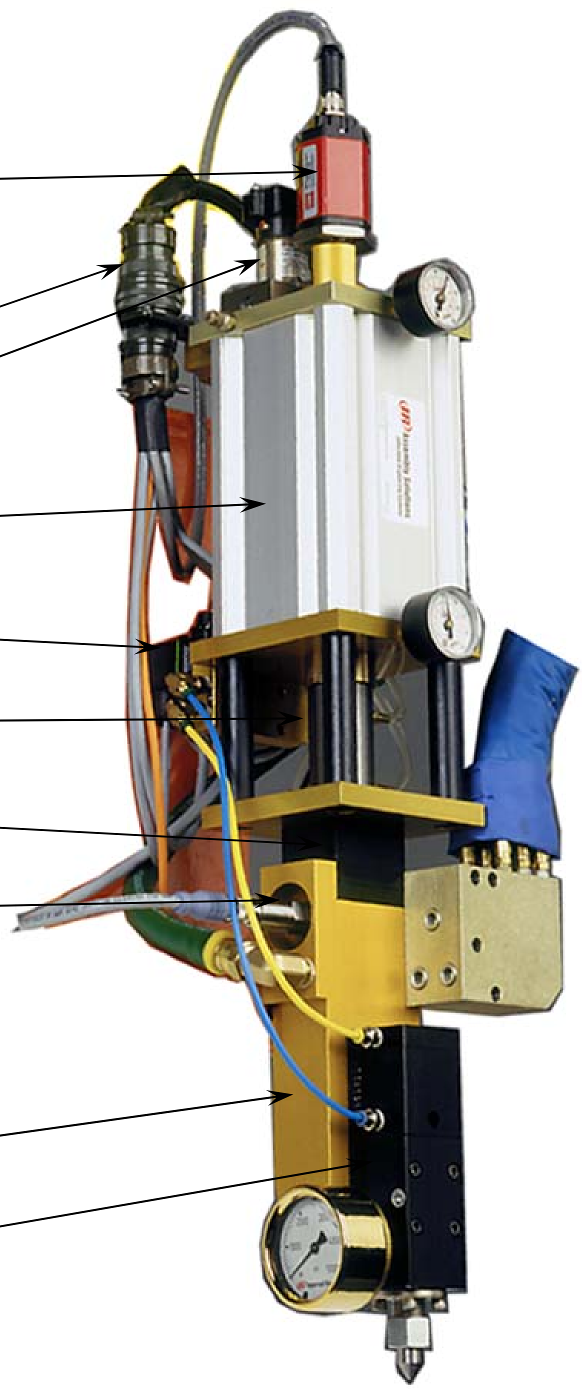
Seal Cartridge

PSI Transducer

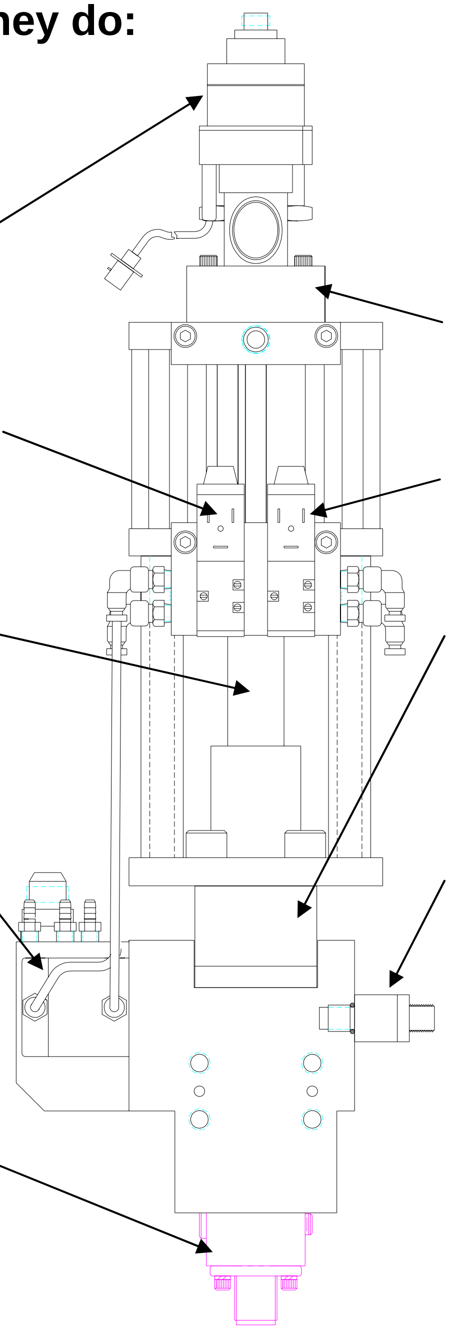
Refill Valve (behind material hose block)

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.

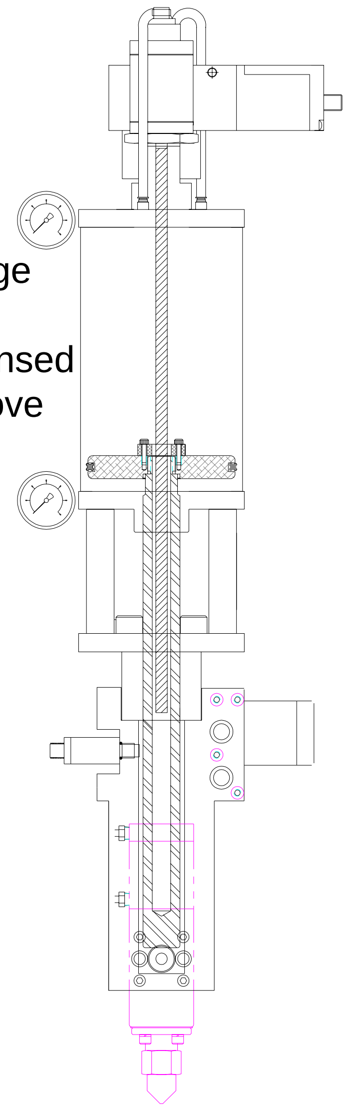
MLDT
Magnetostrictive Linear Displacement Transducer

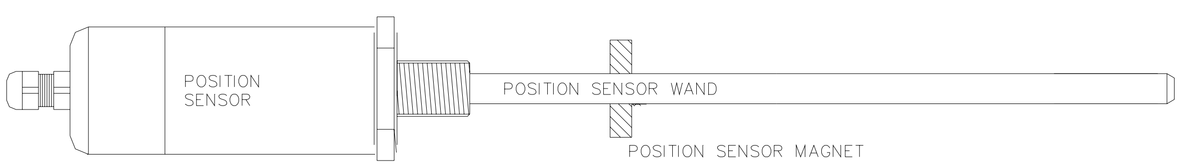
Voltage Range 0-10vdc

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:

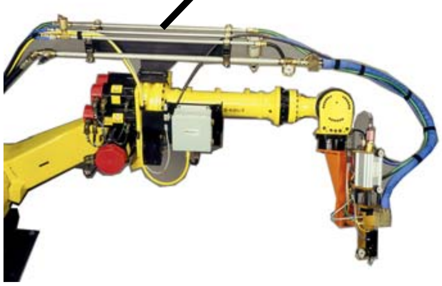
The pressure transducer tells the 1K system how much pressure is in the dispense chamber. It is designed so that it is flush mount. This prevents material from packing around it and giving inaccurate readings. The range of the transducer is 0-5000 PSI with a 1-10VDC output. 0psi = 1VDC.

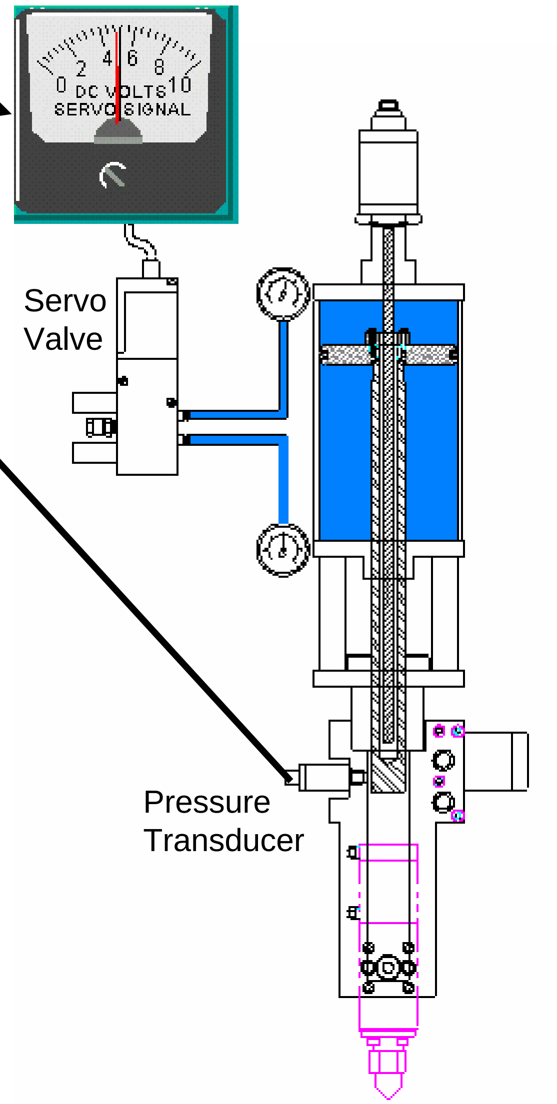
To check the pressure transducer use the following formula.

(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.



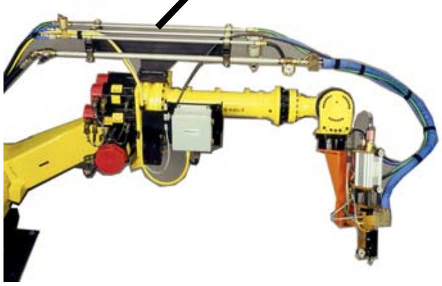


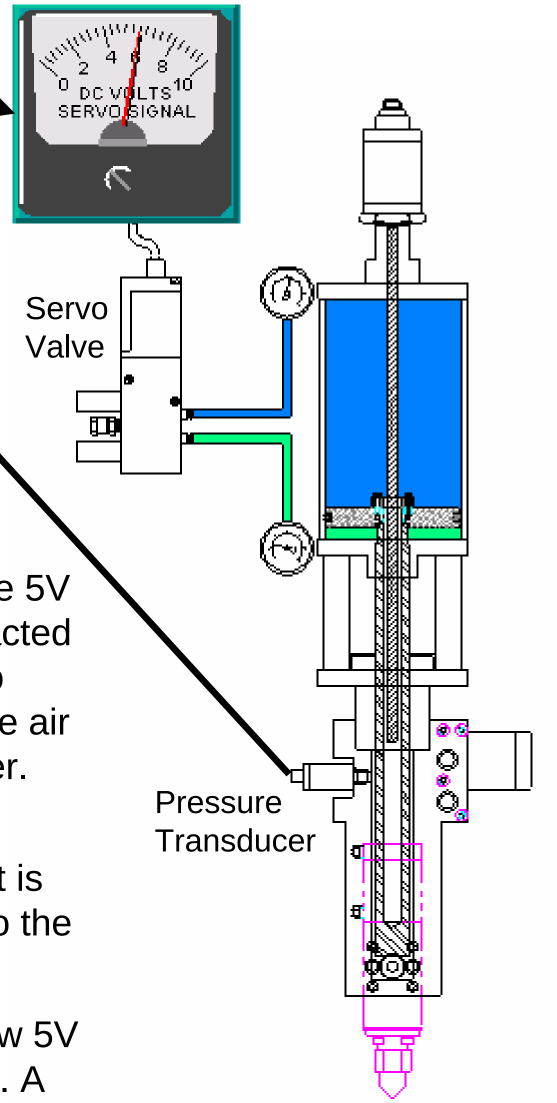
Air Servo Valve:
When the system is not in a dispense mode (Gun Off) the Servo signal will be at 5V. At 5v the same pressure should appear on both sides of the Air Cylinder (within 15 PSI of each other) preventing the piston from moving.

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.



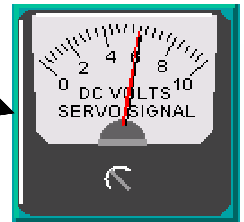


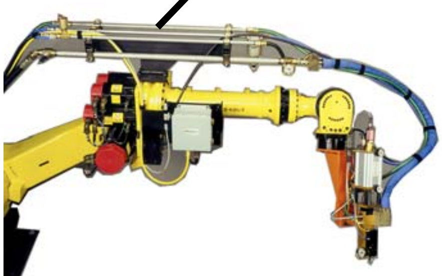
Pressure Loop:
If the robot velocity increases, the output is above 5V when the pressure transducer feedback is subtracted from it. A signal higher than 5V causes the Servo Valve to send maximum pressure to the top of the air cylinder and exhaust the bottom of the air cylinder. The material pressure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

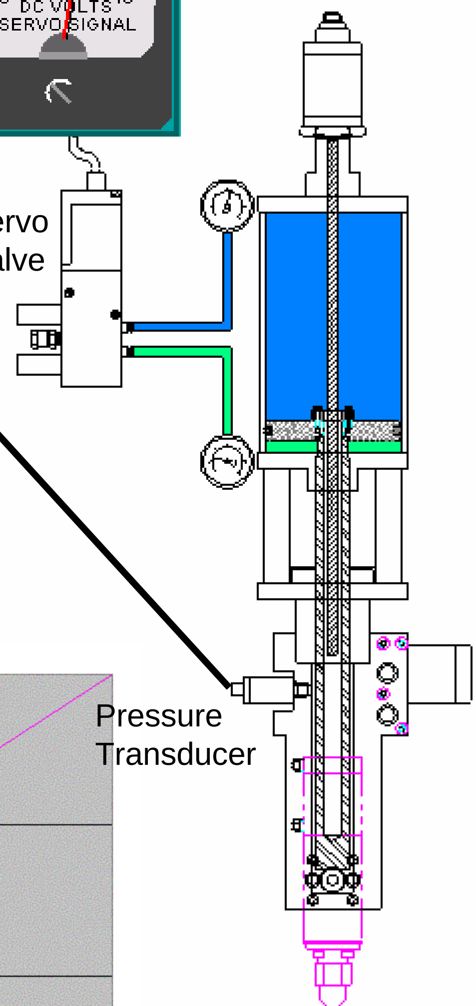
When the material pressure increases to where it is the same as the robot velocity input, the output to the Servo Valve is 5V at idle.

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.

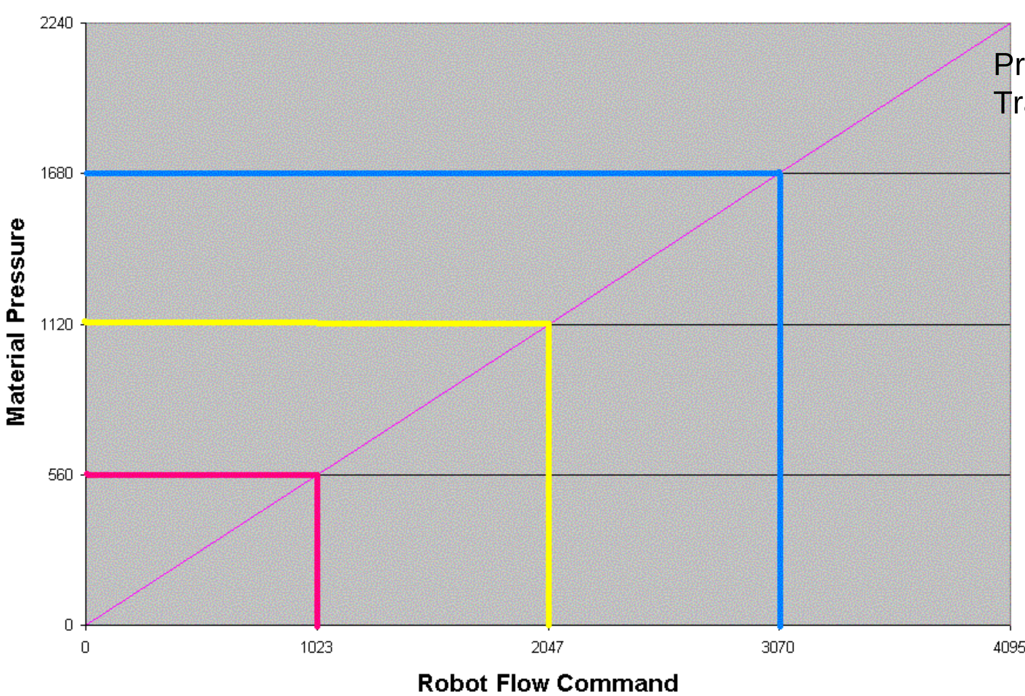
When the material pressure decreases to where it is the same as the robot velocity, the output to the Servo Valve is 5V at idle.







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).

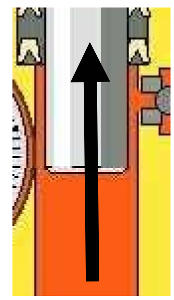


1K Dispense Head Sequence of Operation Manual Mode:

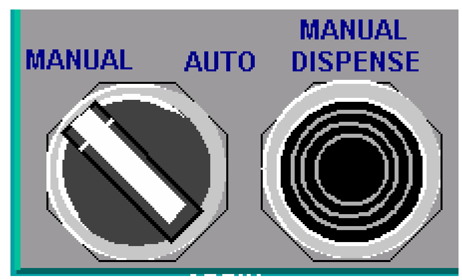
1. The Refill button is depressed and the PC goes into a refill mode.

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.

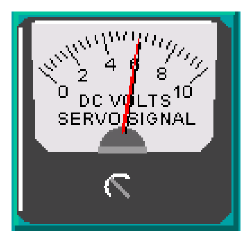


2. The higher the pump pressure is the faster the dispense head will refill.



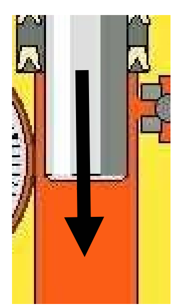
3. The Manual Dispense button is depressed and the PC goes into a dispense mode.

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.

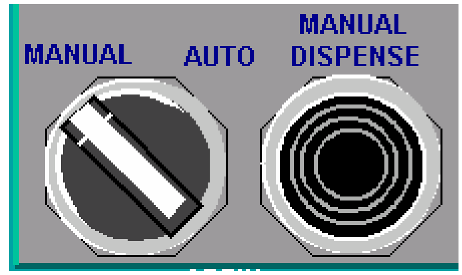


7. After dispensing the Refill button is depressed and the voltage reading is taken of the MLDT and the cc per dispense is calculated. Then step 2 is repeated.

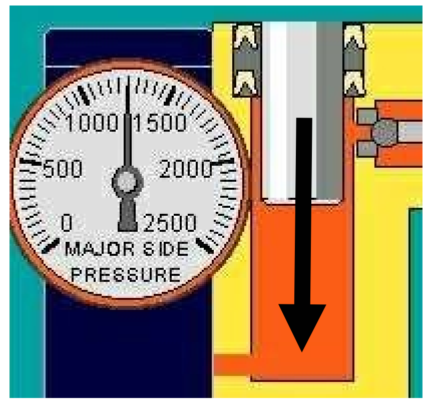
1K Dispense Head checking procedure:

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.

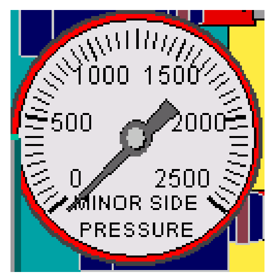


2. Depress the Manual Dispense button until the dispense head has fully depleted all of the material.

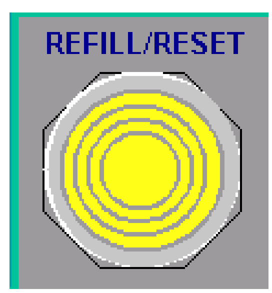


3. Continue holding the Dispense button in for 15 seconds. If the pressure on the gauge is within + or - 150 psi of zero the pressure transducer is calibrated. If not replace or calibrate the transducer

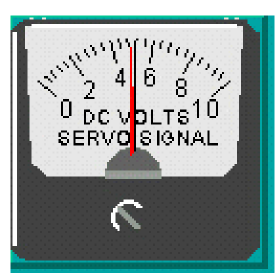
4. Let go of the button and wait for another 15 seconds. If the gauge starts to increase the refill valve could be leaking. Replace the refill valve if the pressure starts to increase.



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.

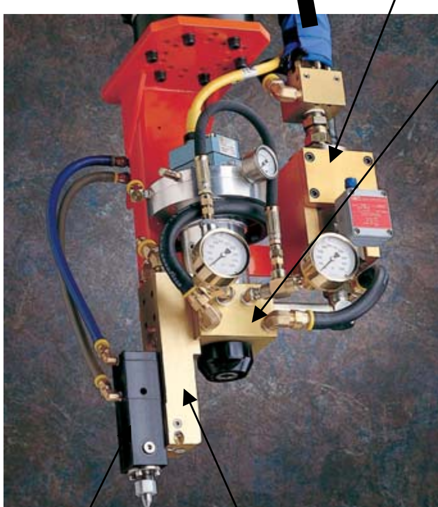


7. If there was not a volume displayed and the piston rod did not move check the MLDT.

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

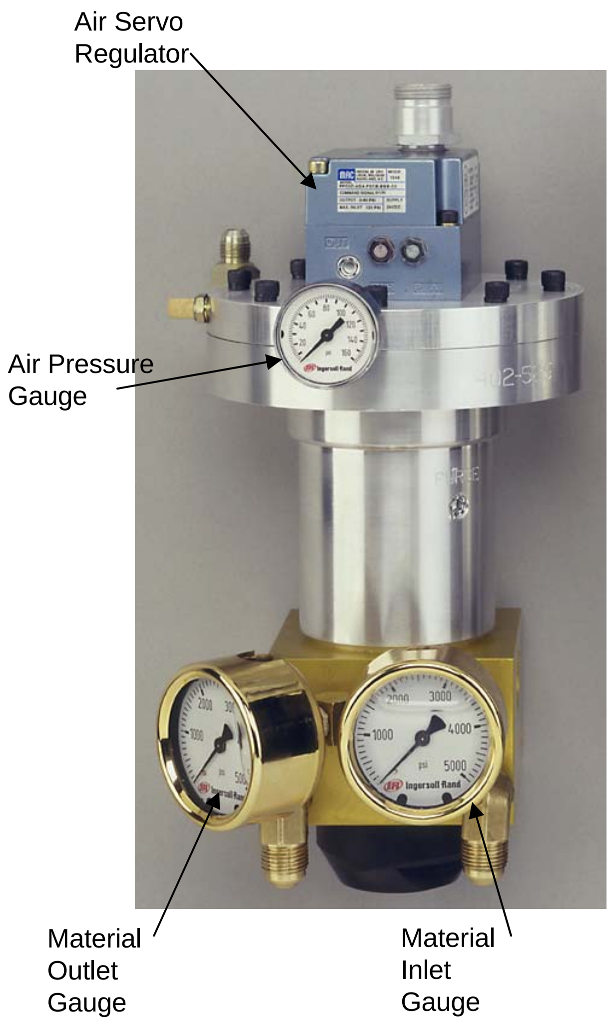
A transition block or dispense (traced) hose is used to supply regulated material to the dispense valve. Systems using a transition block are called closed coupled and have a quicker reaction time then system using a hose.

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



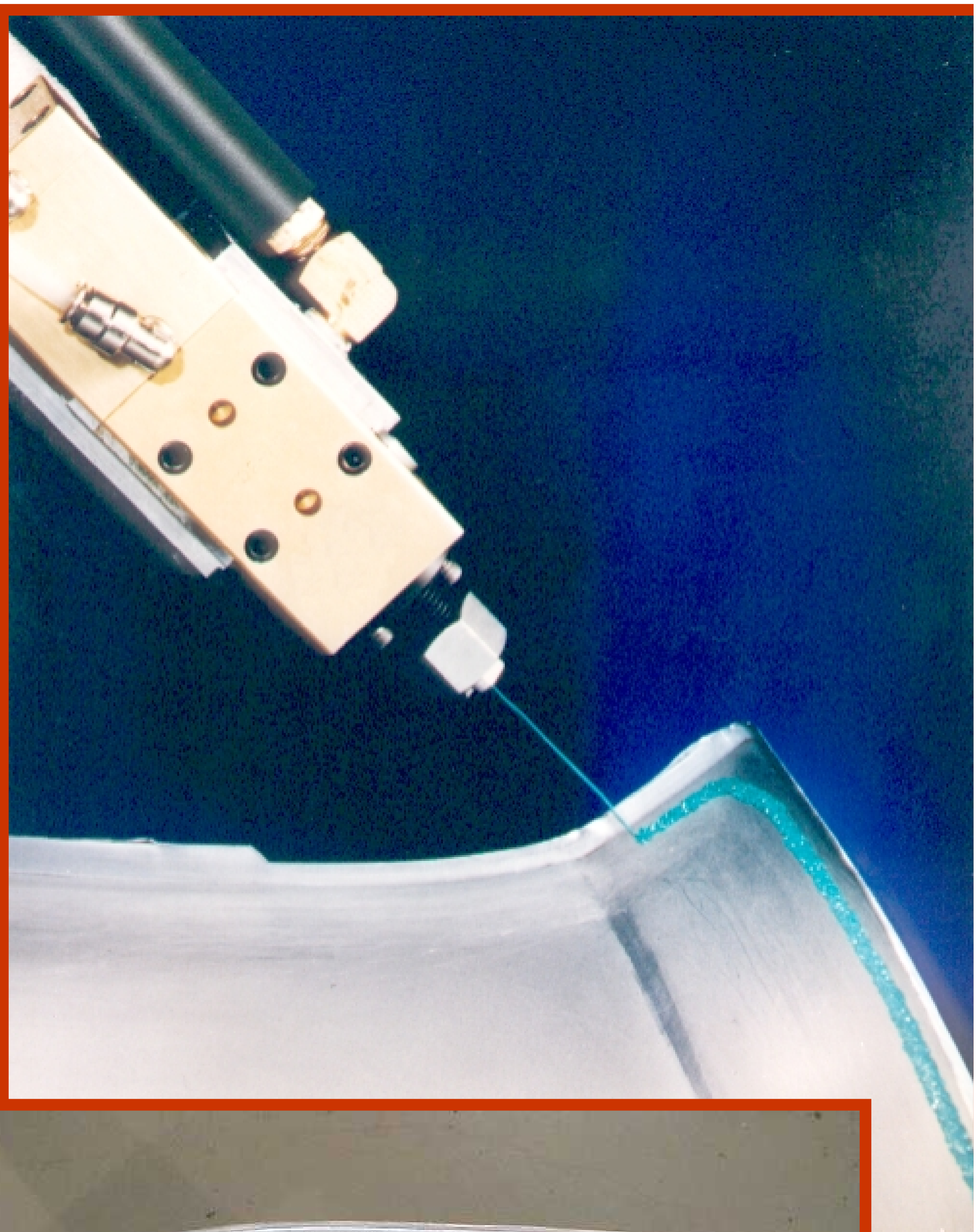
The air servo regulator is the interface between the electrical signals and the mechanical or outlet pressure of the valves.

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.

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

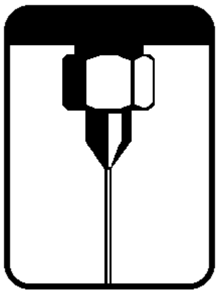
Joint Sealer
Penetrates and seals a joint

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

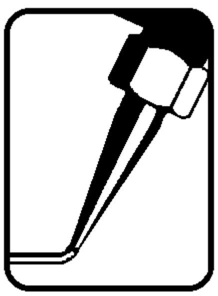
Patches and Coatings
Sprayed patches can replace hand applied patches in Body Panel Reinforcement, Sound Deadening, and Weatherproofing

Processes

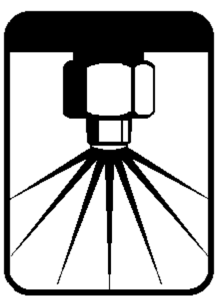
Ingersoll-Rand Systems utilizes award winning technology and state-of-the-art controls to provide the most effective and reliable processes available.



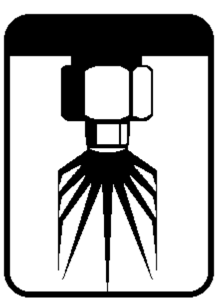
Streaming
Material is applied to the workpiece by a thin jet so that the process is not affected by inconsistencies in the workpiece



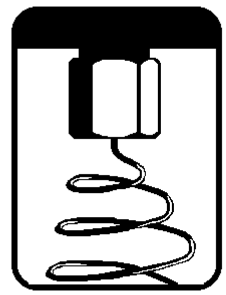
Extrusion
Material is deposited onto the workpiece directly where bead shape is critical to its performance



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

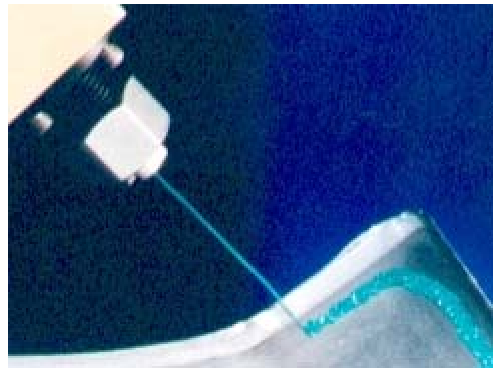
Ingersoll-Rand uses a wide variety of nozzles to dispense a array of different materials in different applications. Specialty nozzles can be made.

Shown are String dispersion, tip orientation, specialty, extrusion

Horse hair brushes and robotic teach tips

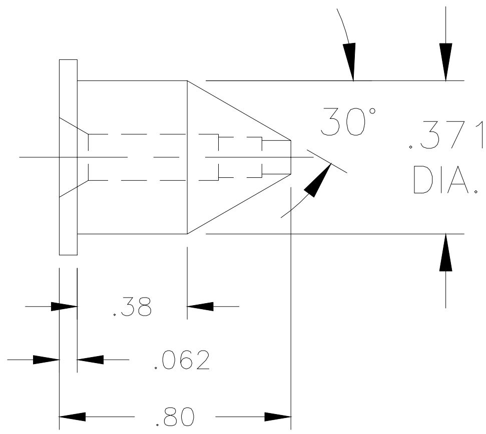
Cone tip streaming, HV style streaming, spraying tips.

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.

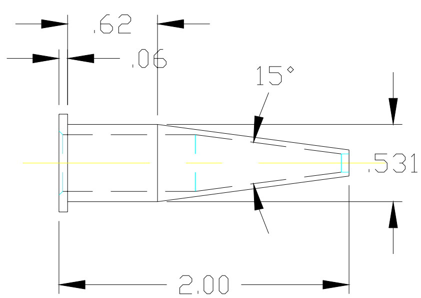
PART No.	DESCRIPTION	ORIFICE
362-853	STREAM TIP W/ INSERT	.030
362-853A	STREAM TIP W/ INSERT	.035
362-853B	STREAM TIP W/ INSERT	.040
362-853C	STREAM TIP W/ INSERT	.045
362-853D	STREAM TIP W/ INSERT	.050
362-853E	STREAM TIP W/ INSERT	.060
362-853F	STREAM TIP W/ INSERT	.018
362-853G	STREAM TIP W/ INSERT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



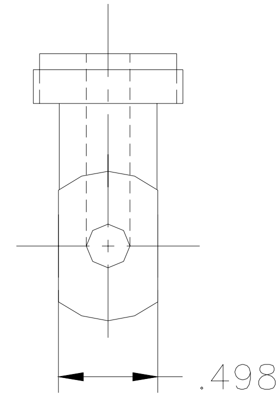
Extruding Nozzle Selection

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

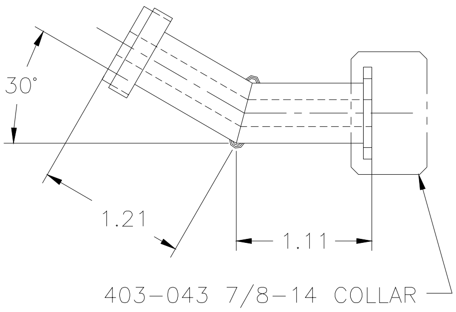


Adaptors

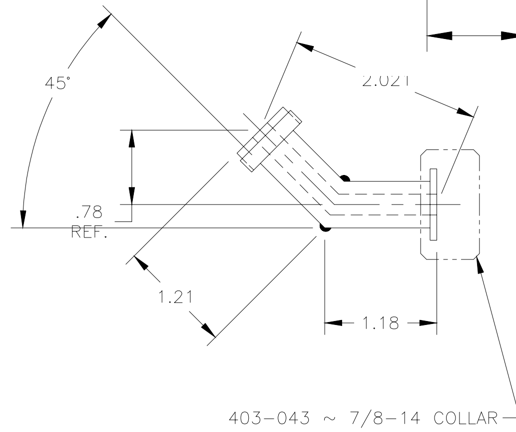


Sometimes it is necessary to install an angle offset adaptor to help make the programming easier. All of the angle adaptors have tip orientations so that they can be installed on the dispense valve in 90 deg. Rotations.

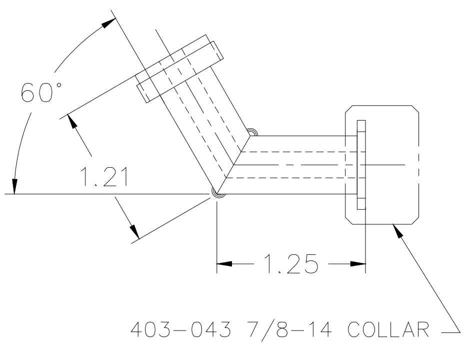
Adaptors can only be install on special dispense valves Such as a 105B038D dispense valve or a 105B038xD 4 or 6 inch extended dispense valve.



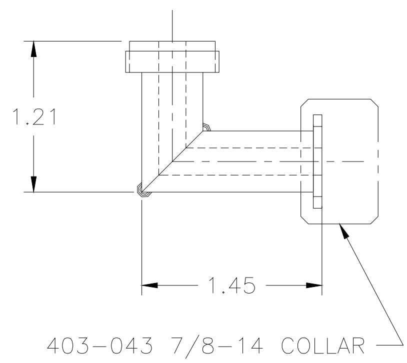
403-114-30



403-114-45A

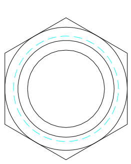


403-114A

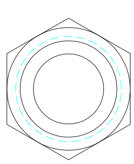


403-114-90B

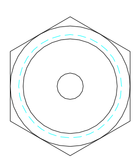
COLLARS



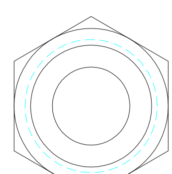
400-667
3/4 in. x 16 thd. .550 opening
Used with Extrusion Nozzles



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



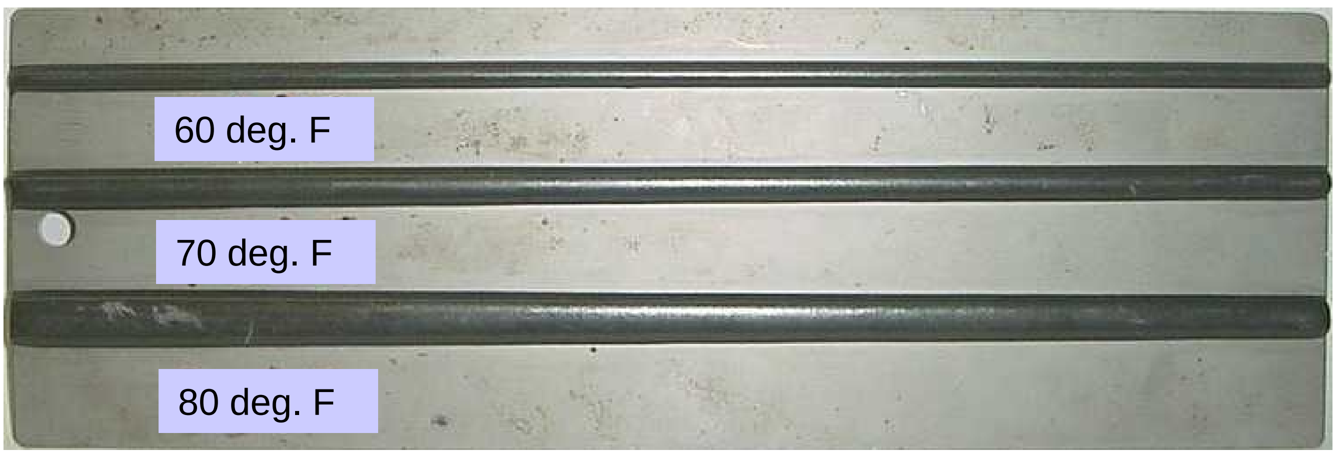
403-132
3/4 in. x 16 thd. .191 opening
Used with HV Type Spray Tips



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

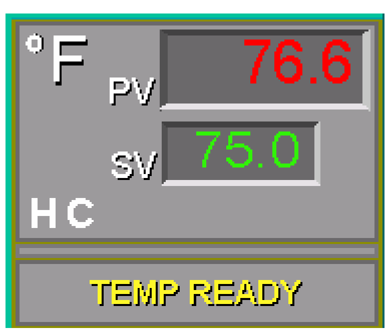
Temperature

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.

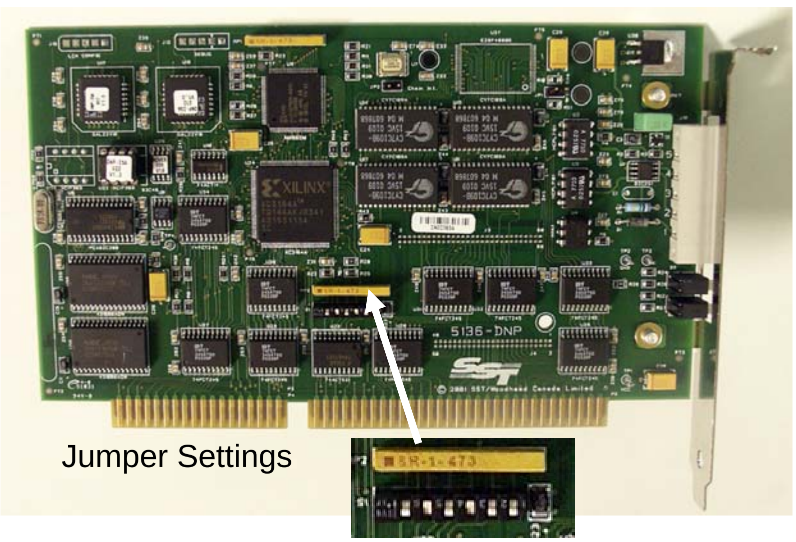
The 100 ohm platinum bulb RTD

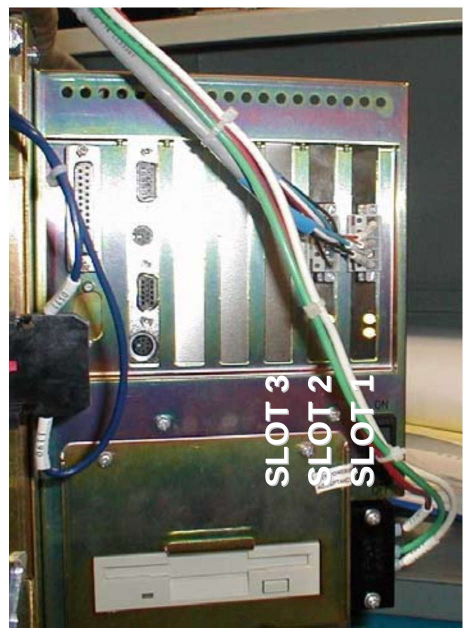


Shown is the PC temperature window which can be displayed in Celsius or Fahrenheit

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

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

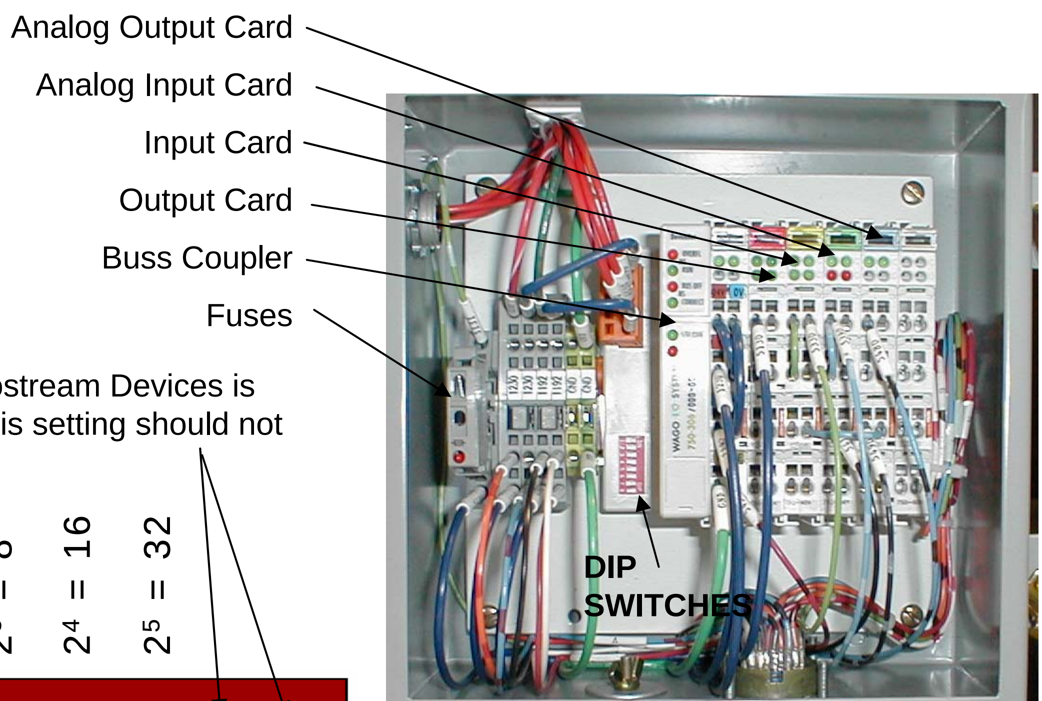
The PC uses several nodes to send inputs and outputs. The main control cabinet, each dispense J-box and pump J-box will have a node. The node consists of a buss coupler, which communicates with the controller card. Attached to the buss coupler an array of I/O cards can be attached to it. Examples are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

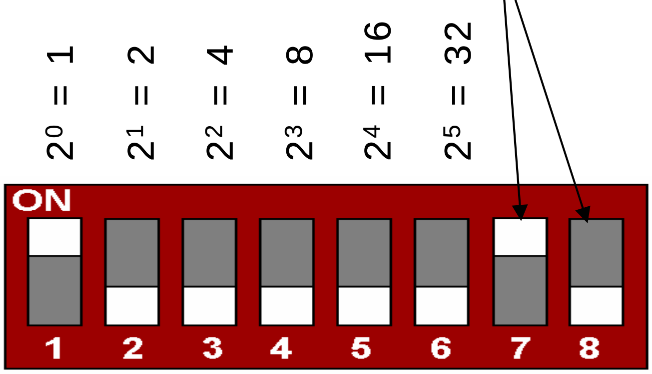
DeviceNet's communication speed is determined by its Baud Rate. Every device on a DeviceNet network **must** be set at the same Baud Rate. The Dispenser baud Rate should be set to 250 baud.

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

Physical DeviceNet Layout

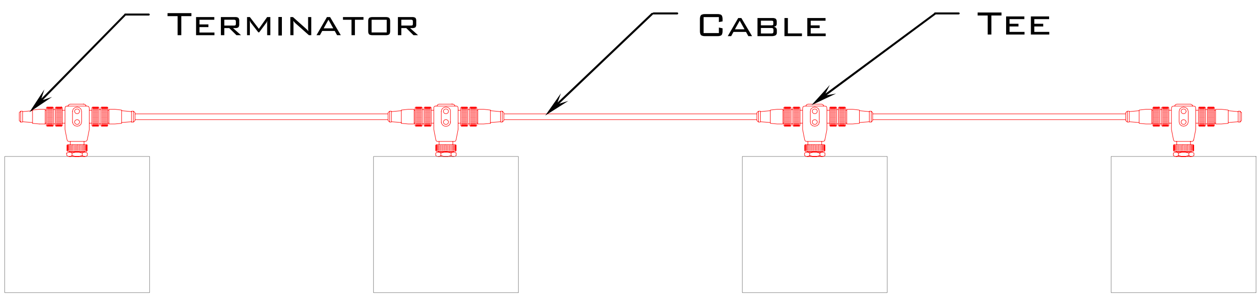
Each DeviceNet network (bus) **must** be set up as a “single-file” string of devices (trunk) connected by special DeviceNet cable.

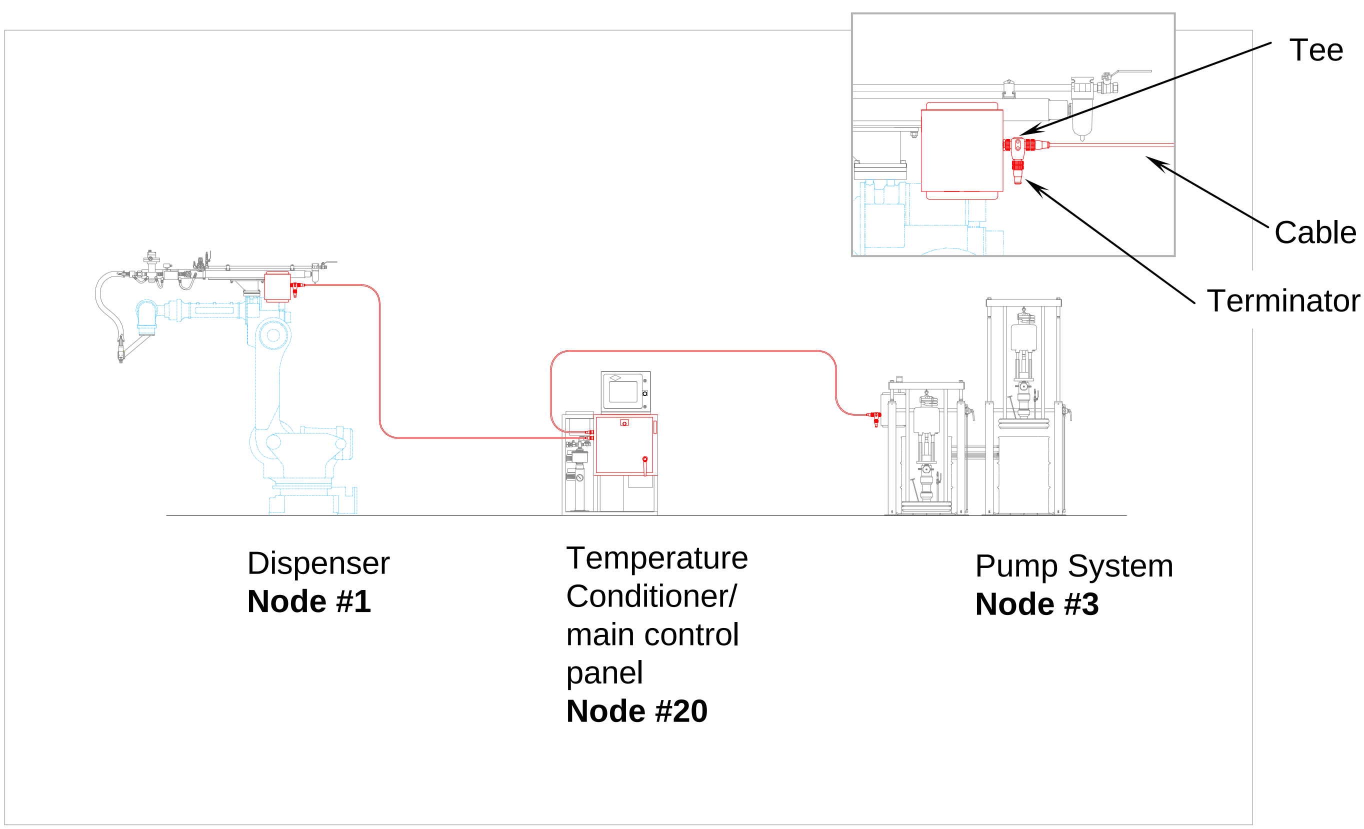
Each DeviceNet network **must** have terminating resistors (Terminators) at each end.

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.





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.

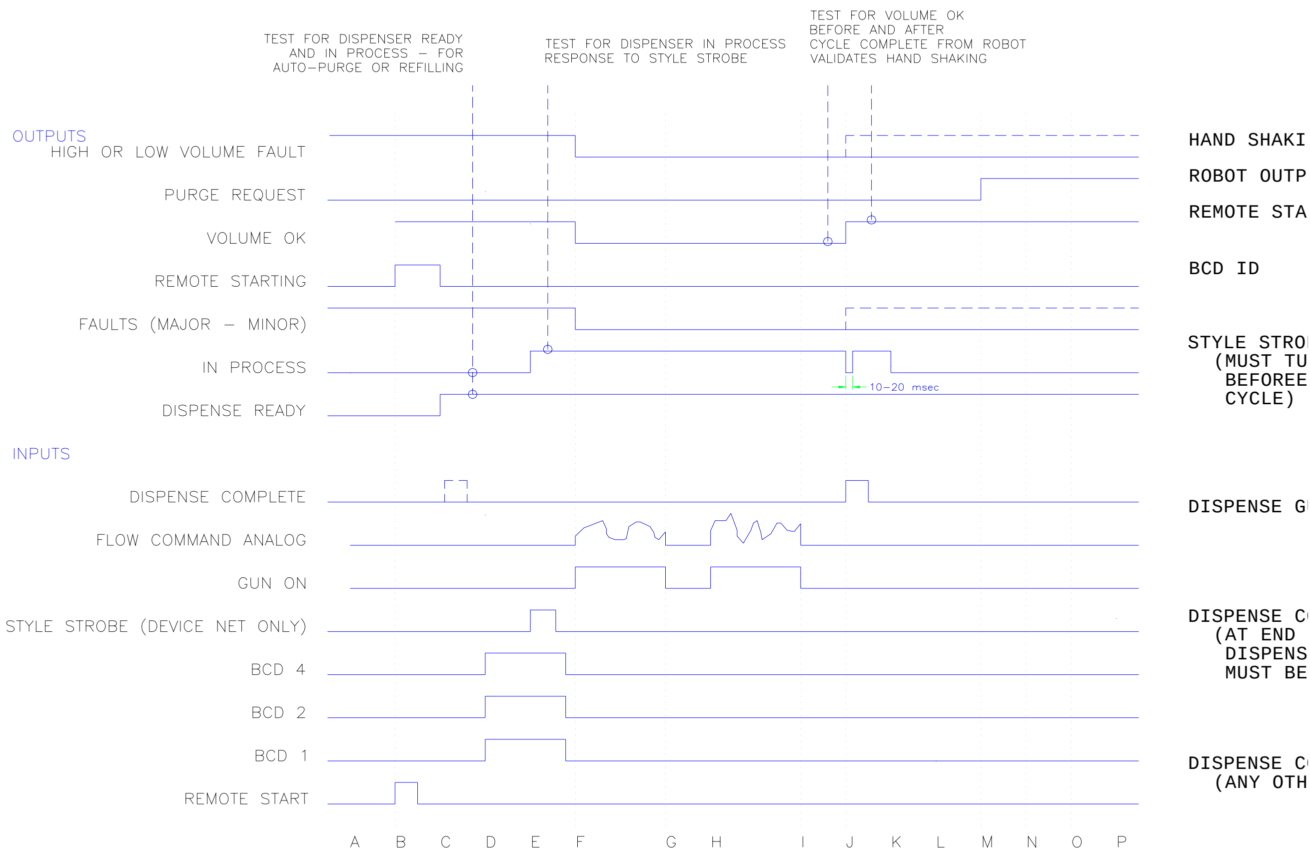
6. When the robot is done dispensing for 250ms (gun=off) check for the Volume OK signal to be LOW. If it is high the device network could be lock up (not responding) and the robot should fault out.

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.

SUGGESTED HANDSHAKING VALIDATION



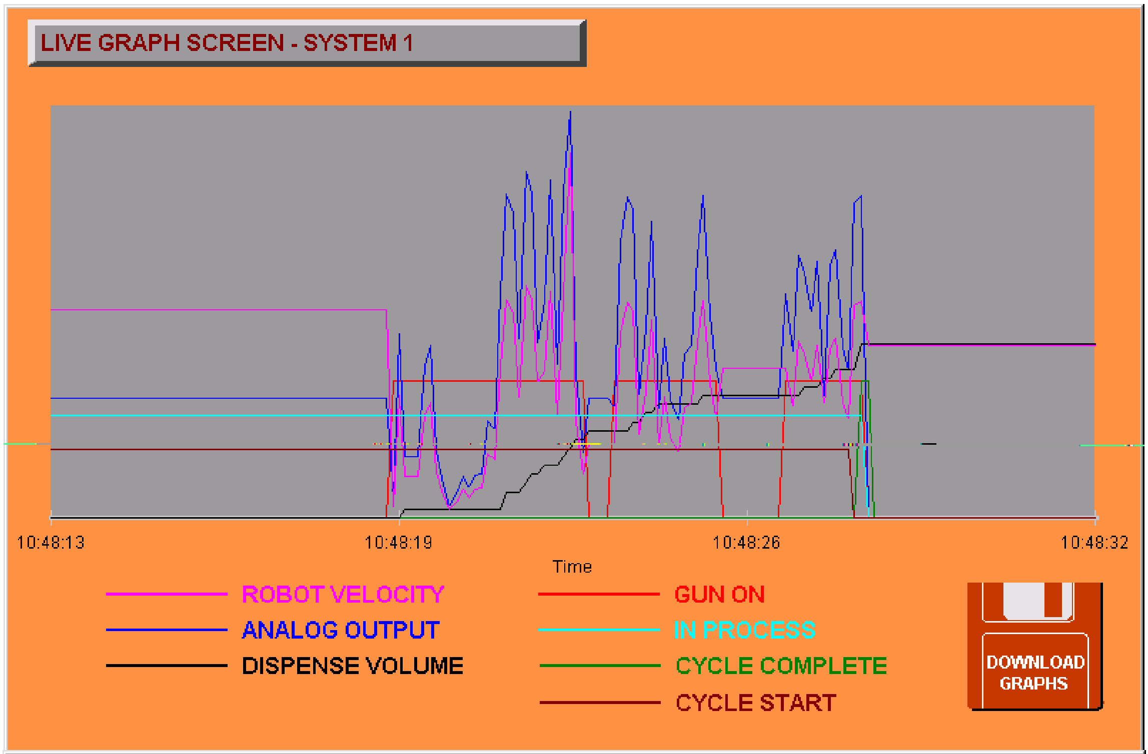
A DISCONNECT POWER ON
B MAIN POWER ON OR REMOTE START
C ROBOT CHECK FOR DISPENSE READY AND IN PROCESS OR PURGE IN PROCESS
D ROBOT IDENTIFY PART (BODY ID)
E ROBOT START MOTION
F ROBOT TURN GUN ON
G ROBOT TURN GUN OFF MULTI DISP
H ROBOT TURN GUN ON
I ROBOT TURN GUN OFF LAST DISP
J ROBOT TURN ON DISP COMPLETE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

PULSES SHALL BE 100MSEC MINIMUM

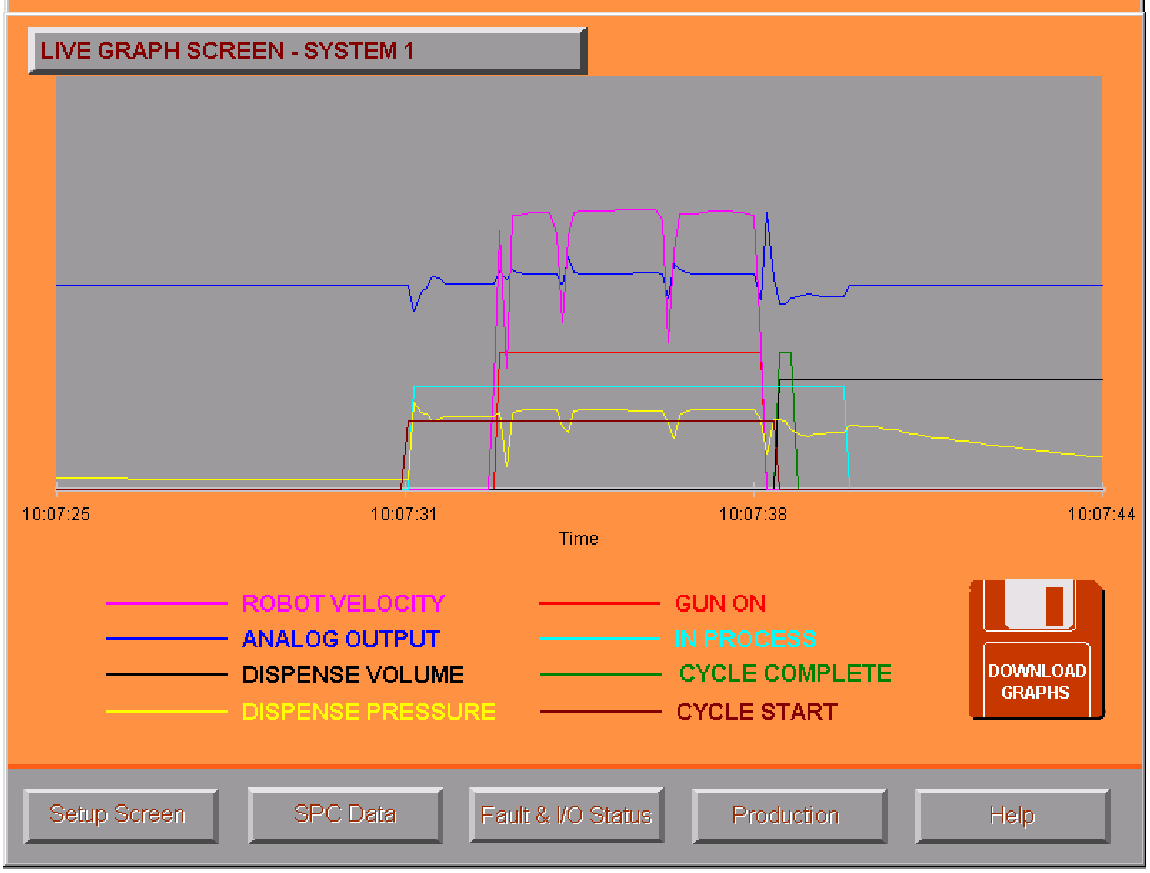
THIS LISTING SHOWS ONLY BASIC AND REQUIRED I/O
ADDITIONAL I/O AVAILABLE FOR DIAGNOSTICS

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.

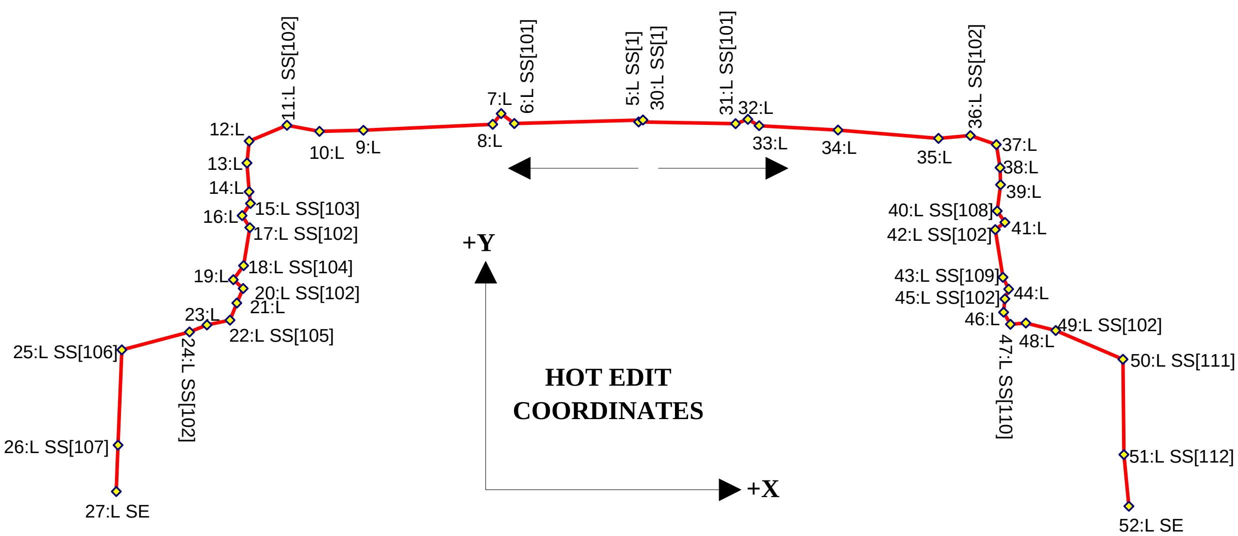
Non - TCP Proportional Approach (Direct Voltage):

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

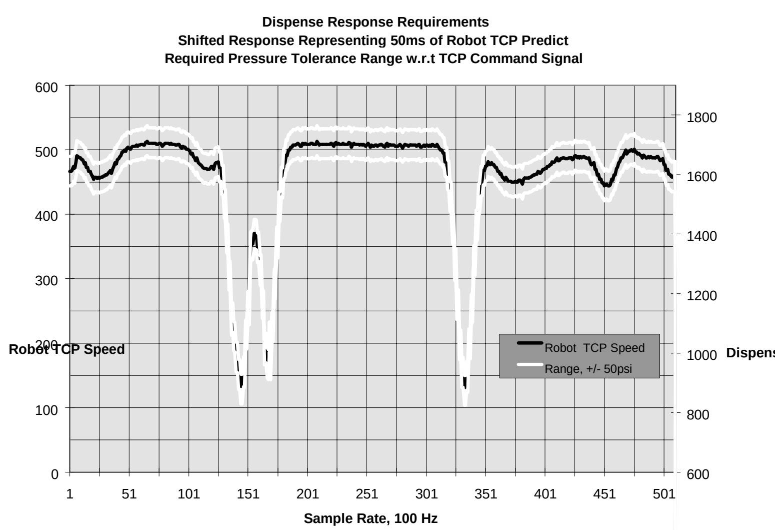


TCPP Tool Center Point Predict

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 <u>without</u> 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.

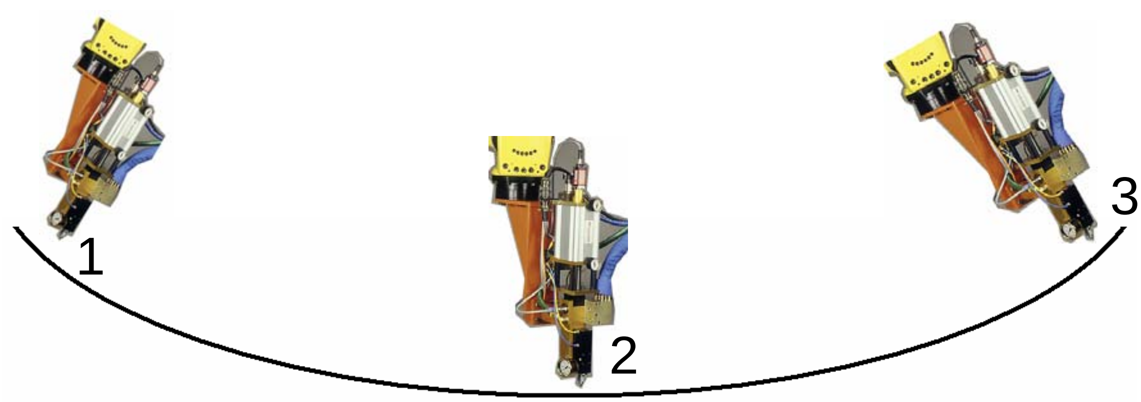
This graph shows the robot Flow command TCPP response. The dispense path is the p panel with two corners one sharper than the other



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

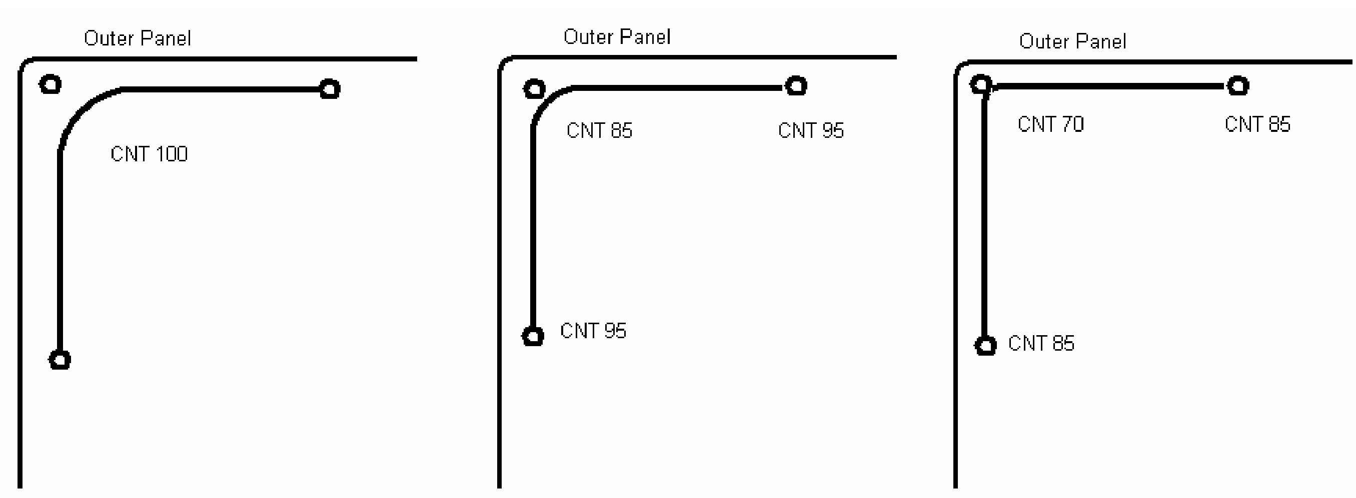


Most panels are not flat and the preferred dispense orientation is perpendicular from the panel (see diagram above). When the dispense head is re-orientated the 4th, 5th and 6th axes must be used. To do this it is best to use the motion of the robot. Start at point #1 and insert a node perpendicular 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

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.

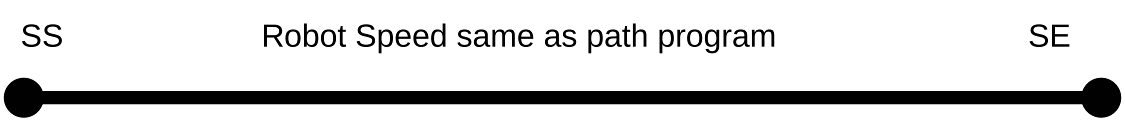
2. Create a path that is a straight line with a SS and SE that is 1 Foot or 30 centimeters long.

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.



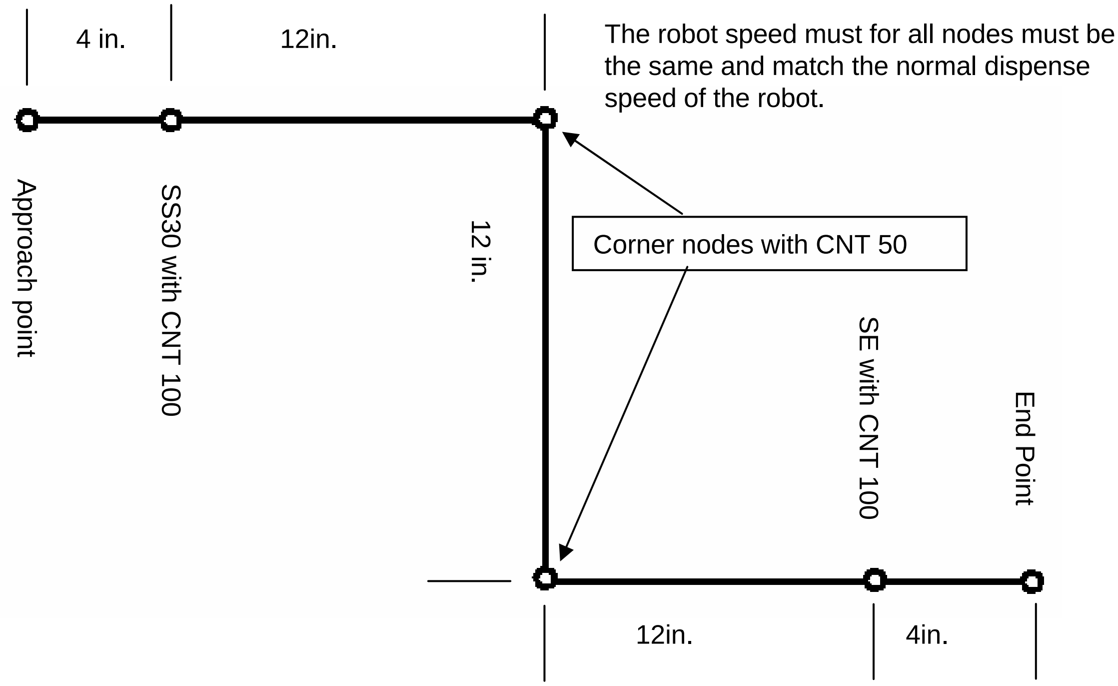
Use the voltage in the Constant / Manual Setup screen to setup desired flow rate. (5v = 2045)

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.

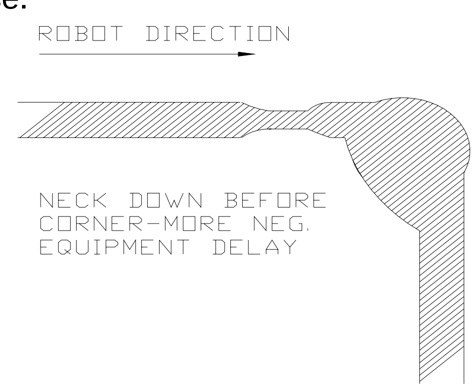
2. Decrease the Offset Bias to -1.5v. This will make the smaller part of the bead (corners) look like they almost have no material.

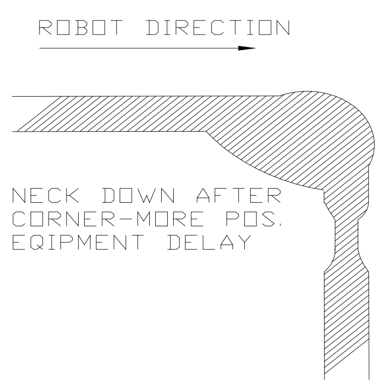
3. Run the bead path – Make sure that a style bit and strobe is sent otherwise the system will run in manual voltage.
   a. The straight away should look heavy.
   b. The corners should have too much material.
   c. There should be a neck down in the bead after the corners.

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

