EUROMAP 67.1

Electrical Interface between Shuttle- and Turntable Injection Moulding Machine and Handling Device / Robot

Version 1.6, May 2015
(11 pages)

This recommendation was prepared by the Technical Commission of EUROMAP.

Maximum delay for safety signals transmitted via two channels added in clause 2.3 (Ver. 1.1, February 2006).

A further supplier added (Ver. 1.2).

A further supplier added (Ver. 1.3).

Supplier's data updated (Ver. 1.4).

A further supplier added (Ver. 1.5).

List of plug suppliers removed (Ver. 1.6).
Please visit www.euromap.org/technical-issues/technical-recommendations for the current list.

Content

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1 Scope and Application

This EUROMAP recommendation defines the connection between a shuttle- and turntable injection moulding machine (Figures 1 and 2) and the handling device / robot. This is intended to provide interchangeability.

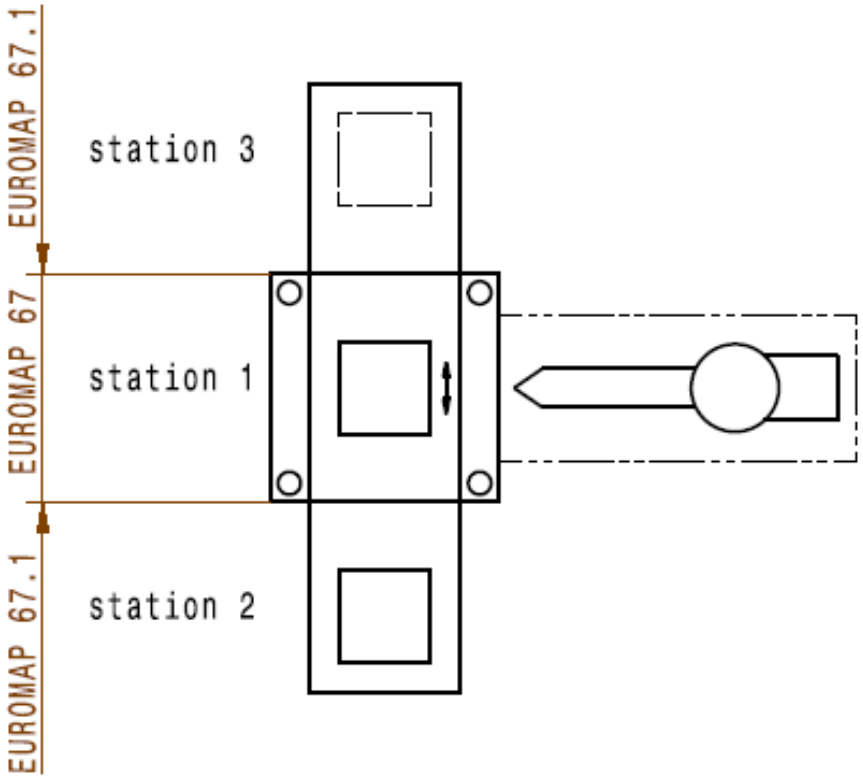


Figure 1: Shuttle table machine

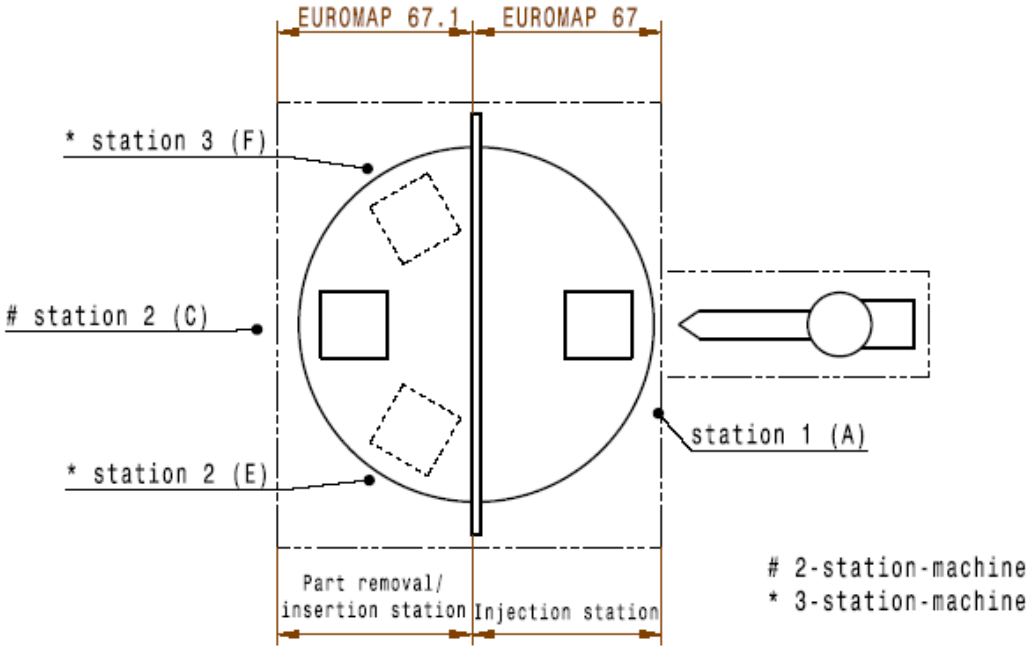


Figure 2: Turntable machine

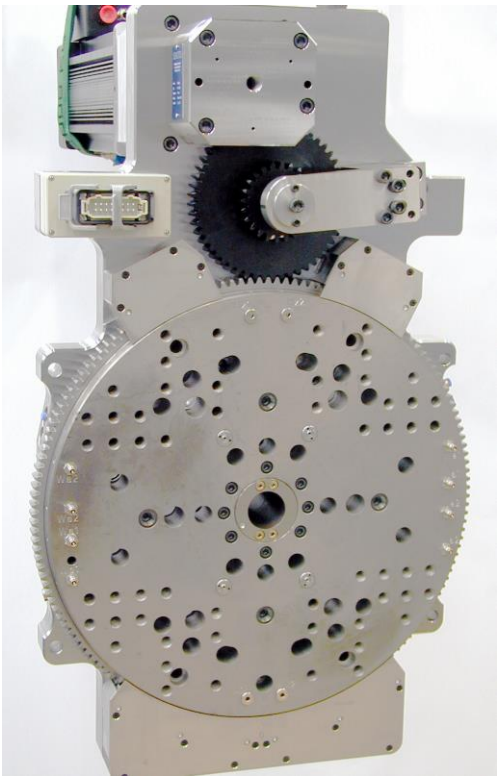


Figure 3: Index unit

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.

Injection moulding machines with an index(ing) unit (figure 3) are not falling under this EUROMAP recommendation; they are covered by EUROMAP 67.

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 5) and the handling device / robot (see Figure 4) 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).

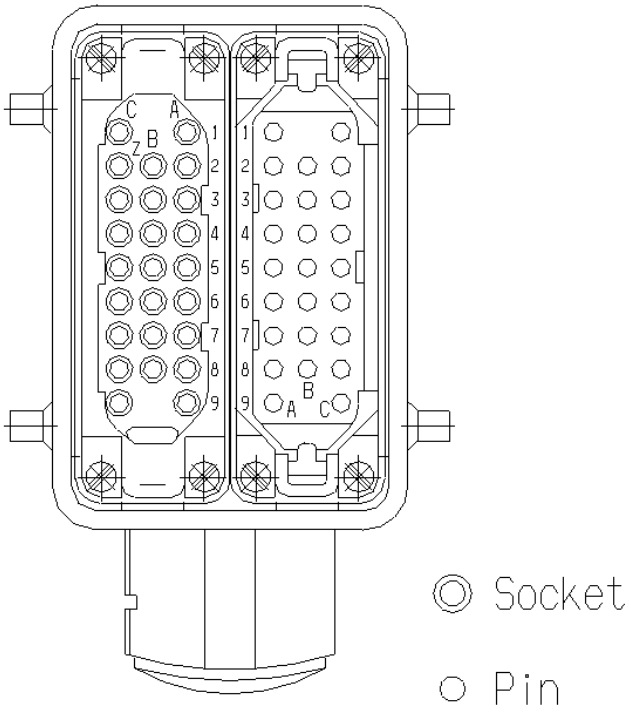


Figure 4: Plug on the handling device

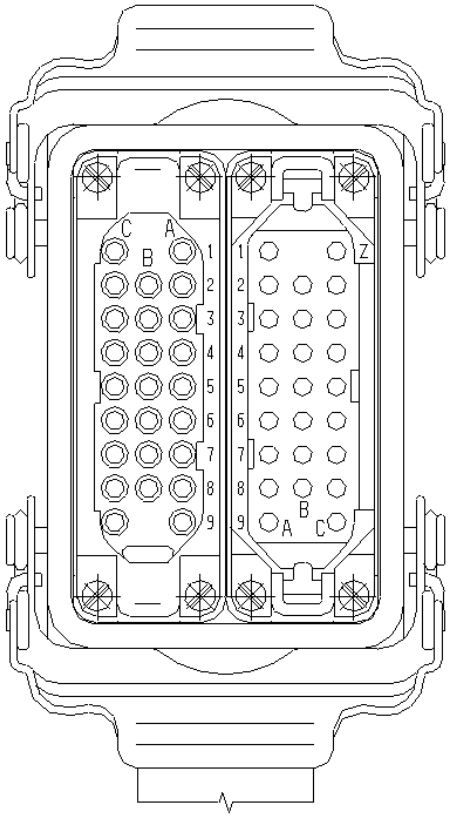


Figure 5: Plug on the injection moulding machine

2.2 Contact specification

2.2.1 Emergency stop, safety devices, table 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	
— Overlayed 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: Table1 / 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 table motion” (Table 2, A6), "Table area free” (Table 2; A3/C3), "Emergency stop channel 1" (Table 2; A1/C1) and "Emergency stop channel 2" (Table2; 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" (Table1; 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 and if the signal on ZC7 is HIGH.
ZA6 **Optional**	Start handling device/robot at position 2 (E)	HIGH signal when a mould half is positioned at station 2 (E).
ZA7	Table in position, general	Enable start handling device/robot. HIGH signal when the rotary or shuttle table is in one of the positions for loading or unloading. This signal is maintained whenever the rotary or shuttle table is in these positions.
ZA8 **Optional**	Start handling device/robot at position 3 (F)	HIGH signal when a mould half is positioned at station 3 (F).
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.
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	End of order	HIGH signal when the quantity is complete. *Example: The handling device/robot must remove the finished part but not pick a new insert.*
ZC6	Insert part(s) in mould	HIGH signal when insert part(s) have been positioned in mould half.

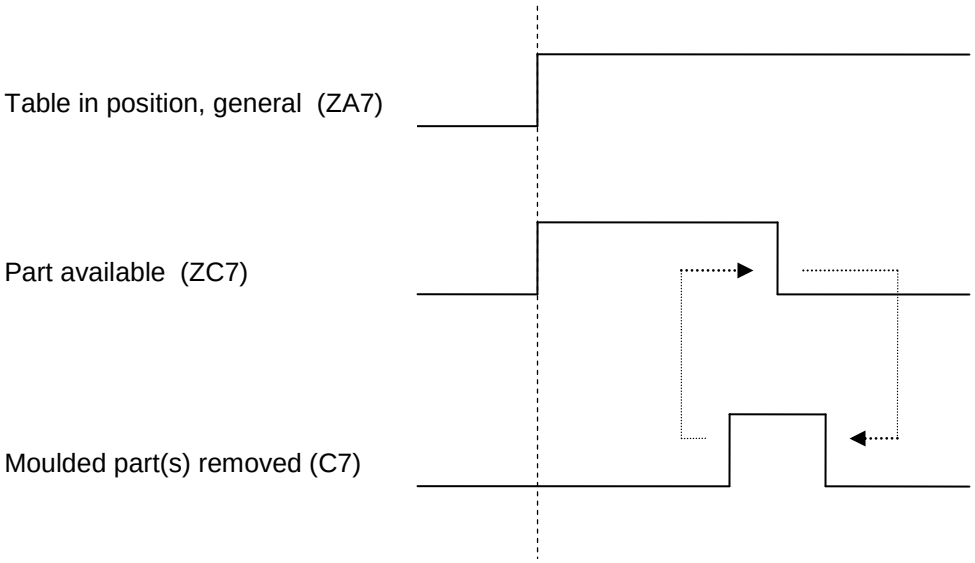
Contact No (male), see fig. 2	Signal designation	Description
ZC7	Part available	HIGH signal if moulded part is available. The signal shall be set with " Table in position, general " (ZA7); it shall change to LOW when C7 changes to HIGH (see Explanation).
ZC8		Not fixed by EUROMAP, manufacturer dependent
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	Table area free	The switch contact is closed when the handling device / robot is outside the table area or outside the area of the moving mould halves. Table motion must be interrupted whenever this signal is not present.
A4 C4		Reserved for future use by EUROMAP
A5		Not fixed by EUROMAP, manufacturer dependent
A6	Enable table motion	HIGH signal to indicate that the robot is in a predetermined safe position and enables the 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 position (see ZA7).
A7		Reserved for future use by EUROMAP
A8		Reserved for future use by EUROMAP
A9	Supply from injection moulding machine	24V DC (Reference potential)
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).

Contact No (female), see fig. 2	**Signal designation**	**Description**
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	Insert part(s) inserted	HIGH signal when the handling device/robot has inserted the insert part(s). The signal shall remain HIGH until ZC6 is HIGH.
C7	Moulded part(s) removed	HIGH signal when the handling device/robot has removed the moulded part(s). The signal shall change to LOW when ZC7 changes from HIGH to LOW (see Explanation).
C8		Not fixed by EUROMAP, manufacturer dependent.
C9	Supply from injection moulding machine	0V (Reference potential)

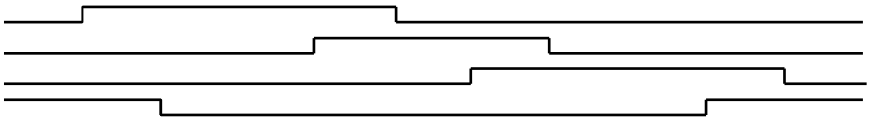
Explanation Signals ZC7 and C7:



3 Ejector sequences (Example)

The following sequence as shown in the time diagram is used

Table2/B4: Enable ejector forward
Table1/ZB4: Ejector forward position
Table2/B3: Enable ejector back
Table1/ZB3: Ejector back position



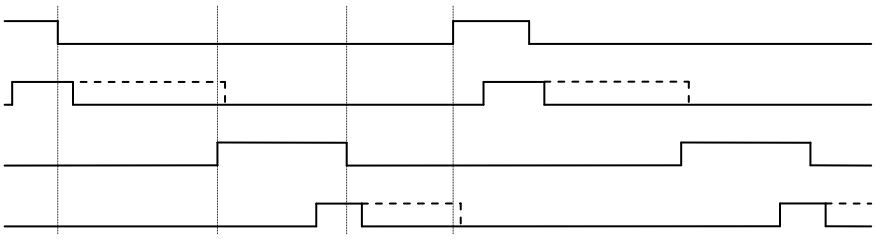
4 Core puller sequences (Examples)

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

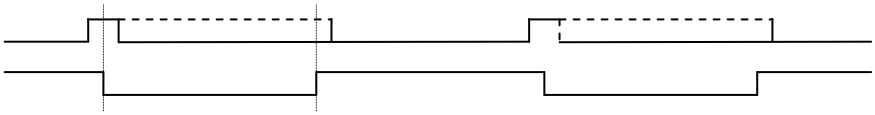
Position 1 is equivalent to ejector back, position 2 is equivalent to ejector forward.

Table1/ZB5 (ZB7): Core pullers in position 1
Table2/B6 (B8): Enable movement of core pullers to position 2
Table1/ZB6 (ZB8): Core pullers in position 2
Table2/B5 (B7): Enable movement of core pullers to position 1

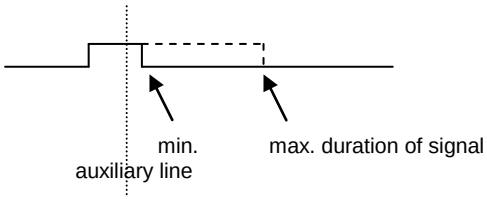


4.2 Core pullers 1 (or core pullers 2) moving in one direction

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

EUROMAP

Europäisches Komitee der Hersteller von Kunststoff- und Gummimaschinen

European Committee of Machinery Manufacturers for the Plastics and Rubber Industries

Comité Européen des Constructeurs de Machines pour Plastiques et Caoutchouc

Comitato Europeo Costruttori Macchine per Materie Plastiche e Gomma

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