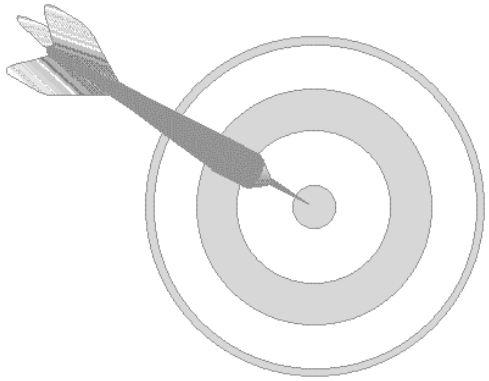
REDI Interface Kit

Installation Guide



Making Molding Simple™

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I. Introduction

The REDI Kit is a standardized set of connectors that allow a new or older molding machine to be configured with all the inputs and outputs needed to provide a "Plug And Play Interface" with RJG data acquisition equipment. Once the REDI kit has been installed on a molding machine, the user can purchase standard RJG interface cables to connect RJG data acquisition equipment to the molding machine with no additional installation. A molder can request an OEM machine manufacturer to install the REDI kit on a new machine and accurately hook up inputs for Injection Forward, Fill, Screw Run and Mold Close. Or a molder can install the kit on a preexisting molding machine (contact RJG Technical Support for further details). Optionally, the machine can be accurately wired to the REDI Kit for transferring the molding machine via cavity pressure.

The REDI Kit consists of two panel mount machine connectors. The T-INT14-M machine interface connector carries power and machine sequence information to RJG data acquisition equipment. In addition, it allows the interfacing of alarm dry contact supplied by the RJG data acquisition equipment to lights, alarms or parts sorters. The T-CNT12-M supplies three different signals for cavity pressure control: Contact Closure, 0-10V Analog Output [conditioned high-level analog] and 0-20 mV Analog Output [conditioned low-level Analog]. The machines control panel can be configured to use any of the signals to transfer the molding machine with cavity pressure.

II. Electrical Connector Section

A. T-INT14-M: Panel Mount Machine Interface Connector for Triggers / Power / Alarms

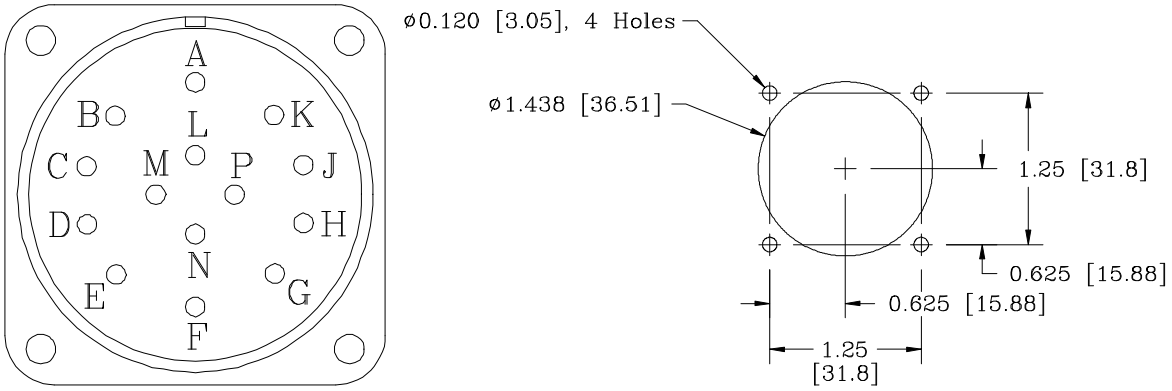

Figure 1: Panel Mount View of the Panel Mount Machine Interface Connector and the Connector's Cut Out Dimensions in Inches [mm]

Pin	Signal	Type	Signal Flow	Wire Color
A	Fill (Trigger 2)	From Machine to DART	Machine ⇒ DART	PINK **
B	Injection Forward (Trigger 1)	From Machine to DART	Machine ⇒ DART	BLUE
C	Screw Run (Trigger 3)	From Machine to DART	Machine ⇒ DART	ORANGE **
D	Mold Close (Trigger 4)	From Machine to DART	Machine ⇒ DART	DARK BROWN **
E	Power Neutral	From Machine to DART	Machine ⇒ DART	WHITE
F	Line Power *	From Machine to DART	Machine ⇒ DART	BLACK
G	Ground	From Machine to DART	Machine ⇒ DART	GREEN
H	Trigger Common	From Machine to DART	Machine ⇒ DART	GRAY
J	Alarm Contact Normally Open	From DART to Machine	DART ⇒ Machine	RED **
K	Alarm Common	From DART to Machine	DART ⇒ Machine	LT BROWN **
L	Cycle Time Normally Open	From DART to Machine	DART ⇒ Machine	VIOLET **
M	Cycle Time Common	From DART to Machine	DART ⇒ Machine	YELLOW **
N	N/A	-	-	**
P	N/A	-	-	**

Table 1: Machine Interface Connector Pin and Pigtail Cable guide

* Reference Table 2 for range

** These pigtailed wires have been individually shrink wrapped and the ends are tinned. The wires are optional for installation and if left exposed could cause unwanted problems. If needed for installation the shrink wrap can be removed.

Installation Guide: T-INT14-M

The power input specifications of RJG DART equipment can be found in Table 2.

Power Input Range	
AC Range	85VAC to 264 VAC; 47-440 Hz
DC Range	120 to 370 VDC
Frequency	47-440Hz
Max Current	1 Amp @ 115 VAC (fused @ 2.5 A)

Table 2: Power input range of RJG DART equipment

RJG DART equipment uses the following four sequence signals (triggers) from the machine controller:

Trigger	Process Stage	Label	Description
Trig 1	Injection Forward	INJ FWD	A signal that comes ON at the start of injection and remains ON during Fill, Pack and Hold.
Trig 2	Fill	FILL	A signal that is ON only when the part is filling and then it goes OFF. Typically, Fill ends when the cavity is 95 - 99% full.
Trig 3	Screw Run	SCR RUN	A signal that is ON while the screw is recovering.
Trig 4	Mold Closed	MLD CLS	A signal that is ON when the mold is fully clamped.

Table 3: Sequence signal used by RJG equipment

Figure 2 visually expresses RJG's preferred triggering sequence.

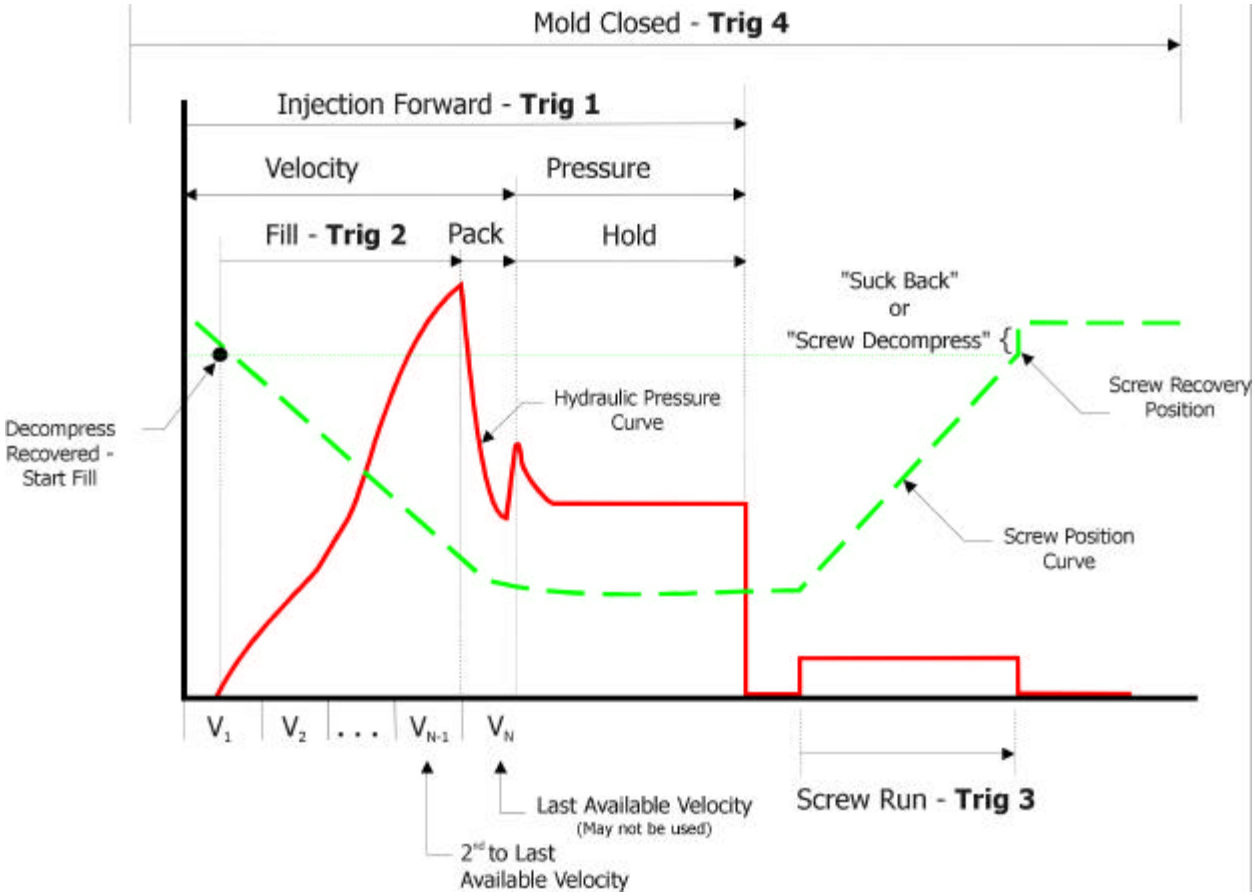

Figure 2: Hydraulic Curve showing preferred timing of triggers

Details on preferences for Injection Forward and Fill triggers

There are several timing sequences which can be used for the Injection Forward and Fill triggers, depending on the signal availability. The preferred and secondary options are outlined in Table 4:

		Preferred Option	2nd Option	Least Desirable Option
Injection Forward Trigger	Start	Starts with the forward **MOTION** of the screw. (Beginning of Injection)	Starts when the signal is sent from the controller to start injection.	
	End	Ends at the end of Hold (end of the Pressure Control stage)		
Fill Trigger	Start	Begins when the screw passes through the point where the screw stopped turning during recovery (i.e. when decompression travel has been recovered)	Begins at same time as Injection Forward Trigger.	
	End	Controller has separate **FILL, PACK,** and **HOLD** segments. Here, the Fill Trigger ends at the end of the **FILL** segment.	Fill ends at the end of the **SECOND TO LAST** Available Velocity profile [V_{N-1}] (the last profile is then reserved for Pack).	Fill ends at the end of the **LAST** Available Velocity profile [V_N], where Velocity Control transfers to Pressure Control.

Table 4: Details of Injection Forward and Fill Trigger Preference

These voltage signals can be taken directly from the valve solenoids or from the machine controller (Refer to Figure 3). The DART equipment inputs these voltage signals using an opto-isolated circuit to insure full isolation from the machine controller. Since the DART equipment gets its power from the machine panel, machines that use contact closure triggers will have to supply the trigger voltage to the contacts. Powering the DART equipment from the machine panel eliminates problems associated with isolating two power sources. However for added protection all DART trigger inputs are opto-isolated and all alarm outputs are contact closure.

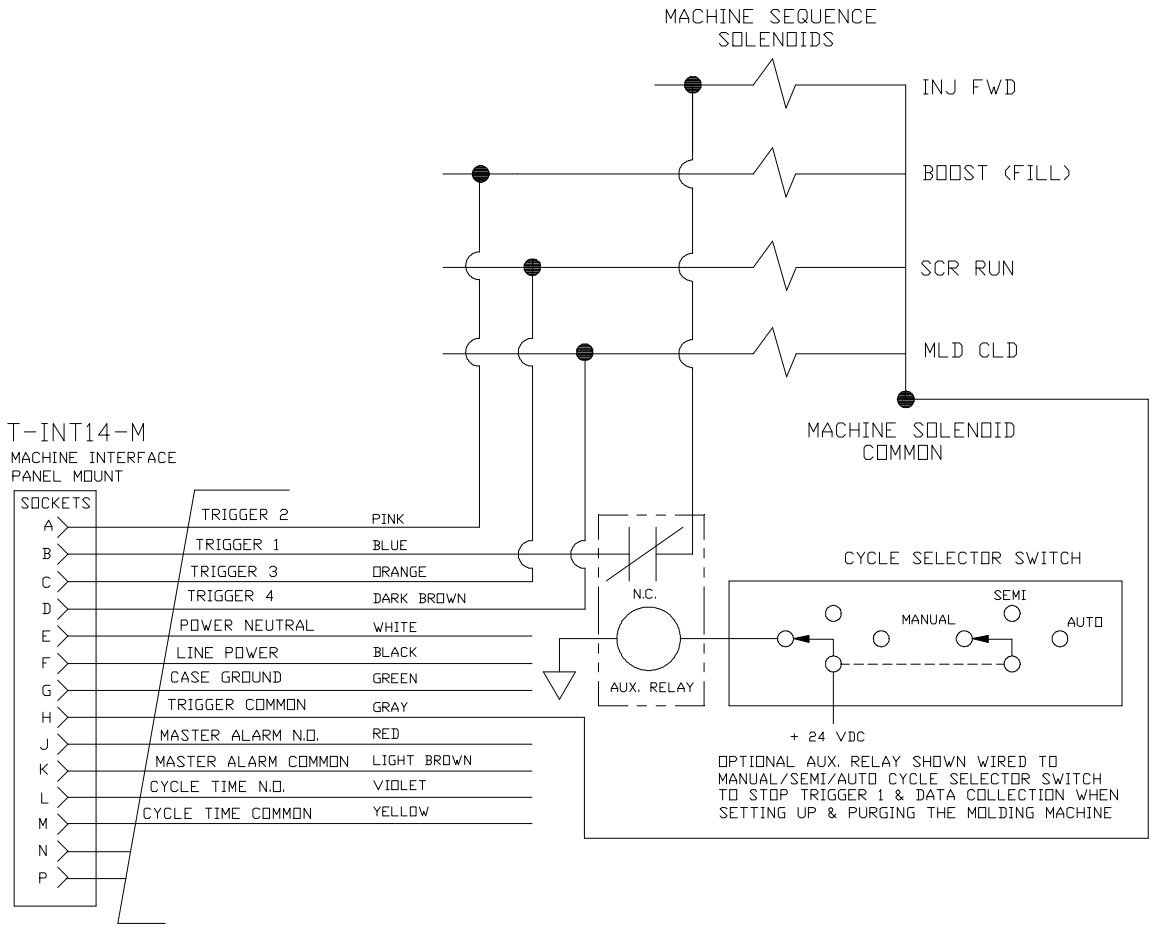

Figure 3: Trigger Wiring Guide

The master alarm contacts will remain open until the DART unit detects a variant cycle. A user will typically configure the DART to alarm before the mold opens. The press will need to make a set of contacts available, using this signal, for use with a customer-supplied part separator, as well as using the information for any press alarms, production log, etc. that the controller normally features. If requested, Cycle Time Alarm can be wired as needed

Table 4 shows the differential voltage ranges the DART equipment can use for trigger inputs. The DC 'ON' voltage can be positive or negative as long as when the trigger is 'OFF', the differential voltage is zero.

Trigger Signal Type	Voltage Range
AC Trigger	AC: 120VAC - 220VAC
DC Trigger	DC: ± 24VDC - ± 100VDC

Table 5: Trigger Voltage Ranges

B. T-CNT12-M: Panel Mount Machine Interface Connector for Mold Pressure Control

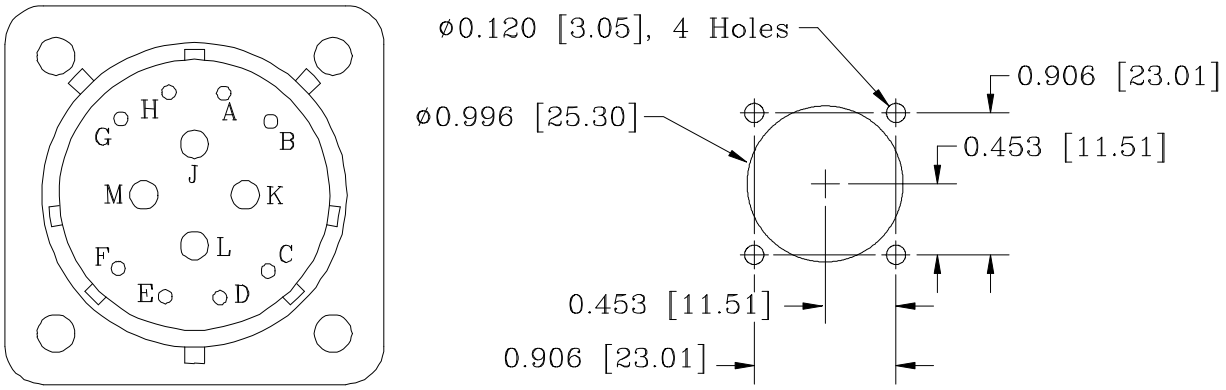

Figure 4: Panel Mount View of the Panel Mount Machine Control Connector and the Connector's Cut Out Dimensions in Inches [mm]

Pin	Signal	Type	Signal Flow	Wire Color	
G	MPT 1: +Analog Signal (0-10V)	From DART to Machine	DART ⇒ Machine	Pair →	RED **
H	MPT 1: Analog Signal Common (0-10V)	From DART to Machine	DART ⇒ Machine		BLACK **
A	MPT 1: +Analog Signal (0-20mV)	From DART to Machine	DART ⇒ Machine	Pair →	WHITE **
B	MPT 1: Analog Signal Common (0-20mV)	From DART to Machine	DART ⇒ Machine		BLACK **
J	MPT 1: Transfer Contact Normally Open	From DART to Machine	DART ⇒ Machine	Pair →	GREEN
M	MPT 1: Transfer Common	From DART to Machine	DART ⇒ Machine		BLACK
C	MPT 2: +Analog Signal (0-10V)	From DART to Machine	DART ⇒ Machine	Pair →	BLUE **
D	MPT 2: Analog Signal Common (0-10V)	From DART to Machine	DART ⇒ Machine		BLACK **
E	MPT 2: +Analog Signal (0-20mV)	From DART to Machine	DART ⇒ Machine	Pair →	YELLOW **
F	MPT 2: Analog Signal Common (0-20mV)	From DART to Machine	DART ⇒ Machine		BLACK **
L	MPT 2: Transfer Contact Normally Open	From DART to Machine	DART ⇒ Machine	Pair →	BROWN
K	MPT 2: Transfer Common	From DART to Machine	DART ⇒ Machine		BLACK

Table 6: Machine Control Connector pin and pigtail cable guide

** These pigtailed wires have been individually shrink wrapped and the ends are tinned. The wires are optional for installation and if left exposed could cause unwanted problems. If needed for installation the shrink wrap can be removed.

Installation Guide: T-CNT12-M

DART equipment supplies up to three types of signals for Cavity Pressure Control: Contact Closure, 0 - 10 V Analog Output [Conditioned High-Level Analog] and 0 - 20 mV Analog Output [Conditioned Low-Level Analog]. The machine manufacture should select just one type of control that best suits their needs. Table 6 is provided as a guide to the three different control options.

> **CAUTION:** When using an RJG cavity pressure transfer control input, it is important to ensure that backup setpoints for time, position or pressure are used. In the event the cavity pressure transfer control input is not seen by the machine controller, the backup setpoints will prevent damaging the tool.

Though one channel is typical, RJG DART equipment may be configured with two or more Mold Pressure Control channels. Each Machine Control Connector is capable of carrying up to two channels of Mold Pressure Control (refer to Table 4 for Machine Control Connector Pin and Pigtail Cable guide).

Here are some ways to utilize multi-channel mold pressure control:

- One or more channels as redundant backup control for the first
- Letting the first channel of multiple channels to reach set-point transfer the machine
- Multiple set-points for rising and falling control edges
- Two or more channels must reach pressure for transfer to happen

While currently it is rare to configure more than one cavity pressure control channel, the addition of one or more cavity pressure measurements for monitoring is common. The T-CNT12-M connector(s) can also be used to interface any additional number of monitoring channels.

Control Type	Typical Usage	Sensor Excitation & Autozero	Signal Calibration Requirements	Control Set-Point Requirements	Can Use CVP
Contact Closure	Press Control does not have a Mold Pressure Transfer Setup screen (Common w/Retrofits)	Provided by the DART	None by the Press Control - All calibration done by the DART	Ability to select External Boost cut-off & set a Safety Transfer Set-Point	Yes
Conditioned High-Level Analog (0-10V)	Press Control has Mold Pressure Transfer on its screens	Provided by the DART	See Scaling Notes and Sensor Compatibility Table	Mold Pressure and Safety Transfer Set-Points	Yes
Conditioned Low-Level Analog (0-20 mV)	Press Control has Mold Pressure Transfer; but has a redundant signal conditioner that cannot be bypassed	Provided by the DART	See Scaling Notes and Sensor Compatibility Table	Mold Pressure and Safety Transfer Set-Points	Yes

Table 7: Comparison of Control Type Options

Contact Closure Control

If Contact Closure Control is selected the machine controller will need to provide the ability to select external boost cut-off & set a safety transfer set point. RJG DART equipment provides a normally open set of contacts that will close when the mold pressure passes through the set point on the rising slope and will open when the pressure falls through the set point. RJG DART equipment provides all signal excitation, auto zeroing and calibration

Conditioned 0-10V Analog/Conditioned 0-20 mV Analog Control

If Conditioned 0-10V Analog or Conditioned 0-20 mV Analog control is selected, the machine controller will have to provide the ability to choose the following parameters on the set-up screens:

- Choice of Direct (mounted flush to the cavity) or Indirect (placed behind an ejector pin) Sensor
- If Indirect Sensor, the Ejector Pin Size and/or Ejector Pin Area

- Full Scale Rating of Transducer being used by RJG DART equipment (Force = Indirect, Pressure = Direct)
- Single Or Multi-Channel Control Configuration (Optional)

Gain	**0 - 10 Volt Output Range**		**0 - 20 mV Output Range**	
Switch position	Transducer scale range	Voltage range	Transducer scale range	Voltage range
High (500)	0 to ½ full scale	0 to 10 Volts	0 to ½ full scale	0 to 20 mV
Standard Mid (250)	0 to full scale	0 to 10 Volts	0 to full scale	0 to 20 mV
Low (1)	N/A	N/A	N/A	N/A

Table 8: Control output and scale output ranges

The machine controller will set the scaling based on these parameters. Signal excitation and autozeroing is provided by RJG DART equipment. Refer to Table 8 for an overview of this scheme. What follows is a detailed explanation of the scaling scheme. Figure 5 shows a typical mold pressure curve whose peak is at exactly full scale of the transducer.

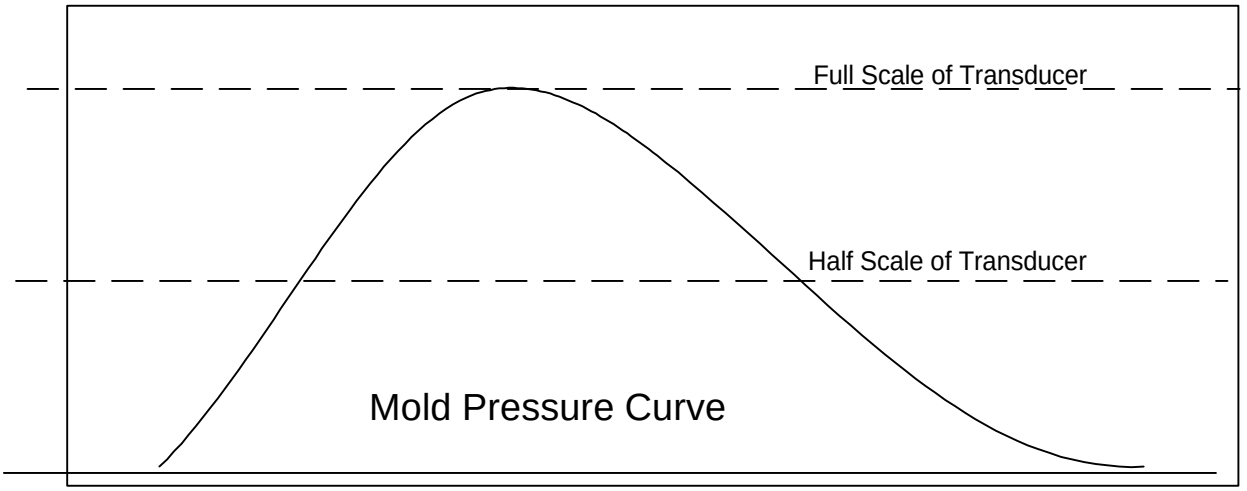

Figure 5: Typical mold pressure curve with a peak at full-scale pressure of the transducer

High Gain (500) Direct Sensor Scaling Notes

RJG DART equipment will provide either a 0 to 20 mV signal or a 0 to 10V signal relating to 0 to 1/2 of the full scale rating of the transducer. If the pressure on the transducer goes above half scale, the output will stay at 10 Volts (20 mV). Refer to Figure 6 for a graphical representation.

Example: RJG DART equipment utilizing a direct sensor with a full scale rating of 20,000 psi will provide a Voltage of 5V(Conditioned High-Level Analog) or 10 mV (Conditioned Low-Level Analog) when the direct sensor's cavity is pressurized to 5000 psi.

Pressure = (Signal Voltage / Maximum Signal Voltage) * (1/2 of Full scale Pressure)

Pressure = 5000 psi = (5V / 10V) * 10,000 psi *(Conditioned High-Level Analog Signal Voltage)*

Pressure = 5000 psi = (10 mV / 20 mV) * 10,000 psi *(Conditioned Low-Level Analog Signal Voltage)*

High Gain (500) Indirect Sensor Scaling Notes

The RJG DART equipment will provide either a 0 to 20 mV signal or a 0 to 10V signal relating to 0 to 1/2 of the full scale rating of the transducer. If the pressure on the transducer goes above half scale, the output will stay at 10Volts (20 mV). Refer to Figure 6 for a graphical representation.

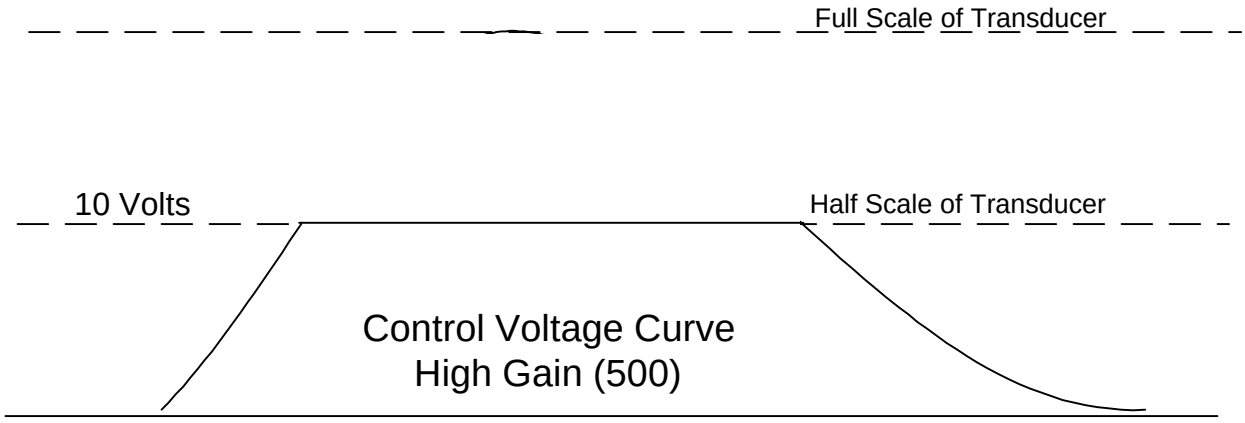

Figure 6: Voltage output relating to the mold pressure curve of Figure 5, Gain=500.

Example: RJG DART equipment utilizing an indirect sensor with a full scale rating of 2000 lb. sitting under a 1/4" injector pin will provide a voltage of 5V or 10 mV when the indirect sensor's cavity is pressurized to 10,186 psi.

Pressure = (Signal Voltage / Maximum Signal Voltage) / (1/2 of Full scale Pressure / Injector Pin Area)

Pressure = 10,186 psi = (5V / 10V) * (1000 lb. / 0.04909 in^2) *(Conditioned High-Level Analog Signal Voltage)*

Pressure = 10,186 psi = (10 mV / 20 mV) * (1000 lb. / 0.04909 in^2) *(Conditioned Low-Level Analog Signal Voltage)*

Standard Mid Gain (250) Direct Sensor Scaling Notes

RJG DART equipment will provide either a 0 to 20 mV signal or a 0 to 10V signal relating to 0 to the full scale rating of the transducer. If the pressure on the transducer goes above half scale, the output will follow it all the way to the full scale of the transducer. Refer to Figure 7 for a graphical representation.

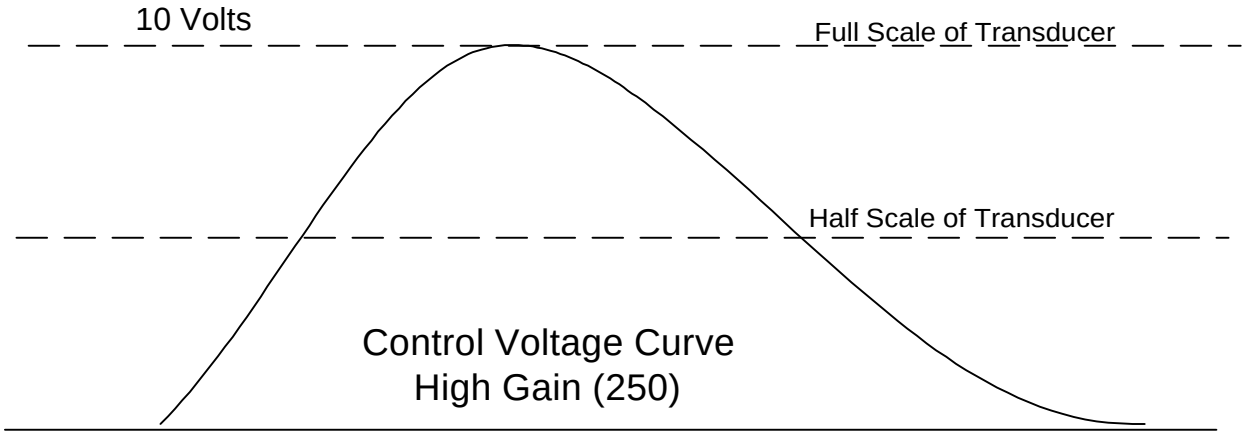

Figure 7: Voltage output relating to the mold pressure curve of Figure 5, Gain=250.

Example: RJG DART equipment utilizing a direct sensor with a full scale rating of 20,000psi will provide a Voltage of 2.5V(Conditioned High-Level Analog) or 5mV(Conditioned Low-Level Analog) when the direct sensor's cavity is pressurized to 5000psi.

Pressure = (Signal Voltage / Maximum Signal Voltage) * (Full scale Pressure)

Pressure = 5000 psi = (2.5V / 10V) * 20,000 psi *(Conditioned High-Level Analog Signal Voltage)*

Pressure = 5000 psi = (5 mV / 20 mV) * 20,000 psi *(Conditioned Low-Level Analog Signal Voltage)*

Standard Mid Gain (250) Indirect Sensor Scaling Notes

The full scale entered for an indirect sensor will be its full-scale force rating. RJG DART equipment will provide either a 0 to 20mV signal or a 0 to 10V signal relating to 0 to 1/2 of the full scale rating of the transducer.

Example: RJG DART equipment utilizing an indirect sensor with a full scale rating of 2000 LB sitting under a 1/4" injector pin will provide a voltage of 2.5V or 5mV when the indirect sensor's cavity is pressurized to 10,186psi.

Pressure =(Signal Voltage / Maximum Signal Voltage) / (Full Scale Force / Injector Pin Area)

Pressure = 10,186 psi = (2.5V / 10V) * (2000 lb. / 0.04909 in²) *(Conditioned High-Level Analog Signal Voltage)*

Pressure = 10,186 psi = (5 mV / 20 mV) * (2000 lb. / 0.04909 in²) *(Conditioned Low-Level Analog Signal Voltage)*

C. Important Installation Notes

Refer to Table 6 for a Machine Control Connector pin and pigtail cable guide. If only one control channel is being wired use those control signals labeled MPT1 (Pins G, H, A, B, J and M). If the machine is to be wired for more than two channels of control, additional Machine Control Connectors can be added. Please refer to Tables 9 and 10 for important installation ratings.

Minimum control voltage output resistance	
Conditioned high-level analog output	1k Ohms
Conditioned low-level analog output	100k Ohms

Table 9: Minimum control voltage output resistance

NOTE: RJG DART equipment supplies its own excitation to the transducer, do *not* wire the machine controller's transducer excitation voltage to RJG DART equipment.

Control relay contact ratings	
Item	**Rating**
Maximum switching power	50 Watts
Maximum switching voltage	500 VDC or Peak AC
Maximum switching and carry currents	1 A (limited by current limit fuse)
Maximum control contact switching time after seeing set-point	13mS

Table 10: Control relay contact ratings

NOTE: The control relay is **not** horsepower rated and should **not** be used to control the machine solenoids directly.

CAUTION: When using an RJG cavity pressure transfer control input, it is important to ensure that backup setpoints for time, position or pressure are used. In the event the cavity pressure transfer control input is not seen by the machine controller, the backup setpoints will prevent damaging the tool.

III. Hydraulic Section

The end-user (molder) will need to access the injection forward and back pressures, which build at the cylinder of the ram. This will be done using RJG hydraulic pressure transducers. Therefore, a 1/4" NPTF port should be made available at a convenient location on the hydraulic circuit of the machine to accept a 1/4" NPTM male interface fitting.