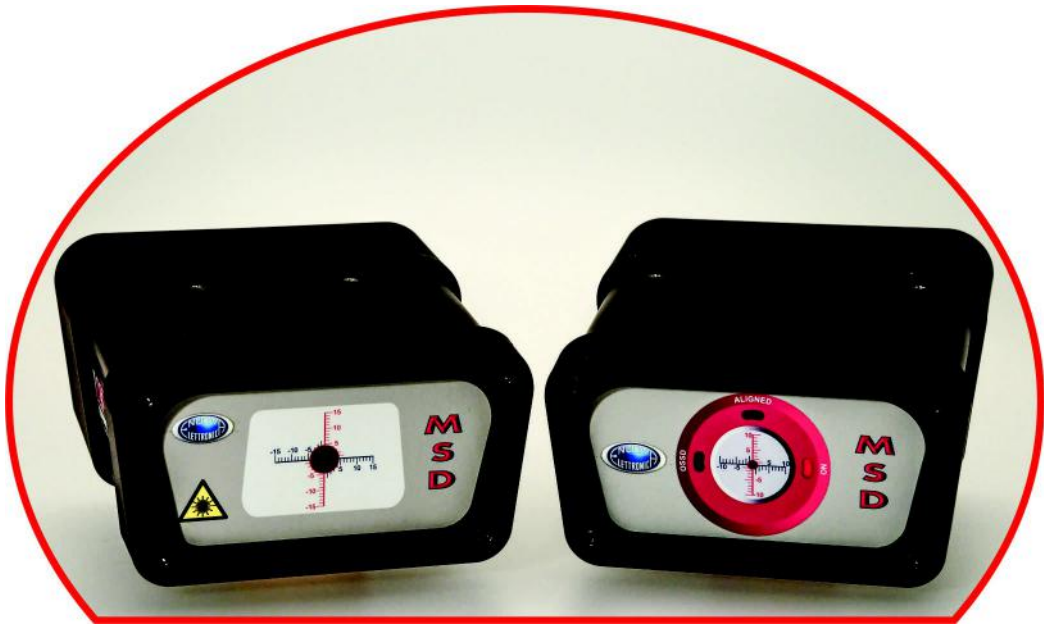
SAFETY DEVICE 3
WITH VISIBLE LASER EMISSION

MSD



INSTRUCTION MANUAL

Revision 1.1 of 09.12.2016

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1. Foreword

This manual provides the information necessary to the user and/or to the technician for the proper use of the MSD device as regards the functions of safety and the risk prevention, for which it has been designed.
The manual has to be preserved with care and stored where it can be immediately available when necessary.
Refer to the MANUFACTURER for explanations or to require possible additional copies or updates of the manual itself.

The Manufacturer reserves the right to make changes to the production and to the manual without the obligation to update the production and the previous manuals.

2. Warranty

The manufacturer guarantees for his products for a period of 12 months after the date of the sale. The warranty covers the parts of the device, if proved they are defective as regards the materials or the assembly, at the following conditions:

1) With "warranty" we mean the replacement of all the parts resulted defective as regards the manufacturing, in normal conditions of use.
   The warranty is not valid if not presented together with the copy of the invoice which certifies the purchase.
   Moreover, the warranty is not valid in the following cases:
   a) Any kind of tampering of the device;
   b) Use of the device with modalities not in compliance with the warnings reported on this manual;
   c) Damages caused by the inadequacy of the environment where the device operates and by phenomena independent by the normal operation (e.g.: irregularity of the values of voltage and frequency of the supply system);
   d) Repair interventions made by persons or Technical service centers not authorized by the Manufacturer.
2) The costs and the risks relevant to the transport, the packaging and the possible labor necessary for this purpose are at Purchaser's charge.
3) The replacement of the device is excluded as also the extension of the warranty after the intervention due to fault.
4) No refund is foreseen for possible periods of inactivity of the device for the time necessary for the repair.

Manufacturer

The Support and repair service, as even the answers to the requests of specific information and explanations, are directly provided by the Manufacturer of the equipment:

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3. Table of contents

4. Safety precautions

4.1. Signal of residual risks

- The MSD device has been designed with the aim to eliminate or reduce, as more as possible, any risk for the user. However, in case of improper use, conditions of limited danger, not completely removable, could occur. In the continuation of the manual, where necessary, these situations will be highlighted by **Warning**.

4.2. Precautions

- The operations regarding the installation, the test and the maintenance of MSD have to be performed only by qualified personnel and accurately respecting the instructions reported in this manual.

4.3. Electrical dangers

- Lay the connection cables in such a way to avoid accidental contacts with objects which can damage them (hot, sharp or abrasive objects).
- Never use the device if the connection cables are damaged.
- Avoid the contact between connection cables and water or wet surfaces.

4.4. Prohibitions

- **Opening of the device**
  Given the special function of the device, it is prohibited to open the TX and RX containers and even attempt the repairs. The laser beam used by this device can be dangerous for the eyesight if exposed. For the repairs, call only the MANUFACTURER.

4.5. Controls

- **Check the device operating voltage before the use.**
  The operating voltage must correspond to the local power supply grid voltage. The operating voltage is reported on the plate placed on the transformer.
- **Stop immediately the use of the device in case of penetration of liquids or objects inside it.**
  Disconnect the device and make qualified personnel inspects it.
  In order to disconnect the device, refer to the procedure described in the chapter relevant to the removal of the device.

4.6. Decommissioning

- When you decide to stop using the MSD device because obsolete or irremediably faulted, proceed to its decommissioning making the device itself not operative and safe. Seal the device within a robust package and provide to its disposal acting in compliance with the current laws, calling the local entities charged of these operation.

5. Legend

MSD	=	Initials of this device
ESPE	=	Electro-Sensitive Protective Equipment
OSSD	=	Output Signal Switching Device
TX	=	Transmitter (MSD part which generates the laser beam
RX	=	Receiver (MSD part which includes the sensitive function, the control and command function and the two OSSD's)

6. Service

- The Support and repair service, as even the answers to the requests of specific information and explanations, are directly provided by the MANUFACTURER.

7. Main reference standards

- The MSD device has been designed respecting even the indications present in the standard CEI EN 61496-1:2014 and CEI EN 61496-2:2014. It can be classified as ESPE of type 4; EN ISO 13849-1 PL=e.

- The laser contained in MSD is classified CLASS 1M according to the standard CEI EN 60825-1:2015.

MSD, if properly installed and used as described in this Manual, is in compliance with the prescriptions of:

- Machinery Directive 2006/42/CE and relevant reference standards and specifications:
  - CEI EN 61496-1:2014 and CEI EN 61496-2:2014
  - EN ISO 12100: 2010
    EN 12622:2014, CEI EN 60204-1:2006, CEI EN 60825-1:2015

- Low Voltage Directive 2006/95/CE and relevant reference standards
  - CEI EN 61496-1:2014
  - CEI EN 60204-1:2006

- Electromagnetic Compatibility Directive 2014/30/UE and relevant reference standards
  - CEI EN 61496-1:2014
  - CEI EN 61000-6-3: 2007 and CEI EN 61000-6-2: 2006

8. Overview

The photoelectrical safety device MSD is a single beam barrier with emission of visible laser which, within a more general control system, contributes to the protection of the operator in the use of machinery including dangerous mobile parts controlled by electric or electro-mechanical devices.

Main task of MSD is to detect, within the limits defined by the device detection capability, the intrusion of any opaque physical elements inside the area defined as "detection area", which is defined by the point of the emission of the laser beam generated by the transmitter up to the point of reception of the receiver of this device. The tool has been designed to disconnect, in case of danger, the power supply of the machine control devices and/or to activate functions which stop the motion of the dangerous parts.

These functions have been realized providing in output, via the contacts of the two OSSD's, two different electrical ON/OFF signals: the status ON corresponds to the condition when the transmitter beam reaches collimated the receiver, while the status OFF corresponds to the lack of collimation between the two components (due, for instance, to the intrusion of an element into the detection area) or to the lack of power supply to MSD. The OSSD outputs, properly inserted in the electric circuit for the command of the machinery dangerous parts, enable the control of the machinery movement (in status ON), or, vice versa, the capacity to inhibit or stop it (in status OFF).
Note that, anyway, the control of the procedure for the stop, suspension and reactivation of the machine is entrusted to the main control panel of the machine itself.

8.1. Design safety measures

- MSD is composed by one transmitter and one receiver, each of them enclosed within its own case and by one transformer which supplies them.
- The activation of the receiver is possible only by the emission generated by the transmitter which it is electrically connected to. Any emission generated by an identical transmitter, but not electrically connected to the receiver, cannot activate it.
- The laser beam, with limited power and visible light, is classified as belonging to CLASS 1M, that is defined as safe for man by the standard EN 60285-1, because the eye protection is ensured by the eye's defense reactions, eyelid reflex included.

8.2. Foreseen use of MSD device

The MSD device has been designed to create, by means of a laser beam emitted by the transmitter and intercepted by the receiver, an intangible barrier which delimits an area (volume) to protect against the intrusion of any opaque physical element.

The area (volume) to protect against the intrusion of any opaque physical element shall be steady in the space, therefore are excluded the applications where the supports of the MSD device are mobile.

In brief, the foreseen use of this safety device regards steady machines and/or installations where the possibly mobile members and/or components do not determine a change in the physical position of the different components of the device itself.

The detection of the continuity or of the interruption of this beam determines the status ON/OFF of two electric signals made available by MSD and which can be used to control dangerous parts of machines and/or installations.
The correct use of the device foresees the installation of transmitter and receiver near the dangerous area of the machine to monitor. The connection of the supports foreseen for this purpose must be rigid and integral by means of screws ensured against unscrewing (self-locking screws with spring washers).
Obviously, MSD must be connected in such a way to enable and/or disable the activation of the dangerous movement whose risks have to be prevented, and in such a way not to inhibit the activation of a possible emergency break foreseen for this purpose.

8.3. Improper use of the device

Any use different from those clearly allowed and indicated in the proper Use and Maintenance Manual of MSD is, and must be considered, explicitly forbidden. For these uses not allowed and/or not foreseen by the Manufacturer NUOVA ELETTRONICA s.n.c. di Pasqui F. & C., any form of explicit and implicit warranty as any responsibility for possible accidents decays.

The presence of a laser beam, even if of very limited power, could make (directly or indirectly) the improper use of the device dangerous.

The protection of the eyes is however ensured, even in absence of PPE, by the same eye defense reactions, as the eyelid reflex.

8.4. Definitions and description of the operation

Definitions:

Detection area	=	Area within which the specific test part will be detected
Detection capacity	=	Minimum size of the test part which can be detected
Reception area	=	Area within which the beam emitted by the transmitter is detected by the receiver
Reaction time	=	Time interval between the introduction of the test part into the detection area and the moment when the two OSSD's switch to status OFF
Intervention time	=	Minimum time interval during which the test part must stay within the detection area so to be detected
Status OFF	=	Status when the output circuit is open and interrupts the flow of the current
Status ON	=	Status when the output circuit is closed and allows the flow of the current
Collimation	=	Procedure which allows the alignment of the laser beam generated by TX to the RX reception area

The transmitter generates the emission of a modulated laser beam with intensity lower than 1 mW which, if detected by the receiver, creates a detection area and causes the receiver activates the switch to status ON of the two OSSD's present in it. Note that the activation of the receiver is possible only by the emission generated by the transmitter which it is electrically connected to. Any emission generated by an identical transmitter, but not electrically connected to the receiver, cannot activate.

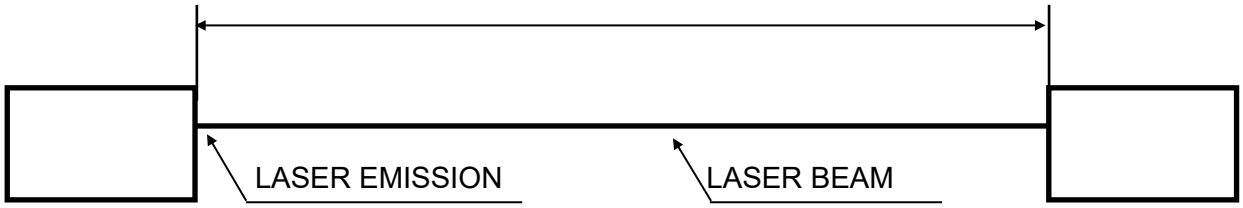

Fig.1

In "**status ON**" the MSD device is actively monitoring the machinery during the operation, while in "**status OFF**" MSD has been already intervened on the machinery deactivating its control mechanism due to the occurrence of a condition of possible danger, the intrusion of an element within the detection area.

The receiver is schematically composed by:

- One circuit which acts as sensitive function.
- One circuit, composed by two independent micro-processors, which controls and monitors the system.
- Two safety switching devices OSSD's.

This type of circuit involves a high level of redundancy, with double circuits, in compliance with the standard EN 61496-1 and -2 to an ESPE device of type 4, SIL3. In detail, during the normal operation the two OSSD's switch to status OFF (within the reaction time), when one of the following conditions occurs:

- Intrusion into the detection area
- Power supply missing
- Electrical disconnection of the synchronism signal (SINC).

In any condition of dangerous fault of the MSD itself, at least one of the two OSSD's switches to status OFF (within the reaction time) and remains in this status until the fault is fixed.

8.5. Light indicators: diagram and functions

The MSD device is provided with some light indicators which allow the rapid identification of its operating status. In detail, we can individuate the laser emission on the transmitter (Fig. 2) and three LED's on the receiver (Fig. 3).

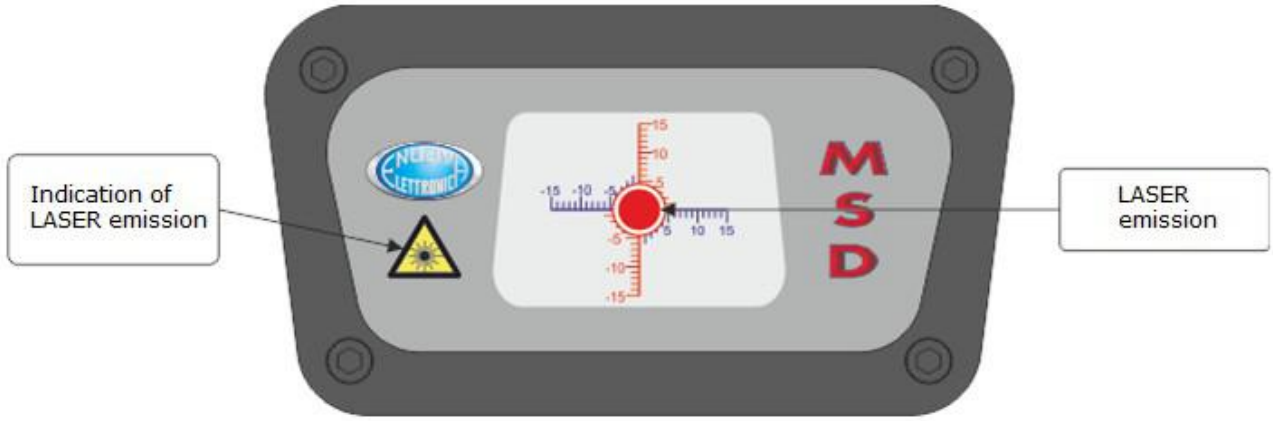

Fig.2

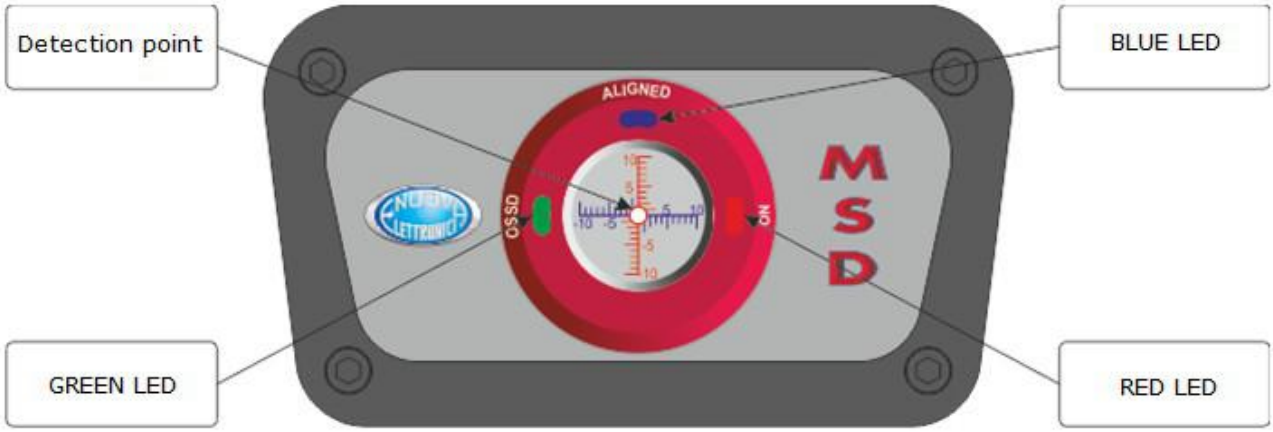

Fig.3

Blue LED on the receiver

- The led in status On indicates that the laser beam emitted by the transmitter, hitting the reception area, can activate the two switching OSSD devices making they stay in status ON, except for anomalies of the detected by the control and monitoring circuit.
- The led in status Off indicates that the laser beam emitted by the transmitter does not hit the reception area.

Green LED on the receiver

The green led in status On, located on the right of the reception area, indicates the active status of the two outputs OSSD1 and OSSD2. When the outputs are active (status ON), the green led is On. When the outputs are in status OFF, the green led is in status Off.

Red LED on the receiver

- The red led in status On indicates that the power supply is connected to the receiver.

8.6. Identification plate

The following data are reported on the TX identification plate:

- Name, address and contact references of the Manufacturer of the device
- Safety category in compliance with standard EN 61496-1:SIL3
- Logo "Costruito in Italia"
- Indication of presence of the laser beam
- Class of the laser equipment according to EN 60825: class 1M
- Warning with the indication not to see directly at the laser beam with optical instruments
- Serial number and manufacturing date

Fig.4

The following data are reported on the RX identification plate:

- Name, address and contact references of the Manufacturer of the device
- Safety category in compliance with standard EN 61496-1:SIL3
- Logo "Costruito in Italia"
- Detection capacity: ≥ 6mm
- Response time: 5ms
- TX-RX protection degree: IP65
- Operating temperature: 0-50°C
- TX-RX power supply voltage: 15Vac +/-10%
- Serial number and manufacturing date

Fig.5

8.7. Standard supply

The MSD device is composed by the following items:

- Transmitter (TX)
- Receiver (RX)
- Copy of this instruction manual

8.8. Transport and unpacking

MSD is delivered in a proper rigid cardboard package weighting about 2 Kg. The limited weight and dimensions do not cause problems or risks for the transport and unpacking operations.

Warning

- The items constituting the package have not to be disposed in the environment. Contact the specialized collection centers equipped for the disposal for the respect of the nature and the laws.
- Check, by sight, the presence and the integrity of all the components constituting the device, making sure that there are not evident damages caused by the transport. If damages are present, do not use the device and contact the MANUFACTURER.

9. Installation

MSD is a device with high safety degree. However it is essential to install and use it properly respecting the instruction reported here below.

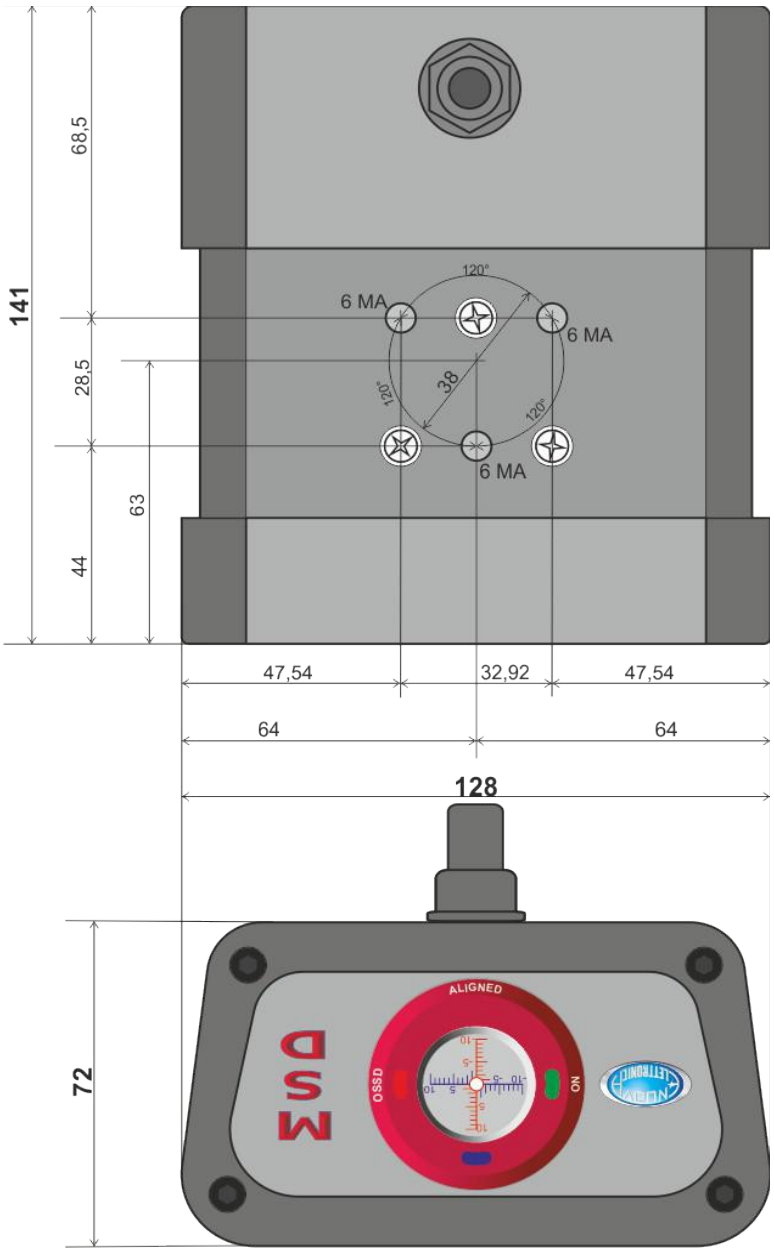

Fig.6

9.1. Definition of the detection area and installation of the device

Warning: The TX and RX containers are similar. However RX and TX can be immediately recognized by the plates located on the containers.

- Define the detection area, that is the area which shall be delimited (and then monitored) by MSD; then place TX and RX accordingly in such a way that the detection area makes not accessible the dangerous part of the machine, unless interrupting the optical connection between TX and RX, causing the intervention of the control mechanism.

Warning: Special care shall be dedicated to this operation because this area defines the limits of intervention of MSD for the protection of the operator.

- Fasten TX and RX to the machine by means of three screws with thread 6MA, screwing in the proper seats present on the equipment.
  Warning: make sure that the screws are tightened in such a way not to be loosened by the machine vibrations. The torsion force of the screws must be lower than 1.96 N*m (20 kgf*cm).

9.2. Electric connection

Warning: Make sure that the characteristics of the electric system, which MSD is connected to, correspond to those reported on the identification plate of the device.
For the realization of the connection to the electric grid and the connections among the components of the MSD device, refer to the relevant chapter "**Electric connection drawing**" and the reported drawing, avoid to connect the outputs of the two OSSD's to the main control panel of the machine.
Connect TX and RX to the power supply. Then power MSD, supplying voltage to the electric panel which it is connected to. We will have:

On TX:
The laser turns on
On RX collimated with TX:
The green, red and blue LED's turns on
On RX not collimated with TX:
Only the red LED turns on

Warning: Note that, anyway, the control of the procedure for the stop, suspension and reactivation of the machine is entrusted to the main control panel of the machine itself and, for this reason, the Manufacturer of the machine must keep in consideration the prescriptions and the indications contained in the main safety rules for the machine to equip with the safety device MSD.

10. Commissioning

10.1. Device power supply

- Once RX and TX are powered, RX could be already collimated with TX: in this case, stop the collimation (for instance interposing an opaque body between TX and RX within the detection area or slightly moving the axis of RX or TX).
- Make sure the two OSSD's are in status OFF. This condition is signaled by the blue and green LED's on the front part of RX, off and it is moreover possible to verify the missing of electric continuity between the NA outputs of OSSD's present on RX (for instance, use an ohmmeter: this instrument must indicate a value of resistance infinite, corresponding to a condition of open circuit).
- Then collimate TX and RX in such a way the laser beam emitted by TX hits the RX reception area causing the blue LED and the green LED on RX turn on.
- Make sure the two OSSD's are in status ON. This is possible verifying the electric continuity between the NA outputs of the OSSD's present on RX (for instance, use an ohmmeter: this must indicate a value of resistance null, corresponding to a condition of short circuit).
- Connect the outputs of the two OSSD's in the points foreseen by the machinery electrical circuit.

10.2. Test

- Verify that the introduction of the test part inside the detection area generates the passage from status OFF of OSSD. Repeat this test in different points of the detection area.

Warning: Verify that the detection area generated by the laser beam of MSD is sufficient to ensure the safety of the operator in the intervention area.

11. Maintenance

- **Cleaning of the MSD device**
  Verify that no scales, impurities or moisture drops settle on the emission and detection surfaces respectively of transmitter and receiver. In this case, use a soft and wet rag.

Warning:

- Do not use toxic or flammable substances when cleaning the device
- Do not direct water jets against the device.

12. Troubleshooting

Description	Cause	Action
No LED is on	Power supply missing	Check the presence of voltage in the power supply grid or the disconnection of this from the transformer power supply line
The device does not switch and stays OFF	Power supply voltage of the receiver is too low	Verify the power supply voltage provided to MSD device
The device does not switch and stays ON	The safety device has been tampered by means of a by-pass	Stop immediately working and make sure no other tampering has been performed; restore the correct situation replacing and taking the proper precautions in such a way this type of tampering has not performed any more

13. Removal of the device and re-installation after the repair

If MSD shows a defect or a malfunction and, then, it is necessary to disconnect it from the machine and send it to repair, act as described here below (this procedure allows avoiding the disconnection of the cables, limiting the operation only to the disassembly of the component of the device to repair):

- Disconnect the machine from the electric network; if MSD has been properly installed downstream the main switch (as described in the procedure for the electrical connection), the device will be automatically disconnect from power supply.
- Disconnect mechanically TX and RX from the machine.
- Remove the rear cover, as from Fig.7 both from TX and RX, unscrewing the four screws.

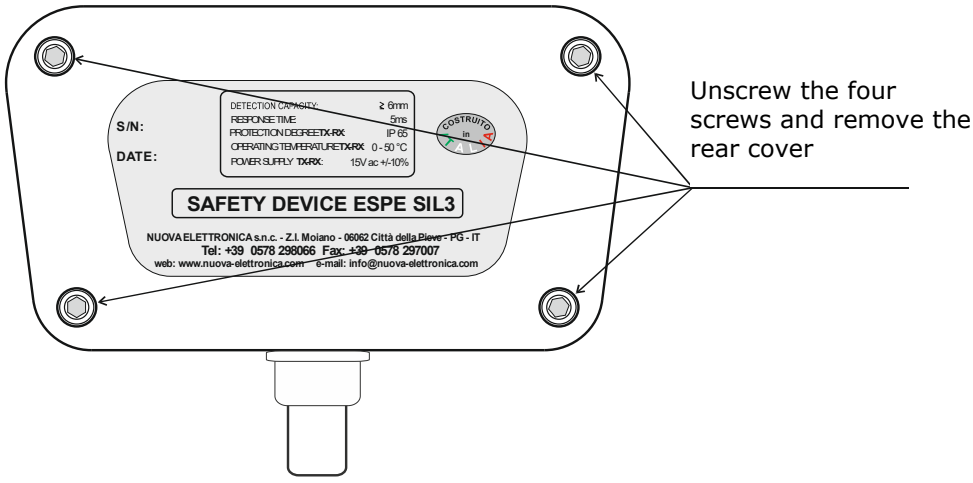

Fig.7

- Extract the 4-pin female connector from the male connector welded on TX, the 14-pin connector from the male connector welded on RX. Extract even the female from the faston connection from the male anchored on the RX container. TX and RX are separated from the machine.

- Disconnect mechanically TX and RX from the machine.
- Send the two parts to the Manufacturer, according to the modes described in the chapter Warranty, indicating the detected defect.
- Before reconnecting the parts returned from repair, make sure the machine is disconnected from the electric grid.
- Reconnect mechanically TX and RX to their brackets.
- Insert, with care, the female connectors of TX and RX.
- Put the rear cover in place and, as from Fig.7, screws the four screws both on TX and RX.
- Perform again the commissioning and test procedures described in the relevant chapter.

14. Electric connection drawing

The drawing of the connections between electric grid and components of the MSD device is represented here below.

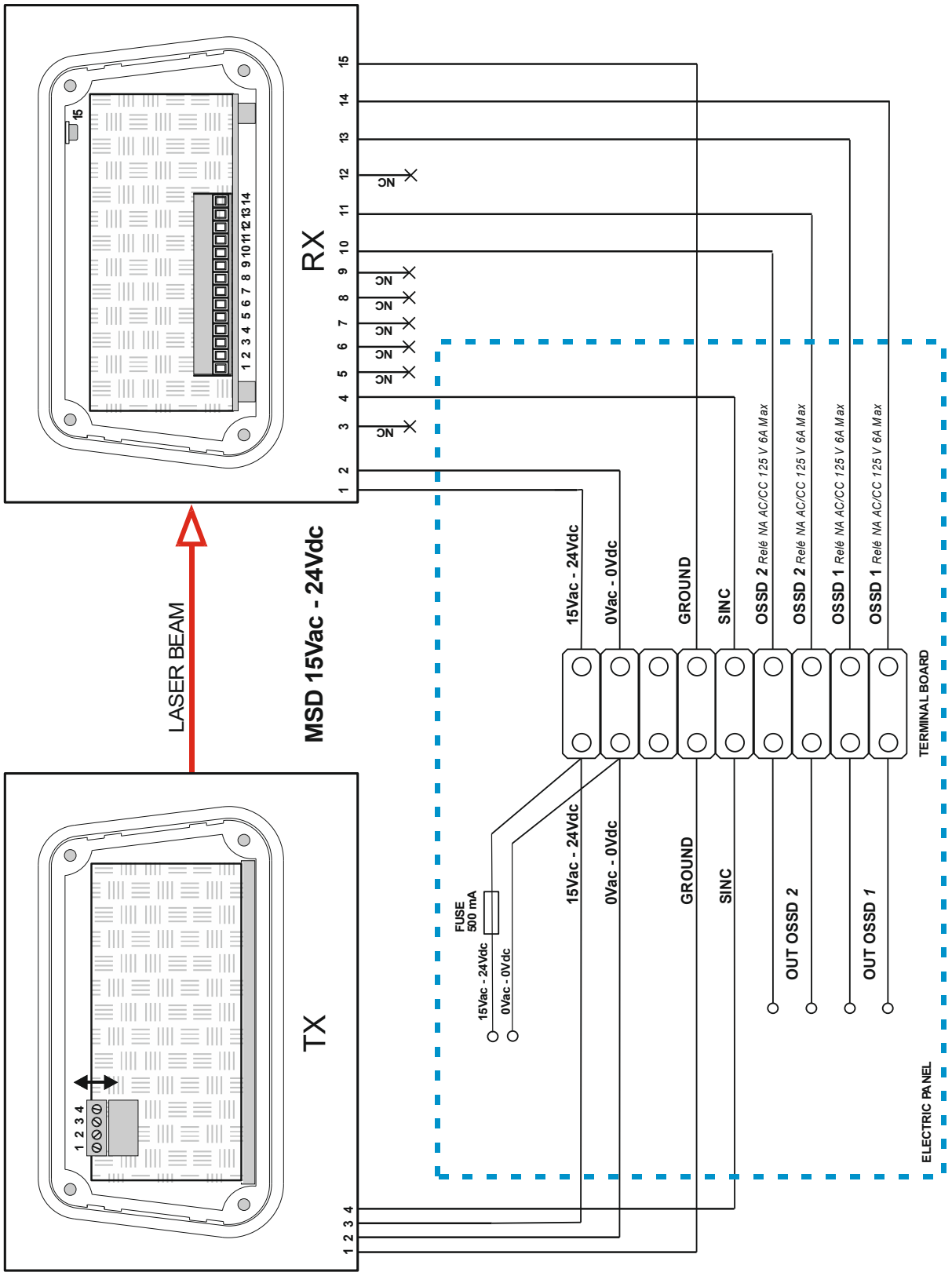

Fig.8

TX SIGNALS
Terminal n. 1: connect the GROUND signal.
Terminal n. 2: connect the power supply signal 0Vac/dc.
Terminal n. 3: connect the power supply signal 15Vac-24Vdc.
Terminal n. 4: connect the signal SINC.

RX SIGNALS
Terminal n. 1: connect the power supply signal 15Vac-24Vdc.
Terminal n. 2: connect the power supply signal 0Vac/dc.
Leave the terminal n.3 not connected (NC).
Terminal n. 4: connect the signal SINC.
Leave the terminals n.5, 6, 7, 8, 9 not connected (NC).
Terminal n. 10 and 11: the contacts of the relay output OSSD 2 are available.
Leave the terminal n.12 not connected (NC).
Terminal n. 13 and 14: the contacts of the relay output OSSD 1 are available.
Terminal n. 15: connect the GROUND signal.

15. Technical characteristics

ELECTRIC DATA

- Transmitter power supply: 15Vac - 24Vdc;
- Receiver power supply: 15Vac - 24Vdc;
- Consumption: 10 W;
- OSSD outputs made with 2A drive contact relays for 24V cc/ac;

OPTICAL DATA

- Visible laser beam source: 650 nm
- Beam divergence: < 0,2 mrad
- Laser classification: class 1 M
- Diameter of the laser beam at TX output = 6 mm;
- Suggested operating distance 0,5 ÷ 8 meters in normal industrial environment; Maximum operating distance in standard atmosphere and absolute absence of fine dust: 15 m;

GENERAL DATA

- Response time: 14 ms;
- Detection capacity ≥ 6 mm;
- Case protection degree: IP 65;
- Operating temperature 0°C 50°C;
- TX dimensions (fairlead excluded): 141mm X 128 mm X 72 mm
- RX dimensions (fairlead excluded): 141mm X 128 mm X 72 mm
- TX mass: about 695 g ± 5 g
- RX mass: about 765 g ± 5 g