

EUROMAP 67

**Electrical Interface
between Injection Moulding Machine
and Handling Device / Robot**

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(9 pages)

This recommendation was prepared by the Technical Commission of EUROMAP.

A note under 2.3 and further suppliers have been added (Ver.1.1).

Editorial corrections made (Ver.1.2).

A further supplier added (Ver. 1.3).

Clause on handling device/robot power supply deleted (Ver. 1.4).

Editorial corrections made (Ver.1.5).

Maximum delay for safety signals transmitted via two channels added in clause 2.3
(Ver. 1.6, February 2006).

A further supplier added (Ver. 1.7).

A further supplier added (Ver. 1.8).

Supplier's data updated (Ver. 1.9).

A further supplier added (Ver. 1.10).

List of plug suppliers removed (Ver. 1.10).

Please visit www.euromap.org/technical-issues/technical-recommendations for the current list.

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1 Scope and Application

This EUROMAP recommendation defines the connection between the injection moulding machine and the handling device / robot. This is intended to provide interchangeability.

In addition recommendations are given for signal voltage and current levels.

Please note that the risk assessment for the movements of the handling device / robot mostly require redundancy which is achieved by two channels on Table 1: ZA3, ZC3 and ZA4, ZC4 on the injection moulding machine. EUROMAP 12 shall therefore only be applied for replacement purposes on existing equipment.

2 Description

The signals in both the injection moulding machine and the handling device / robot are given by contacts, e.g. contacts of relays or switches, semiconductors, etc. The contact making is either potential-free or related to a reference potential supplied to a contact of the plug mounted on the injection moulding machine or the handling device / robot (see Tables 1 and 2). All signals which are not optional shall be supported by all injection moulding machines and handling devices / robots.

2.1 Plug and socket outlet

The connection between the injection moulding machine and the handling device / robot is achieved by the plugs specified below. For the injection moulding machine (see Figure 2) and the handling device / robot (see Figure 1) the plug contacts should be capable of taking a minimum of 250 V and 10 A.

Arrangements of pins and sockets viewed from the mating side (Opposite the wiring side).

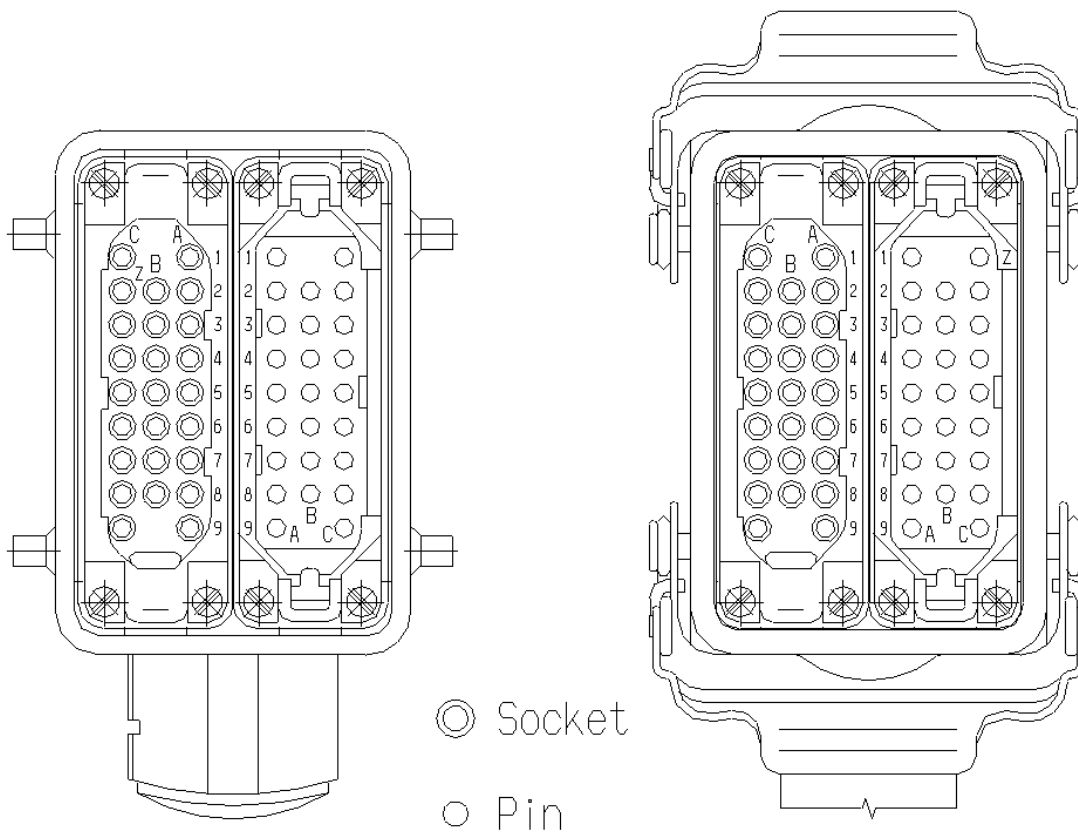


Figure 1 = Plug on the handling device

Figure 2 = Plug on the injection moulding machine

2.2 Contact specification

2.2.1 Emergency stop, safety devices, mould area free

- The voltages of the signals must not exceed 50 V DC or 250 V AC.
- A current of at least 6 mA must be maintained during signalling.
- The maximum current is 6A.

2.2.2 Logical Signals

- These signals shall be in accordance with clause 3.3.1 of EN 61131-2, Table 9, Type 2 or with clause 3.3.3 of EN 61131-2, Table 11, 0,1 A max.

2.2.3 Reference potential (Table 1: ZA9, ZC9 and Table 2: A9, C9)

- Voltage 18 – 36V DC
- Overlaid ripple max. 2,5Vpp
- Withstand against overvoltage up to 60V min. 10 ms
- Current max. 2A

2.3 Plug contact assignment

Notes on the tables below:

- Unless otherwise noted, the switch contacts are switching the reference potential on plug contacts: Table 1 / No ZA9 (Injection moulding machine signal) and Table 2 / No A9 (Handling device / robot signal).
- All signals are continuous signals unless otherwise noted.
- The signals are conducted from the signal source to the respective pin.
- Apart from the handling device / robot signals "Handling device/robot operation mode" (Table 2; B2), "Enable mould closure" (Table 2, A6), "Mould area free" (Table 2; A3/C3), "Emergency stop channel 1" (Table 2; A1/C1) and "Emergency stop channel 2" (Table 2; A2/C2) the signals can assume any status when the handling device / robot is switched off.
- Apart from the injection moulding machine signals "Emergency stop channel 1" (Table 1; ZA1/ZC1), "Emergency stop channel 2" (Table 1; ZA2/ZC2), "Safety devices of machine channel 1" (Table 1; ZA3,ZC3) and "Safety devices of machine channel 2" (Table 1; ZA4,ZC4) the signals can assume any status when the handling device / robot is switched off.
- **Core pullers 1 or core pullers 2 may be used for a single core puller or a group of core pullers.**
- Safety signals transmitted via two channels shall have a maximum delay <0,5 s between channel 1 signal and channel 2 signal. This is to be applied to "Emergency stop of machine", "Safety devices of machine" and "Emergency stop of handling device/robot".

**2.3.1 Table 1: Plug on the injection moulding machine
Signals from the injection moulding machine to the handling device / robot**

Contact No (male), see fig. 2	Signal designation	Description
ZA1 ZC1	Emergency stop of machine channel 1	The switch contact must be open when the injection moulding machine emergency stop device is being actuated. Opening the switch contact causes emergency stop of the handling device / robot.
ZA2 ZC2	Emergency stop of machine channel 2	The switch contact must be open when the injection moulding machine emergency stop device is being actuated. Opening the switch contact causes emergency stop of the handling device / robot.
ZA3 ZC3	Safety devices of machine channel 1	The switch contact is closed when safety devices (e.g. safety guards, footboard safety, etc.) on the injection moulding machine are operative so that dangerous movements of the handling device / robot are possible. The signal is active in any operation mode. The signal must be the result of limit switch contact series of mould area safety devices according to EN 201.
ZA4 ZC4	Safety devices of machine channel 2	The switch contact is closed when safety devices (e.g. safety guards, footboard safety, etc.) on the injection moulding machine are operative so that dangerous movements of the handling device / robot are possible. The signal is active in any operation mode. The signal must be the result of limit switch contact series of mould area safety devices according to EN 201.
ZA5 Optional	Reject	HIGH signal when the moulding is a reject. HIGH signal when the mould is open and must remain HIGH at least until "Enable mould closure" (see table 2: handling device / robot signals contact No A6.). It is recommended to have HIGH signal already when the mould opening starts.
ZA6	Mould closed	HIGH signal when the mould closing is completed. Note: The signal "Enable mould closure" is then no longer required (see table 2: handling device / robot signals contact No A6)
ZA7	Mould open position	HIGH signal when mould opening position is equal or more than required position. Inadvertent alteration to mould opening stroke smaller than that required for the handling device / robot to approach must be impossible. The signal must remain HIGH as long as the mould is open and must not be interrupted by a change of operation mode or safety guard opening.
ZA8 Optional	Intermediate mould opening position	HIGH signal when mould opening reaches a set position smaller than mould opening position (see table 1: injection moulding machine signals contact No ZA7). The signal remains HIGH to the end of mould opening position. Two sequences are possible with this signal: a) Mould opening stops on intermediate position and gives start signal to handling device / robot. Mould opening restarts with the signal "Enable full mould opening" (see table 2: handling device / robot signals contact No A7). b) Mould opening does not stop on intermediate position, however gives the signal to handling device / robot. At this sequence the signals " Enable full mould opening" (see table 2: A7) and "Mould area free" (table2: A3/C3) are not in use. LOW signal when intermediate mould opening position is not in use.
ZA9	Supply from handling device / robot	24 V DC (Reference potential)
ZB2	Enable operation with handling device / robot (Automatic)	HIGH signal when the injection moulding machine is able to be operated with handling device / robot. This signal shall not be used to start the handling device / robot. If the signal turns LOW during the operation mode of the handling device / robot "operation with injection moulding machine", it is recommended that the handling device / robot continues its automatic cycle until the end position.
ZB3	Ejector back position	HIGH signal when the ejector has been finally (e.g. after the number of its set cycles) retracted regardless of the moving platen position. The signal is the acknowledgement for the "Enable ejector retraction" signal (see table 2: handling device / robot signals contact No B3), when the ejector sequence is selected. It is recommended to have HIGH signal when the ejector sequence is not in use.
ZB4	Ejector forward position	HIGH signal when the ejector has been advanced. The signal is the acknowledgement signal for the "Enable ejector advance,,(see table 2: handling device / robot signals contact No B4). It is recommended to have HIGH signal when the ejector sequence is not in use.
ZB5 Optional	Core pullers 1 in position 1 (Core pullers 1 free for handling device / robot to approach)	HIGH signal when the core pullers 1 are in position 1 (see table 2: handling device / robot signals contact No B5). It is recommended to have LOW signal when the core puller sequence is not in use.
ZB6 Optional	Core pullers 1 in position 2 (Core pullers 1 in position to remove moulding)	HIGH signal when the core pullers 1 are in position 2 (see table 2: handling device / robot signals contact No B6). It is recommended to have LOW signal when the core puller sequence is not in use.
ZB7 Optional	Core pullers 2 in position 1 (Core pullers 2 free for handling device / robot to approach)	HIGH signal when the core pullers 2 are in position 1 (see table 2: handling device / robot signals contact No B7). It is recommended to have LOW signal when the core puller sequence is not in use.

Contact No (male), see fig. 2	Signal designation	Description
ZB8 Optional	Core pullers 2 in position 2 (Core pullers 2 in position to remove moulding)	HIGH signal when the core pullers 2 are in position 2 (see table 2: handling device / robot signals contact No B8). It is recommended to have LOW signal when the core puller sequence is not in use.
ZC5		Reserved for future use of EUROMAP
ZC6		Reserved for future use of EUROMAP
ZC7		Reserved for future use of EUROMAP
ZC8		Not fixed by EUROMAP, manufacturer dependent
ZC9	Supply from handling device / robot	0 V (Reference potential)

2.3.2 Table 2: Plug on the injection moulding machine Signals from the handling device / robot to the injection moulding machine

Contact No (female), see fig. 2	Signal designation	Description
A1 C1	Emergency stop of handling device / robot Channel 1	The switch contact must be open when the handling device / robot emergency stop is being actuated. The switch contact opening causes emergency stop of the injection moulding machine. The switch contact must be operative if the handling device / robot is switched off. It is recommended that the switch contact is operative when the handling device / robot is unselected.
A2 C2	Emergency stop of handling device / robot Channel 2	The switch contact must be open when the handling device / robot emergency stop is being actuated. The switch contact opening causes emergency stop of the injection moulding machine. The switch contact must be operative if the handling device / robot is switched off. It is recommended that the switch contact is operative when the handling device / robot is unselected.
A3 C3	Mould area free	The switch contact is closed when the handling device / robot is outside the mould area and does not interfere with mould opening and closing movements. The switch contact must be opened when the handling device / robot leaves its start position. If the switch contact is open neither opening nor closing of the mould may occur. However the injection moulding machine may ignore this signal when mould opening is carried out after e.g. an intermediate stop (see table 1: injection moulding machine signals contact No ZA8), if the optional sequence is selected on the injection moulding machine. The signal must have the described effect even when the handling device / robot is switched off. It is recommended to close the switch contact when the handling device / robot is unselected.
A4 C4		Reserved for future use by EUROMAP
A5		Not fixed by EUROMAP, manufacturer dependent
A6	Enable mould closure	HIGH signal when the handling device / robot is retracted enough for start of mould closure. The signal must remain HIGH at least until "Mould closed" (see table 1: injection moulding machine signals contact No ZA6) is available. If the signal is LOW as a result of a fault, mould closing must be interrupted. The signal "Enable mould closure" must not be a logical "or" with either other signals, e.g. "Close safety guard" or a push button in any operation mode. The signal must be HIGH if the handling device / robot is switched off. It is recommended to have HIGH signal when the handling device / robot is unselected.
A7 Optional	Enable full mould opening	HIGH signal when the handling device / robot has taken the part and allows to continue mould opening. The signal must remain HIGH until "Mould open" signal is given by the injection moulding machine (see table 1: injection moulding machine signals contact No ZA7).
A8		Reserved for future use by EUROMAP
A9	Supply from injection moulding machine	24V DC / 2A (Reference potential)

Contact No (female), see fig. 2	Signal designation	Description
B2	Handling device / robot operation mode (operation with handling device / robot)	LOW signal when the handling device / robot mode switch is "Operation with injection moulding machine". HIGH signal when the handling device / robot mode switch is "No operation with injection moulding machine". HIGH signal when the handling device / robot is switched off.
B3	Enable ejector back	HIGH signal when the handling device / robot enables the movement for ejector back. The signal must remain HIGH at least until "Ejector back" signal is given by injection moulding machine (see table 1: injection moulding machine signals contact No ZB3).
B4	Enable ejector forward	HIGH signal when the handling device / robot enables the movement for ejector forward. The signal must remain HIGH at least until "Ejector forward" signal is given by the injection moulding machine (see table 1: injection moulding machine signals contact No ZB4).
B5 Optional	Enable movement of core pullers 1 to position 1 (Enable movement for handling device / robot to approach freely)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 1 to position 1. It is recommended that the signal remains HIGH at least until "Core pullers 1 in position 1" signal is given by injection moulding machine (see table 1: injection moulding machine signals contact No ZB5). The signal shall remain at least until position 2 has been left. (see table 1: injection moulding machine signals contact No ZB6).
B6 Optional	Enable movement of core pullers 1 to position 2 (Enable core pullers 1 to remove the moulding)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 1 to position 2. It is recommended that the signal remains HIGH at least until "Core pullers 1 in position 2" signal is given by injection moulding machine (see table 1: injection moulding machine signals contact No ZB6). The signal shall remain at least until position 1 has been left. (see table 1: injection moulding machine signals contact No ZB5).
B7 Optional	Enable movement of core pullers 2 to position 1 (Enable movement for handling device / robot to approach freely)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 2 to position 1. It is recommended that the signal remains HIGH at least until "Core pullers 2 in position 1" signal is given by injection moulding machine (see table 1: injection moulding machine signals contact No ZB7). The signal shall remain at least until position 2 has been left. (see table 1: injection moulding machine signals contact No ZB8).
B8 Optional	Enable movement of core pullers 2 to position 2 (Enable core pullers 2 to remove the moulding)	HIGH signal when the handling device / robot is in position to enable the movement of the core pullers 2 to position 2. It is recommended that the signal remains HIGH at least until "Core pullers 2 in position 2" signal is given by injection moulding machine (see table 1: injection moulding machine signals contact No ZB8). The signal shall remain at least until position 1 has been left. (see table 1: injection moulding machine signals contact No ZB7).
C5		Not fixed by EUROMAP, manufacturer dependent
C6		Reserved for future use by EUROMAP
C7		Reserved for future use by EUROMAP
C8		Not fixed by EUROMAP, manufacturer dependent
C9	Supply from injection moulding machine	0V (Reference potential)

3 Ejector sequences (Example)

The following sequence as shown in the time diagram is used

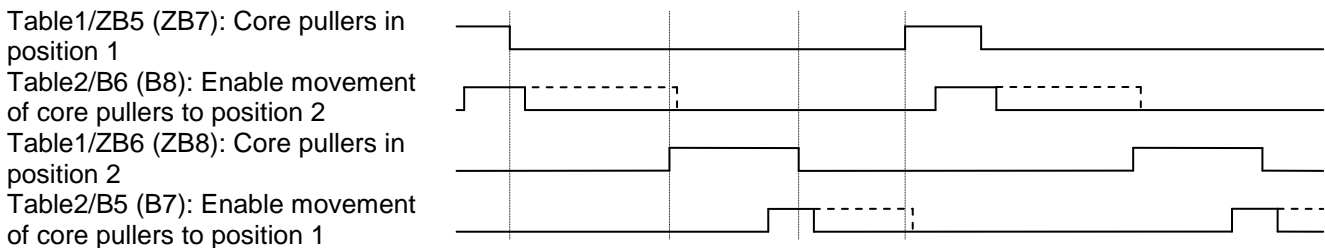


4 Core puller sequences (Examples)

In general positions 1 and 2 are used for synchronization between the injection moulding machine and the handling device / robot, where position 1 is preferable the position for free movement of the handling device / robot through the mould area. Positions 1 and 2 are used alternating.

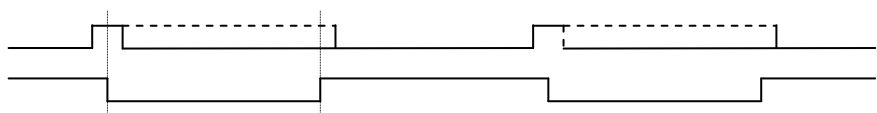
4.1 Core pullers 1 (or core pullers 2) moving in two directions

Position 1 is equivalent to ejector back, position 2 is equivalent to ejector forward.

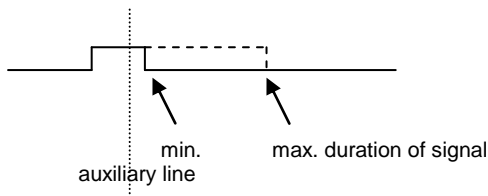


4.2 Core pullers 1 (or core pullers 2) moving in one direction

Example: Unscrewing gear box
 Table2/B6 (B8): Enable movement of core pullers to position 1
 Table1/ZB5 (ZB7): Core pullers in position 1



Explanation:



5 Sources of supply

A list of plug suppliers is available for download on the EUROMAP website:
www.euromap.org/technical-issues/technical-recommendations

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