

DRAFT
EUROMAP 78

**Electrical Interface
between Injection Moulding Machines
and External Safety Devices**

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9 pages

This draft EUROMAP recommendation was prepared by the Technical Commission of EUROMAP.

Please note:

This draft is presented to the public for review and opinion. The final EUROMAP recommendation may differ from this version.

Comments are invited until **31 October 2015**.

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History

Date	Changes
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Contents	Page
1 Introduction	4
1.1 Scope and Application	4
1.2 References	4
2 Description.....	5
2.1 Guard locking function	5
2.2 Plug and socket outlets.....	5
2.3 Contact specification	6
2.3.1 Emergency stop, safety device	6
2.3.2 Logical Signals	6
2.3.3 Reference potential	6
2.3.4 Performance levels of signals	6
2.4 Plug contact assignment.....	7
3 Sequence for guard locking.....	8
4 Schematic drawing of the interface.....	9
5 Sources of supply	9

1 Introduction

1.1 Scope and Application

This EUROMAP recommendation defines the connection between an injection moulding machine (IMM) and an external safety device, e.g. doors in fences around IMM, preventing access to the danger areas of the IMM with the possibility to reach into the area with high safety level specified in EN 201 "Plastics and rubber machines – Injection moulding machines – Safety requirements". This is intended to provide interchangeability.

EUROMAP 78 requires a two channel safe signal in accordance with specified Performance Levels which can be delivered by a safety device and/or safety control unit.

The interface is only used for the risks of the IMM. It is a supplement to interfaces between injection moulding machines and peripheral devices (e.g. EUROMAP 67) for the transmission of safety signals to the injection moulding machine.

It is assumed, that external safety device is used in parallel to the machine door. It is the task of the machine control to check, if the machine door is present/closed and locked (if applicable) or the safety signal from the interface is active before dangerous movements of the IMM are initiated.

This recommendation defines two subtypes:

- Subtype A: External safety device with guard locking
- Subtype B: External safety device without guard locking

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

This recommendation does not cover signals from the IMM to a handling device or other auxiliary equipment that is also protected by the external safety device. If safety signals are necessary for this equipment, this falls under the responsibility of the user/ integrator, especially for modifications after delivery of the IMM.

1.2 References

Short name	Title	Version
EN 201	Plastics and rubber machines – Injection moulding machines – Safety requirements	2009
EN 61131-2	Programmable controllers – Part 2: Equipment requirements and tests	2007
EN ISO 13849-1	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design	2008
EN ISO 14119	Safety of machinery – Interlocking devices associated with guards – Principles for design and selection	2013
EUROMAP 67	Electrical Interface between Injection Moulding Machine and Handling Device / Robot	1.9 August 2013

2 Description

The signals in both the injection moulding machine and the external safety device 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 (see tables 1 and 2).

2.1 Guard locking function

If an external safety device with guard locking is used the following requirements shall be met:

- the guard locking shall be designed for protection of a person as defined in 3.28 of EN ISO 14119;
- the unlocking function shall be a conditional unlocking as described in 4.3.1 of EN ISO 14119;
- for the guard locking device, well tried components in accordance with $PL_r = c$ (EN ISO 13849-1) shall be used;
- the guard locking function shall be monitored;
- the holding force of the guard locking shall be at least 1000 N.

2.2 Plug and socket outlets

The connection between the injection moulding machine and the external safety device is achieved by the plugs specified below. For the injection moulding machine (see Figure 2) and the external safety device (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)

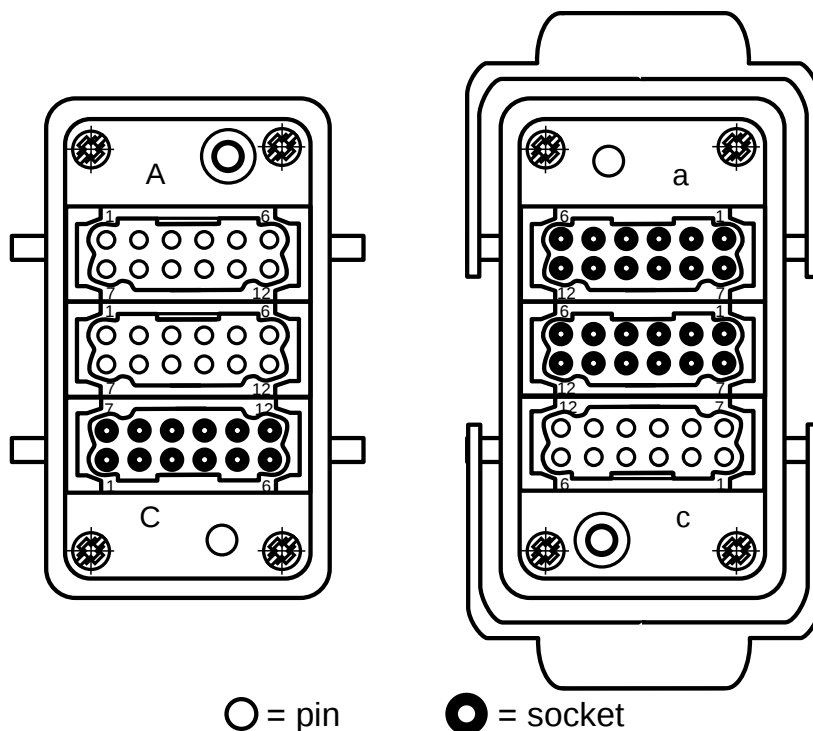


Figure 1: Plug on the external safety device

Figure 2: Plug on the injection moulding machine

2.3 Contact specification

2.3.1 Emergency stop, safety device

- The voltages of the signals must not exceed 50 V DC.
- A current of at least 6 mA must be maintained during signalling.
- The maximum current is 2 A.

2.3.2 Logical Signals

These signals shall be in accordance with clause 5.2.2.1 of EN 61131-2, Table 9, Type 2 or with clause 5.3.1 of EN 61131-2, Table 11, max. 0,1 A unless otherwise specified.

The signals can come from safety switches mounted directly on safety guards, or from other equipment (e.g. safety control devices).

2.3.3 Reference potential

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

2.3.4 Performance levels of signals

The signal "External safety devices closed" shall be in accordance with $PL_r = e$ (EN ISO 13849-1) or EN 201:2009 clauses 5.1.2.3 and 5.2.1.

External safety devices purchased from a supplier shall be certified components according to $PL_r = e$.

External safety devices/system manufactured by the user/integrator shall be certified by a laboratory in accordance with ISO/IEC 17025:2005.

The "emergency stop signal" shall be in accordance with $PL_r = d$ (EN ISO 13849-1).

2.4 Plug contact assignment

Notes on the tables below:

- All signals are continuous signals unless otherwise noted.
- The signals are conducted from the signal source to the respective pin.

**Table 1: Plug on the injection moulding machine
Signals from external safety device to IMM (female)**

Contact No. see fig. 2	Signal designation	Description	Subtype
a1/a7	External safety devices closed, acknowledged and guard locking active Channel 1	With safety guard closed the contact is closed. With safety guard NOT closed the contact is open.	A
b1/b7	External safety devices closed, acknowledged and guard locking active Channel 2	With safety guard closed the contact is closed. With safety guard NOT closed the contact is open.	A
a2/a8	External safety devices closed and acknowledged Channel 1	With safety guard closed the contact is closed. With safety guard NOT closed the contact is open.	B
b2/b8	External safety devices closed and acknowledged Channel 2	With safety guard closed the contact is closed. With safety guard NOT closed the contact is open.	B
a4	Status signal: External safety devices closed, acknowledged and locked (if applicable)	High level with safety guard closed. Low level with safety guard NOT closed. No safety signal; it can be used e.g. for user information	A / B
a3/a9	Emergency stop Channel 1	The switch contact shall be open when the emergency stop device of the external safety device is being actuated. Opening the switch contact causes emergency stop of the IMM.	A / B
b3/b9	Emergency stop Channel 2	The switch contact shall be open when the emergency stop device of the external safety device is being actuated. Opening the switch contact causes emergency stop of the IMM.	A / B
a5	Request signal	High level: Operator actuates a device (e.g. push button) on the external safety device in order to request access to the protected area. Minimum duration 100 ms	A
b6	Interface connected	High level: Interface connected Low level: interface NOT connected	A / B
a6	Supply from IMM	24 V DC – reference high level	A / B
a12	Supply from IMM	0 V – reference low level	A / B
a10/a11 b4/b10	Spare	Reserved for future use by EUROMAP	A / B
b5/b11/b12	Spare	Not fixed by EUROMAP, manufacturer dependent.	A / B

**Table 2: Plug on the injection moulding machine
Signals from IMM to external safety device (male)**

Contact No. see fig. 2	Signal designation	Description	Subtype
c1/c7	Enabling release of guard locking	Open = opening NOT enabled Closed = opening enabled Maximum load 1A / 24V DC Only closed when the "Request signal" (a5) is at low level (see timing diagram) Note: Closed contact indicates that the injection moulding machine has reached the safe condition. The unlocking may be depending from other parameters	A
c3/c9	Indication of request	Closed: IMM has received the request (see a5) for the opening of the guard but has not reached the safe condition for enabling opening of the guard. May be used for a (blinking) signal lamp at the external safety device. Open when c1/c7 becomes closed	A
c2/c4/c8/c10	Spare	Reserved for future use by EUROMAP	A / B
c5/c6/c11/c12	Spare	Not fixed by EUROMAP, manufacturer dependent.	A / B

3 Sequence for guard locking

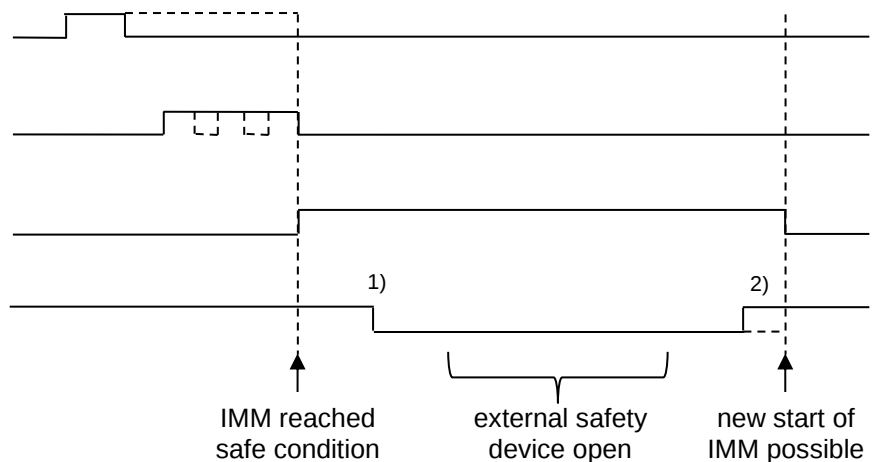
The following diagram shows the sequence for the signals related to guard locking:

a5: Request signal

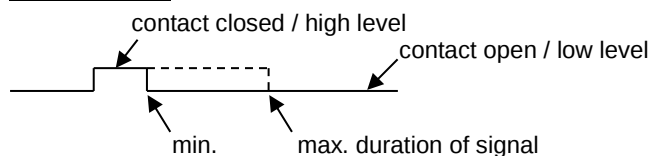
c3/c9: Indication of request

c1/c7: Enabling release of guard locking

a1/a7 + b1/b7: External safety devices closed, acknowledged and guard locking active



Explanation:



¹⁾ The unlocking may be depending from other parameters. High signal c1/c7 only shows, that the IMM is in a safe condition and allows the unlocking. Other devices protected by the guard may prevent immediate unlocking. The contacts for the signals a1/a7 and b1/b7 become open when the guard is really unlocked.

²⁾ The locking may be forced by another device than the IMM before the IMM leaves the safe condition.

4 Schematic drawing of the interface

Figure 3 shows the schematic drawing for an example with type A (with guard locking) and all functions in one external device:

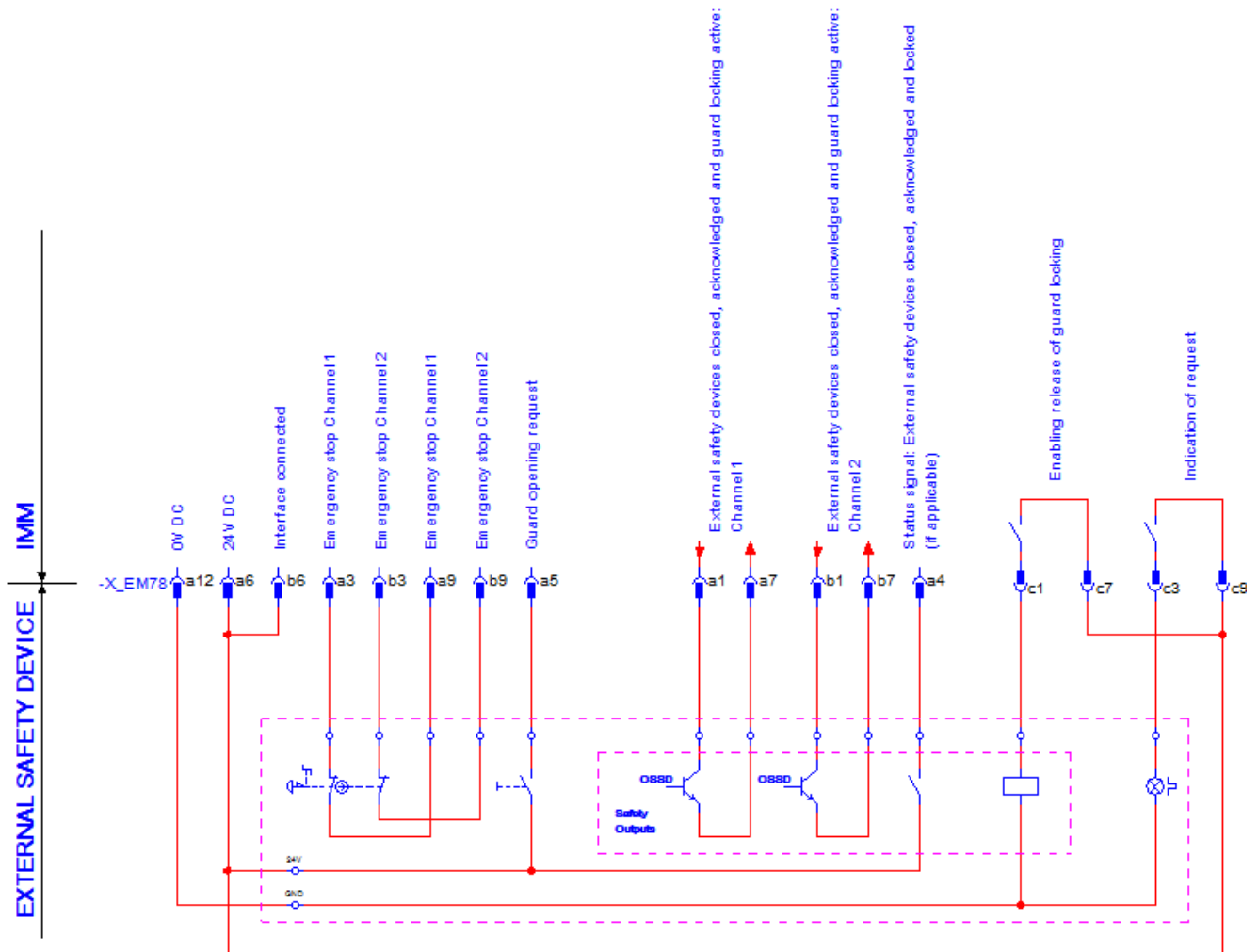


Figure 3: Schematic drawing of the interface (example)

5 Sources of supply

A list of suppliers for the plugs described in clause 2 can be downloaded from the following website:
<http://www.euromap.org/technical-issues/technical-recommendations>