



OPX-457-T2: Manual Reset
 OPX-457-T4: Automatic Reset

Safety instructions
Installation instructions
Operating instructions
Technical specifications

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1. GENERAL INFORMATIONS

The Digimec Emergency Stop Safety Relays OPX-457-T2 and OPX-457-T4 are designed for systems related to machine safety and meet the requirements SIL3 of EN IEC 62061 and can be used up to category 4 - PLe in accordance with the EN ISO 13849-1 standards.

Digimec safety relay are designed to perform safety functions as part of a machine. It is highly important that a specialized safety technician carry out a risk analysis of the machine, before incorporating any protection elements or emergency stop systems.

2. TERMS AND ABBREVIATIONS

CAT	Category: Refers of the classification of products that are intended for safety systems in terms of how much they are immune to failures and their behavior immediately after detecting a failure occurrence. <small>[EN ISO 13849-1:2015]</small>
PL	Performance Level: Indicator used to determine the capability of the product and safety-related control systems under foreseeable conditions. <small>[EN ISO 13849-1:2015]</small>
SIL	Safety Integrity Level: Is defined as a relative level of risk reduction provided by a safety function or to specify a target level of risk reduction, where integrity level is 4 which is the highest level, and the lowest level is 1. <small>[EN / IEC 61508 parts 1-7:2010]</small>
PFD_{avg}	Probability of Dangerous Failure Demand: Probability of Dangerous Failure Demand is defined between average rates of safety failures plus detected dangerous failures and most dangerous safe failures. <small>[EN / IEC 61508 parts 1-7:2010]</small>
PFH	Probability Failure per Hour: Probability failure occurring in 1 hour. <small>[EN / IEC 61508 parts 1-7:2010]</small>
MTTFd	Mean Time to Failure: Mean time until a dangerous failure occurs. <small>[EN / IEC 61508 parts 1-7:2010]</small>
SFF	Safe Failure Fraction Safe Failure Fraction is defined as the ratio of the average rate the subsystem to of safe failures plus dangerous detected failures of the total average failure rate of the subsystem. <small>[EN / IEC 61508 parts 1-7:2010]</small>
DC_{avg}	Diagnostic Coverage Fraction of dangerous failure detected by automatic on-line diagnostic test. The fraction of dangerous failures is computed by using the dangerous failure rates associated with the detected dangerous failures divided by the total rate of dangerous failures. <small>[EN / IEC 61508 parts 1-7:2010]</small>
SELV PELV	Safety Extra Low Voltage, Protective Extra Low Voltage: Electrical power supply devices in which the voltage cannot exceed the established extra low voltage value, protecting against electrical shock under normal operation and single fault conditions, including ground faults in electrical circuits. <small>[EN / IEC 61508 parts 1-7:2010]</small>

3. SAFETY ALERTS

The warning symbols shown below will be used throughout this manual to indicate potential life hazards, warnings, recommendations, or Important notes.

	DANGER Potential risk of serious irreversible injury and also cause death.
	ATTENTION Risk of causing minor injuries, reversible with temporary leave from work.
	NOTE Symbol for guidelines and important notes and or correct actions.

4. FEATURES

- 3 safety redundant with double channel outputs.
- 1 auxiliary contact (signaling contact).
- Input safety connection of:
 - ✓ Emergency stop buttons,
 - ✓ Safety switches,
 - ✓ Steel cable operated safety emergency stop switches,
 - ✓ Magnetic safety sensors,
 - ✓ Non-contact safety switches,
 See figures 4 until 7.
- Feedback loop for monitoring contactors, See figures 10 and 11.
- Fault detection, every time the OPX-457 is restarted.
- Indication of the switching status of the safety output relays by yellow leds.
- 2 models with manual and automatic reset:
 - ✓ Manual OPX-457-T2. Fig 8
 - ✓ Automatic OPX-457-T4. Fig 9
- Fault detection on the manual reset button. It has an internal circuit that detects mechanical locking and welding of this button contacts.
- Compliance for **CAT4 - PLe, SIL3**.

5. FUNCTIONS

The Emergency Stop Safety Relay's OPX-457-T2 or T4 are designed for safe isolation of safety circuits with zero stop category according standard EN 60204-1 and can be used up to safety category 4 and PLe, according to standard EN ISO 13849-1.

The internal logic system closes the output safety contacts when the emergency button is released (pulled up) and the reset button is pressed momentarily, on the OPX-457-T2 model. On the OPX-457-T4 model, the output safety contacts relay change immediately to closed, when the emergency button is released (pulled up).

In both cases above, when the emergency button is pressed, the output contacts of the internal safety relay will open within a maximum of 15ms and bring the machine to a safe stop.

There is a guaranteed that a single fault that occurs will not lead to the loss of the safety function and that each fault will be detected by the built-in fault detector at the latest when the OPX-457 restarts a new operation.

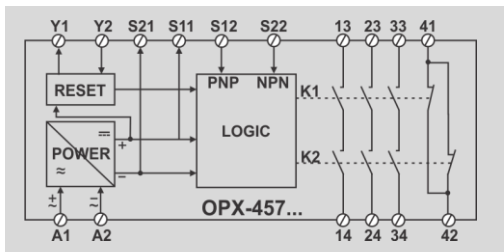


Figure 1 - Block diagram.

6. STANDARDS AND DIRECTIVES

EN / IEC 61508 parts 1-7:2010

European harmonized standards

EN IEC 62061:2021 and EN ISO 13849-1:2015

EMC and Environmental tests

EN 61131-2:2007 and IEC 61131-2:2017

EN 61000-6-7:2014 (FS Immunity requirements)

European Directives

2006 / 42 / EC Machinery Directive

2011/65 / EU + 2015 / 863 RoHS Directive

7. CHARACTERISTICS

- Model OPX-457-T2 with Manual Reset.
- Model OPX-457-T4 with Automatic Reset.
- Protection against overvoltage supply.
- 3 NO safety contact outputs.
- 1 NC auxiliary contact output for signaling.
- Built-in fault detector of input devices and output safety relay contact, every time the OPX-457 is restarted.
- Product suitable for the emergency stop devices at safety inputs, as shown in Fig. 4 until 7.

8. USE AND OPERATION

The OPX-457 Emergency Stop Safety Relays are indicated for emergency stop systems in machines, equipment, or dangerous devices, when they have a great potential to cause injuries, irreversible injuries or even death to their operators.

They are manufactured in two models, the OPX-457-T2 with manual reset and the OPX-457-T4 with automatic reset.

Its entire internal circuit is built in double channel, from the inputs of the emergency buttons to the outputs of the contacts of the internal safety relays, eliminating the possibility of the occurrence of any failure, without it being immediately detected and its internal circuits completely deactivated, instantly interrupting the operation of the machine where they are installed.

The OPX-457-T2 and OPX-457-T4 are only enabled to start operating when the activation requirements of safety inputs S11/S12 and S21/S22 are met, that is, activated almost simultaneously. If there is a lot of time difference between the activation of the inputs, the OPX-457-T.. is not activated and only returns to normal operation when the requirement is met.

The manual reset T2 model will only have its output safety relays activated if the emergency button is released (pulled up) and when the reset

button is momentarily pressed. The output safety relays will be deactivated a maximum of 15ms after the emergency button is pressed.



If the reset button, in the case of the OPX-457-T2, is stuck, or its contacts are welded, the product will fail on the next operation attempt. In this situation, the button must be replaced.








On the OPX-457-T4 model with automatic reset, the output safety relays will be activated every time the emergency button is released (pulled upwards). The output relay will be deactivated in a maximum of 15ms after the emergency button is pressed.

In the remote possibility that any contact of any of the internal output safety relays gets stuck locked, or welded, the device will fail and will no longer start operating, in this situation, the OPX-457 must be forwarded to Digimec, which will evaluate the possibility of your recovery.

When there is a need to use contactors triggered by the OPX-457 safety contacts to trigger more larger loads, it is mandatory to use safety contactors and use their NC contacts connected in series in the feedback link through the terminals Y1 and Y2, in this way the contacts of the contactors will be permanently monitored at each activation operation of the device, according to figures 10 and 11.

9. SAFETY RECOMMENDATIONS

	<p>Never exceed the supply voltage limits and the switching capacity of the relay contacts, as this could cause irreversible damage to the safety relay and put the electrical wiring inside the panel at risk.</p>
	<p>Under no circumstances make bypass bridges or jumpers on the terminals of the safety contacts, of the OPX-457-T2 or OPX-457-T4, as this will characterize a criminal action, subject to the penalties of the law.</p>

	<p>Never improvise electrical connections, or assemblies with poor mechanical fastenings, as you could also cause accidents to operators and people involved in the process.</p>
	<p>The model OPX-457-T4 (automatic reset) safety contacts closes instantly when the emergency button is unlocked (released).</p> <p>If the emergency button is already unlocked (released) and the power is off, the safety contacts will close instantly the moment the power is turned on</p>
	<p>Always use the machine emergency stop circuit in dual channel. If it is a clutch brake press, make sure that the valve that activates the clutch brake is dual channel and has internal sensors or micro switches to use the feedback.</p>
	<p>A functional test shall be performed at least once a month by a technician knowledgeable about the safety systems, pressing the emergency button and checking the correct functioning of the emergency stop machine.</p> <p>[Co-ordination of Notified Bodies Machinery Directive 2006/42/EC, CNB/M/11.050.]</p>
	<p>Always use wiring with the appropriate gauge for the service, fixing terminals at the ends of the wires and identification rings with numbers or letters on each electrical conductor.</p>
	<p>In case of using 24 VAC voltage supply that already exists in the machine or equipment, make sure that the voltage is within the limits specified in the technical specifications table.</p>
	<p>Never use the device OPX-457-T2 or OPX-457-T4 as a power supply to power external devices.</p>

10. INSTALLATION

The product shall be installed and fixed on a 35 mm DIN rail, inside panels or cabinets with minimum **IP54** protection degree.

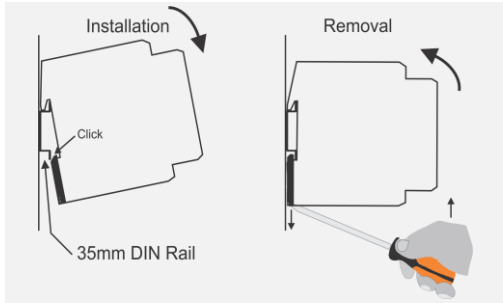


Figure 2 - Installation procedure.

11. ELECTRICAL CONNECTIONS

A1	24 V Power supply [+/-] (Mandatory install a 1A fuse)
A2	24 V Power supply [-/-]
S11	Positive reference voltage
S12	Input positive channel
S21	Negative reference voltage
S22	Input negative channel
Y1	Positive reference reset
Y2	Input positive reset
13-14	Safety contact #1
23-24	Safety contact #2
33-34	Safety contact #3
41-42	Auxiliary contact

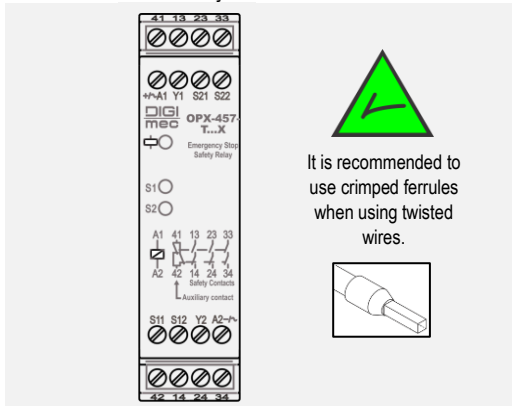


Figure 3 - Terminal connections.

Emergency stop input devices

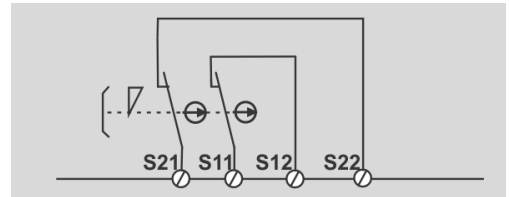


Figure 4 - Emergency stop button.

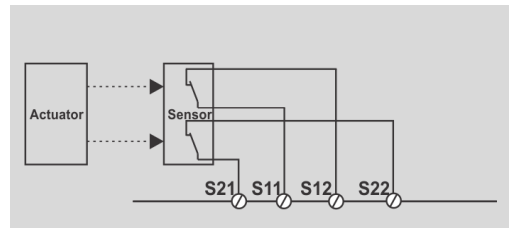


Figure 5 - Magnetic safety sensor with output contacts.

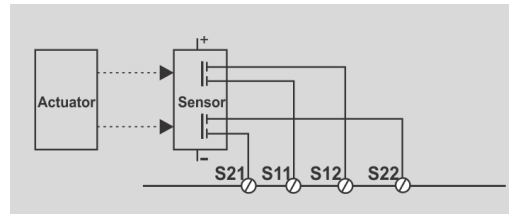


Figure 6 - Magnetic safety sensor with solid state output.

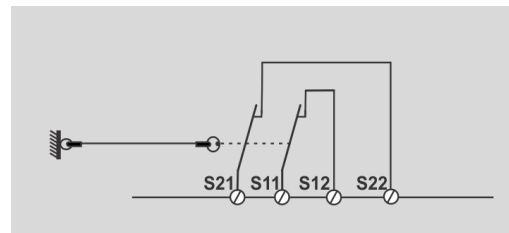
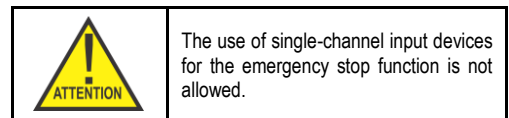


Figure 7 - Steel cable operated safety stop switch.



Input reset modes

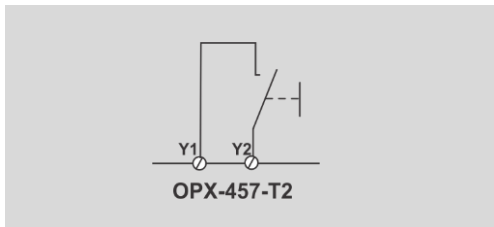


Figure 8 - Monitored button for manual reset mode.

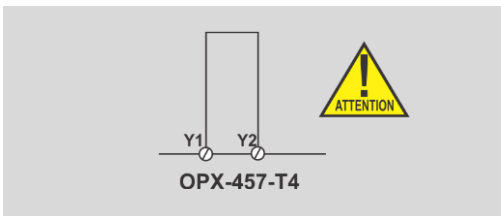


Figure 9 - Jumper for automatic reset mode.

Feedback loop connections

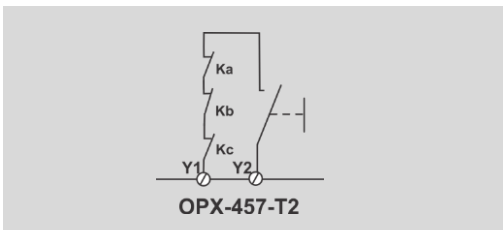


Figure 10 - Interlocking with feedback loop from the external contactors and manual reset button.

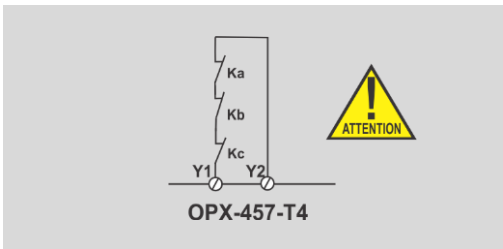



Figure 11 - Interlocking with feedback loop from the external contactors and automatic reset jumper.

	<p>In this configuration the safety relay contacts switching immediately when the emergency stop device is activated.</p>
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Power supply SELV / PELV

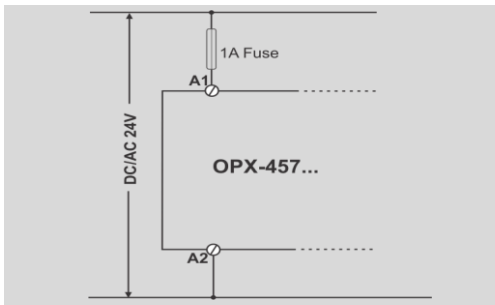


Figure 12 - Supply connections.

Output safety contacts connections

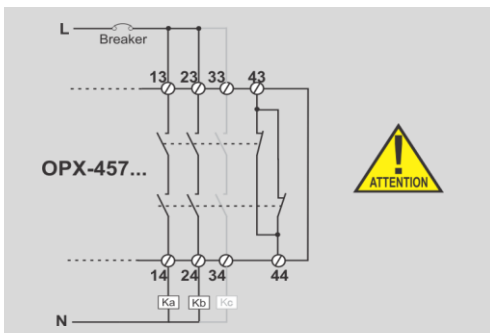




Figure 13 - Connecting loads in the safety contacts.

	<p>When you need to expand the capacity of the output safety relay contacts, use safety contactors, Ka, Kb and optional Kc, in Fig 13, and connect their NC contacts to the Interlocking feedback loop connections according to FIG 10 and 11.</p>
	<p>It is not allowed to use different poles or phases between contacts 13/14, 23/24 and 33/34. Failure to comply may lead to destruction of the product.</p>

12. SIGNALING

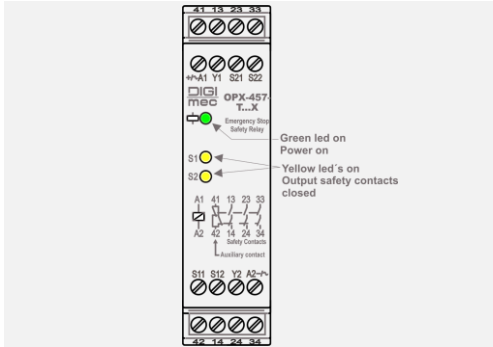


Figure 14 - Front view signaling.

13. TECHNICAL DATA

ELECTRICAL DATA	
Operating voltage	24 V AC/DC (SELV/PELV)
Rated supply frequency	50-60 Hz
Permissible deviation	± 10 %
Power consumption	≤ 2,7 W
Polarity reversal protection	Yes
Overvoltage protection	Yes
Overvoltage category	III
Pollution degree	2
Response time	≤ 15 ms
Safety contacts	3 NO redundant contacts
Auxiliary contact	1 NC contact
Max. cables length	≤ 30 m
Capacity of output contacts	DC-13...24 VDC @ 6 A AC-15...250 VAC @ 5 A
MECHANICAL DATA	
Output switching device	2 relays mechanical guided
Nº of relays operations	10.000.000 operations
Tool	Slit N°3
Electrical connections	Terminal block with screws
Screw maximum torque	0,4 Nm max.
Max. size of conductors	2,5 mm ² or 24 AWG
Degree of protection	IP20
Plastic box material	Yellow engineering ABS
Work temperature	-10 to +50 °C
Storage temperature	-30 to +70 °C
SAFETY PARAMETERS	
Proof Test Interval	20 Years
PFDavg	6.25 x 10 ⁻⁵
SFF	99.51 %
PFH	7.23 x 10 ⁻¹⁰ 1/h
MTTFd	63 years
DCavg	99.18 %

14. MARKING



Figure 15 - Left side marking.

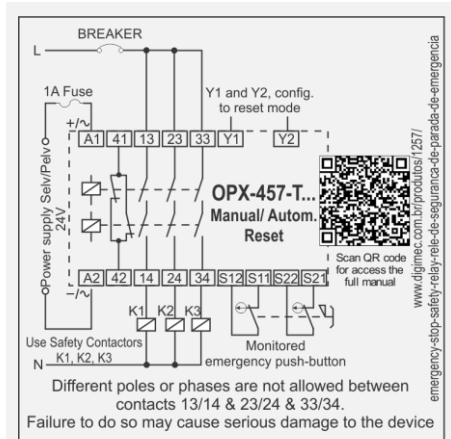


Figure 16 - Right side marking.

15. IDENTIFICATION

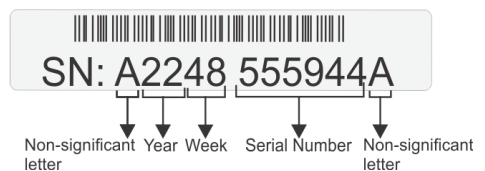


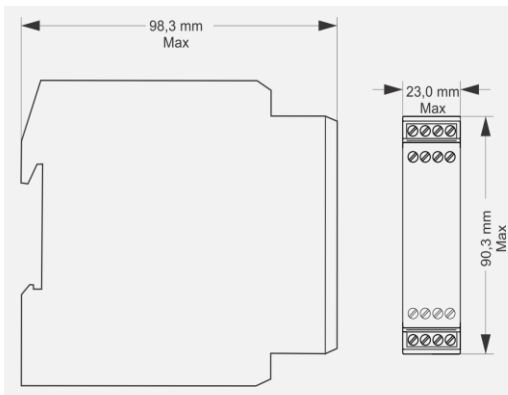
Figure 17 - Label with identification code device.

Serial number location



Figure 18 – Identification.

16. DIMENTIONS



17. WARRANTY

The OPX-457-T2 and OPX-457-T4 have a full warranty on all their components, for a period of 24 months, counted from the date of issue of the product's invoice and always at Digimec's premises, or its representative, accompanied by the respective purchase tax document.

The guarantee will be canceled or will not be accepted by Digimec in case of improper use, or outside the parameters or specifications expressly described in this manual.

18. COMPLIANCE



19. SUPPORT



In case of doubt, or need for a differentiated application for these products, do not hesitate to contact DIGIMEC, through one of the channels above in the header of this page or request help from a representative of DIGIMEC, in your region, which will certainly have a quick solution for your case.

This product was designed and manufactured in Brazil and complies with the required Functional Safety Standards.

20. ENVIRONMENT



NOTES:

GGMA0090- [Version R07]

Due to constant technological developments, Digimec may change the content of this manual at any time without prior notice.

EU Declaration of Conformity

We at **Digimec Controles e Sistemas Ltda**
Rua Boiçununga 157A
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CNPJ 14.447.680/0001-09

Declare, under our full responsibility, that the products listed below:

Type: **Emergency Stop Safety Relay**
Models: **OPX-457-T2 and OPX-457-T4**

If installed, maintained, and used in the applications for which they were designed, and in accordance with relevant installation standards and manufacturer instructions, they comply with applicable European Union harmonization legislation, where applicable.

Directives:

Machinery Directive 2006/42/EC
RoHS Directive 2011/65/EU, 2015/683

Standards:

EN ISO 13849-1:2015
EN IEC 62061:2021
EN / IEC 61508-1-7:2010
EN 60947-5-1: 2017
EN 50581:2012
EN IEC 63000: 2018

Notified Body: TÜV Rheinland Industrie Service GmbH
Notified Body for Machinery (NB No. 0035)
Am Grauen Stein 51105 Köln / Germany

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