



The
Plastics
Industry
Trade
Association

Machinery Division

Recommended Guideline for Robot Injection Molding Machine Electrical Interface

**AN-116
Version 3.3
July 12, 2000**

1.0 PURPOSE

The purpose of this work is to provide electrical interface guidelines for the installation of robots with injection molding machines.

2.0 OBJECTIVE

The objective of the committee was to standardize the electrical interface between the injection molding machine and the robot as well as to specify the electrical connection for this standard interface.

3.0 SCOPE

The guideline applies to the electrical interface between robots and injection molding machines. It does not include any interface for the transfer of data since solutions to this problem are covered by the SPI communications protocol.

4.0 ELECTRICAL INTERFACE

A 32 pin interface connection (DIN #40050) 10A 600V double lever base and hood plug connection will act as the physical link between the robot and the injection molding machine.

Two sets of two inserts are required for the interface. There are 16 male and 16 female pins in each connector. It is intended the "HOT" pins are to be enclosed within the female insert of each connector. There are unassigned pins to meet special requirements or to accommodate further developments. The connector pin assignments and the contact functions are described under Electrical Signals, 4.1, 4.2, & 4.3.

The current of the signals must not exceed 200 mA unless otherwise noted.

The voltage of the signals must not exceed 250 Vac.

For pulses, the pulse width must not be less than 0.5 seconds.

All signals are maintained signals unless otherwise noted.

Note: All pin assignments are required unless otherwise noted as "optional".

4.1 ELECTRICAL SIGNALS (INJECTION MOLDING MACHINE TO ROBOT)

All functions will be Dry Contacts.

| PINS | FUNCTIONS |
|------------------------|---|
| 1/9 | EMERGENCY STOP (I.M.M.) While the injection molding machine emergency stop is activated, the circuit will open and will activate the emergency stop circuit of the robot. The injection molding machine emergency stop circuit will be hard wired in series with the robot emergency stop circuit. The current of this signal must not exceed 6 amps. |
| 2/16 | MOLD FULLY OPEN (I.M.M.) This signal is present when the contacts are closed and indicates that the mold is in a predetermined fully open position. The signal is maintained whenever the mold is in the predetermined fully open position. |
| 2/16 (Vertical) | TABLE IN POSITION (PRIMARY) This signal is present when the contacts are closed and indicates that the rotary or shuttle table is in the primary position. This signal is maintained whenever the rotary or shuttle table is in the primary position. |
| 3/11 | MOVABLE GATES & GUARDS CLOSED. (I.M.M.) This signal is present when the contacts are closed and indicates that the movable gates and guards that prevent access to robot motions are closed. This signal is maintained as long as the movable gates and guards are closed. The current of this signal must not exceed 6 amps. |
| 4/16 | EJECTOR FULLY RETRACTED (I.M.M.) This signal is present when the contacts are closed and indicates that the ejectors are fully retracted. This signal is maintained while the ejectors are fully retracted. |
| 5/16 | EJECTOR FULLY FORWARD (I.M.M.) This signal is present when the contacts are closed and indicates that the ejectors are fully forward. This signal is maintained while the ejectors are fully forward. |
| 6/16 | CORE FULLY SET (I.M.M.) This signal is present when the contacts are closed and indicates that the cores are fully set. This signal is maintained while the cores are fully set. |

| PINS | FUNCTIONS <i>(continued)</i> |
|-------------------------|---|
| 7/16 | CORE FULLY PULLED (I.M.M.) This signal is present when the contacts are closed and indicates the cores are fully pulled. This signal is maintained while the cores are fully pulled. |
| 8/16 | REJECT PART (I.M.M.) This signal is present when the contacts are closed and indicates that the molded part is not acceptable. This signal must be given on/or before the mold fully open signal and removed with the start of mold closing. |
| 10/16 | PERMIT ROBOT OPERATION (I.M.M.) This signal is present when the contacts are closed and indicates that the injection molding machine is in a cycle that requires the robot to operate. This signal is maintained as long as the injection molding machine operation requires use of the robot. <i>NOTE: For horizontal injection molding machines this signal has been called "Fully Automatic" in the past.</i> |
| 12/16 | MOLD FULLY CLOSED (I.M.M.) This signal is present when the contacts are closed and indicates that the injection molding machine has reached tonnage set point. This signal is maintained as long as the mold is fully closed. |
| 14/16 | INTERMEDIATE MOLD OPEN POSITION (I.M.M.) [OPTIONAL SIGNAL] This signal is present when the contacts are closed and indicates that the Mold is at or greater than a predetermined mid-position. This signal should stay on until the mold reaches the fully open position. |
| 14/16 (Vertical) | TABLE IN POSITION (SECONDARY) This signal is present when the contacts are closed and indicates that the rotary or shuttle table is in the secondary position. This signal is maintained whenever the rotary or shuttle table is in the secondary position. |
| 15/16 | NO PART AVAILABLE This signal is present when the contacts are closed and indicates that no molded part is available. This signal must be given before the start of mold opening and removed with the start of mold closing. |

4.2 ELECTRICAL SIGNALS - (ROBOT TO INJECTION MOLDING MACHINE)

All functions will be Dry Contacts

| PINS | FUNCTION |
|-------------------------|---|
| 17/32 | PERMIT CLAMP MOTION - (ROBOT) The closing of this contact indicates that the robot is in a predetermined safe position and permits the IMM clamp to close. Clamp closing motion must be interrupted whenever this signal is not present. This signal is no longer required once the mold is fully closed. |
| 17/32 (Vertical) | PERMIT TABLE MOTION (ROBOT) The closing of this contact indicates that the robot is in a predetermined safe position and permits the VIMM rotary or shuttle table to move. Table motion must be interrupted whenever this signal is not present. This signal is no longer required once the table is in the primary or secondary position. |
| 18/26 | ENABLE CLAMP MOTION - (ROBOT) The closing of this contact indicates that the robot is in a predetermined safe position and enables the IMM clamp motion. Both clamp closing and clamp opening motion must be interrupted whenever this signal is not present. The current of this signal must not exceed 6 amps. |
| 18/26 (Vertical) | ENABLE TABLE MOTION (ROBOT) The closing of this contact indicates that the robot is in a predetermined safe position and enables VIMM rotary or shuttle table to move. Table motion must be interrupted whenever this signal is not present. |
| 19/27 | EMERGENCY STOP (ROBOT) While the robot emergency stop is activated, the circuit will open and activate the emergency stop circuit of the injection molding machine. The robot emergency stop circuit will be hardwired in series with the injection molding machine emergency stop circuit. The current of this signal must not exceed 6 amps. |
| 20/32 | ROBOT NON-OPERATIONAL (ROBOT) The switch contact is open when the I.M.M. is operated with the robot. The switch is closed when the machine is operated without the robot. When the switch is closed, the signal Permit Clamp Close (17,32) Permit Clamp Motion (18,26) and Emergency Stop (ROBOT) (19,27) are still monitored. All other signals can be in an undetermined state. |

| PINS | FUNCTIONS <i>(continued)</i> |
|--------------|---|
| 21/32 | PERMIT EJECTOR RETRACT (ROBOT) The closing of this contact permits the ejectors to retract. This signal is maintained until the ejectors are fully retracted. |
| 22/32 | PERMIT EJECTOR FORWARD (ROBOT) The closing of this contact permits the ejectors to go forward. The signal is maintained until the ejectors are fully forward. |
| 23/32 | PERMIT CORE PULL (ROBOT) The closing of this contact permits the cores to be pulled is maintained until the cores are fully pulled. |
| 24/32 | PERMIT CORE SET (ROBOT) The closing of this contact permits the cores to be set. The signal is maintained until the cores are fully set. |
| 28/32 | PERMIT MOLD FULL OPEN (ROBOT) [OPTIONAL] The closing of this contact indicates that the Mold may move to the fully open position. This contact should remain closed until the Mold Fully Open Signal is received. |

Note: *This signal is to be used in conjunction with INTERMEDIATE MOLD OPEN POSITION.*

4.3 UNUSED PINS

| PINS | FUNCTIONS |
|-------------|------------------|
| 13/16 | SPARE |
| 25/32 | SPARE |
| 29/32 | SPARE |
| 30 | SPARE |
| 31 | SPARE |

5.0 REFERENCED DOCUMENTS

* DIN 40050 – German Standard

¹ May be used as power connection.

² May be used as power connection.

6.0

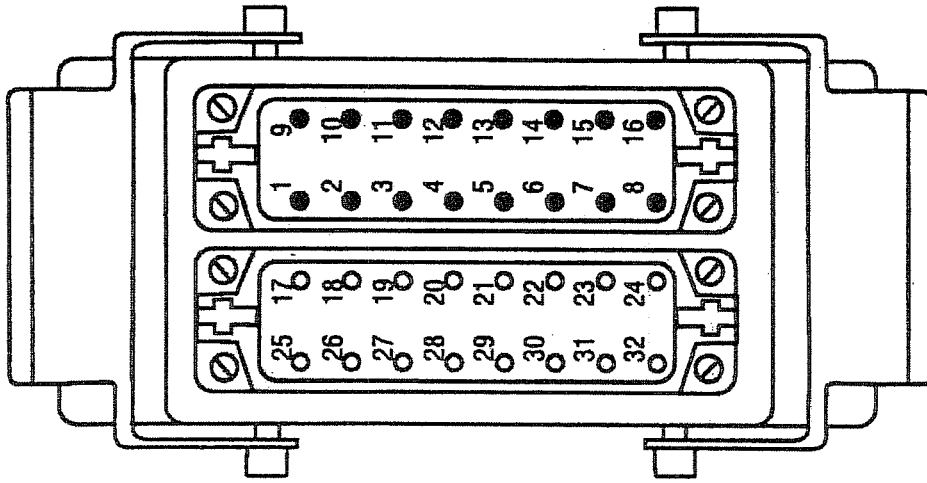
RELATED DOCUMENTS

- * NFPA79 - Electrical Standard for Industrial Machinery
- * ANSI/RIA 15.06 - Safety Requirements for Industrial Robots
- * ANSI/SPI B151.1 - Safety Requirements for Horizontal Injection Molding Machines
- * ANSI/AMT B11 - Machine Tool Standards
- * EUROMAP 12 - Injection Molding Machines, Handling, Equipment, Electrical Interface

7.0 DEFINITIONS

- 7.1 Robot** - A multi-functional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks. The term "Robot" is meant to include reprogrammable manipulators and non-reprogrammable manipulators such as "pickers". This term does not include automatic mold changers or conveyors.
- 7.2 Injection Molding Machine** - For purposes of this guideline, injection molding machine shall mean all injection molding machines that melt plastic materials, either thermoplastic or thermoset, and rubber, and inject said material into a mold held closed by a clamp.
- 7.3 Dry contacts** - The signals in both the injection molding machine and the robot are given by mechanical contacts, e.g. contacts of relays or switches. The contact making is either potential-free or related to a reference potential supplied to a contact of the connector between the injection molding machine and the robot. All contacts should have a minimum rating of 250 Vac and 6 amps.

Injection Molding Machine
Side of Connector

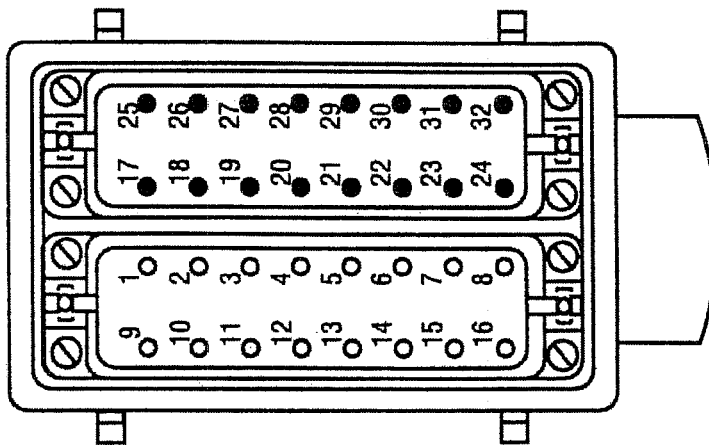


● = Pin
○ = Socket

DIN040050
10 Amp

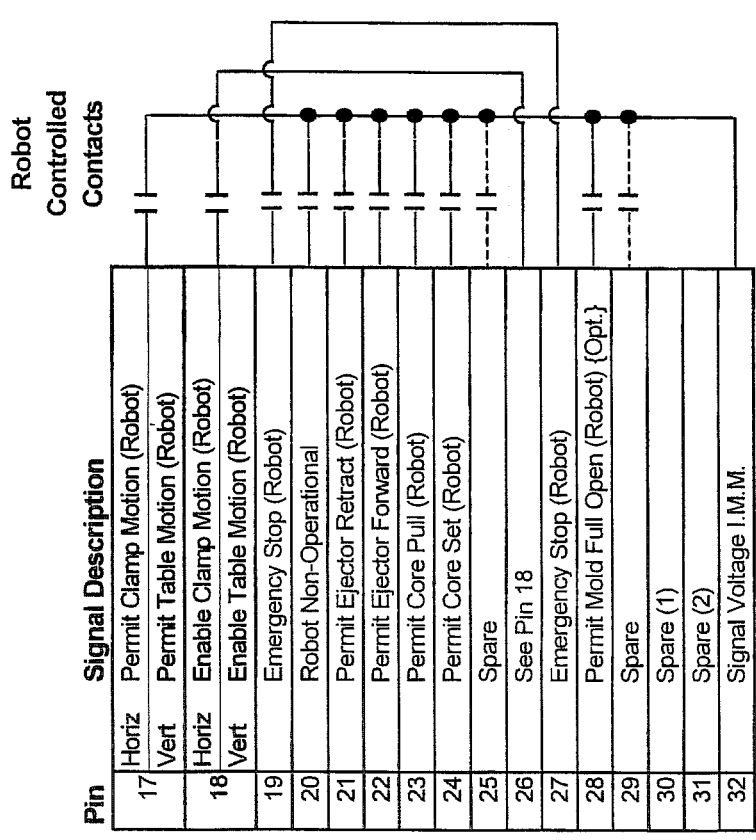
Female Insert, Pins 17 – 32
Male Insert, Pins 1 – 16

Robot Side of Connector



Female Insert, Pins 1 – 16
Male Insert, Pins 17 – 32

Interface Connector Pin Assignments



Notes

- 1) May be used as a power connection
- 2) May be used as a power connection