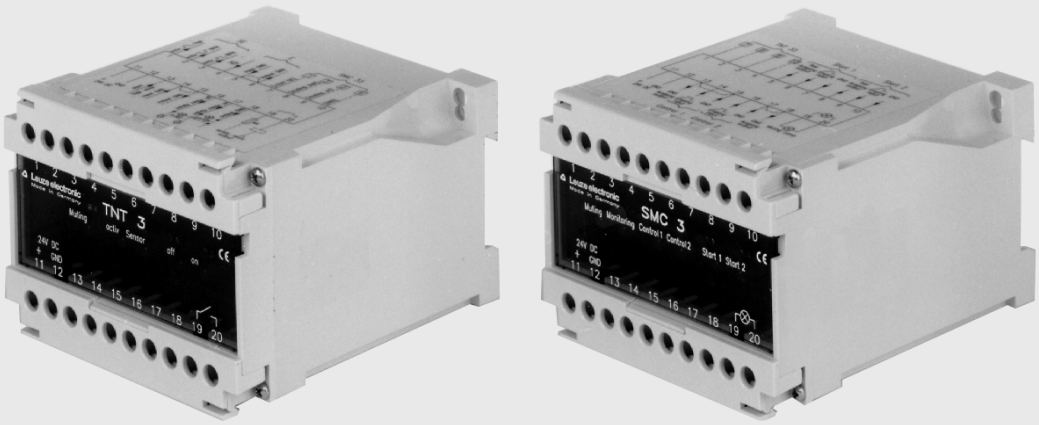
Test Monitoring Units TNT 33 / TNT 34 and Safety Muting Controller SMC 33 / SMC 34

User Information



1 General Information

1.1 Explanation of Symbols

The symbols used in this operating manual are explained below.

Attention!
This symbol appears in front of text which must be carefully observed. Failure to heed this information can lead to injuries to personnel or damage to the equipment.

Notice!
This symbol indicates text which contains important information.

1.2 Declaration of Conformity

The test monitoring units TNT 33 and TNT 34 and the safety muting controllers SMC 33 and SMC 34 were developed and manufactured in accordance with current European standards and directives.

Leuze electronic GmbH+Co. of D-73277 Owen/Teck, the manufacturer of the test monitoring units TNT 33 and TNT 34 and the safety muting controllers SMC 33 and SMC 34, has a certified quality assurance system in accordance with ISO 9001.

1.3 General Information

An active optoelectronic protective device is part of the electrical equipment which has to be applied to those machines which contain the potential risk of bodily injury. They provide protection by causing the machine to move into a safe operating state before a person can get into a dangerous situation (EN 61496-1).

1.4 Definition of Terms

AOPD type 2 The EN 61496 describes two types of active optical electronic protective devices (AOPD) with respect to the requirements concerning safety relevant parts of control units (EN 954-1).

The AOPD type 2 fulfills the requirements of category 2 acc. to EN 954-1. A periodic function test has to detect malfunctions in the safety function. In case of a failure, the next machine cycle may not be released. A malfunction of the AOPD type 2 between the testings can cause the loss of the safety function. In normal function, at least one output switching element of the AOPD type 2 has to move into the OFF-position if the sensor reacts or if the power supply of the AOPD is interrupted.

Contactless active protective device (BWS) Corresponds to AOPD

Output switching element (OSSD) The part of the AOPD which is connected to the machine control and which moves into the OFF-position as soon as the sensor part reacts during normal operation.

Start disable An equipment which disables the automatic machine start if the power supply of the contactless active protective device is switched on or if it had been interrupted and switched on again.

Start testing A manual or automatic test which is performed after the contactless active protective device has been switched on. It tests the complete safety-relevant control system before the normal machine operation is induced.

Muting The intentional bridging of the safety function, e.g. during material transport into the hazardous area.

Muting sensors Muting sensors define between persons and transported material. If the muting sensors are activated simultaneously or in the intended order, the safety function of the AOPD is bridged. Material can be brought into the hazardous area without taking the machine out of operation.

Relay monitoring The relay monitoring checks before every release of the switching outputs if the succeeding contactors are open. Only then, a new release is possible.

Restart-disable An equipment which disables the automatic restart of the machine after the sensor part has reacted during a dangerous part of the machine cycle, a change of the operating mode, and/or operator mode of the machine.

1.5 Selection of Optical Electronic Protective Devices

The following strategy is to be applied (iterative process):

1. Determination of the protected area
2. Determination of the protective function
   - Finger or hand protection
   - Access protection for persons
   - Presence detection
3. Determination of the control category
4. Calculation of the safety distance

Determination of the protected area

Through risk calculation, the following has to be observed:

- the size of the safety field and the access points
- the hazardous areas
- Bypassing possibilities

Determination of the protective function:

Finger and hand protection:	The user is close to the hazardous area.
Access protection:	Access to the hazardous area is protected.
Presence detection:	A hazardous area which is completely surrounded by permanently installed protective devices is monitored for presence of objects or access protection and presence detection are combined.

2 Safety Notices

2.1 Safety Standard

The test monitoring units TNT 33 and TNT 34 and the safety muting controllers SMC 33 and SMC 34 were developed and manufactured in accordance with current European standards and directives. All units satisfy the safety technology requirements of category 2 according to EN 954-1 and EN 61496-1.

2.2 Intended Use

The safety switching units TNT 33 and TNT 34 are used for the protection of hazardous areas or locations in combination with one or several protective photoelectric sensors or safety light barriers.

The safety muting controllers SMC 33 and SMC 34 are designed for the intentional bypassing of a contactless safety device connected to a test monitoring unit TNT 33 or TNT 34.

Attention!
The protection of personnel and the device cannot be guaranteed if the device is operated in a manner not corresponding to its intended use.

2.2.1 Application requirements

Control of the machine or unit to be protected has to be controllable electrically. A switching signal generated by a TNT 33 or TNT 34 has to be followed by an immediate shut-down of the dangerous movement. For application and installation of the protective photoelectric sensors or light barriers, the current European guidelines and standards and/or the safety regulations of the employers' liability insurance association have to be observed.

A switching command originating from an SMC 33 or SMC 34 bypasses the safety device, including the TNT 33 or TNT 34 and the potective photoelectric sensors or safety light barriers connected to it. The relevant EU directives and standards and/or accident insurers' safety regulations also apply to the use of the SMC 33 or SMC 34.

Attention!
Access to or changes on the device, except where expressly described in this operating manual, is not authorized.

2.2.2 Fields of application

The test monitoring units TNT 33 and TNT 34 may be used as disconnecting safety devices for the protection of hazardous areas on power-driven machines.

They are authorised for the following areas of application (extract):

- Edge, frame, star, and carcass press in lumber industry acc. to prEN 691 resp. ZH 1/3.19
- Printing and paper processing machines acc. to prEN 1010
- Power driven windows, doors, and portals acc. to ZH 1/494
- Storage equipment and devices acc. to ZH 1/482 and DIN 15185 part 2
- Textile machines acc. to VBG and DIN EN ISO 11 111
- Food processing equipment acc. to prEN 1672-1 resp. VBG 77
- Packaging machinery acc. to prEN 415-1 to -7 resp. VBG 76
- Meat processing equipment acc. to prEN 12463 resp. VBG 79
- Machines of the chemical, rubber, and plastic industry acc. to VBG 22

The safety muting controllers SMC 33 and SMC may be used in combination with the TNT 33 or TNT 34 as safe bypassing circuits for the following areas of application:

- General packaging machinery
- Palletization and depalletization
- Packing robots
- Strapping machines
- Foil-winding machines
- Settling tanks in the ceramic and stoneware industries
- General transport and storage
- Textile industry

2.3 Organizing Measures

All entries in this operating manual must be heeded, in particular those in the sections "Safety Notices" and "Commissioning".

Carefully store this operating manual where it is accessible at all times.

Observe the locally applicable legal regulations and the rules of the employers' liability insurance association.

Mounting, commissioning and maintenance of the device must only be carried out by qualified personnel. Electrical work must be carried out by a certified electrician.

Adjustment and change of the safety field for the protection of persons may only be carried out by an authorized person.

Repairs, in particular the opening of the housing may only be carried out by the manufacturer or a person authorized by the manufacturer.

3 Mounting of the Safety System

3.1 Installation of the Test Monitoring Units TNT 33 / 34 and the Safety Muting Controllers SMC 33 / 34

All units are designed for installation on a DIN rail in a suitable cabinet (clip-on).

Notice!
The mounting instructions in this chapter have to be heeded for fault-free functioning of the whole safety system.

3.2 Mounting of the Protective Photoelectric Sensor

It is absolutely mandatory that the valid guidelines and standards are observed when mounting the protective photoelectric sensors.

Safety distance

A certain time delay applies between the interruption of the light beam of the protective photoelectric sensors and the stand-still of the machine. The photoelectric sensors have to be installed in such a way that the dangerous area can not be reached within this time delay. The minimum distance for safeguarding the hazardous area is 850mm.

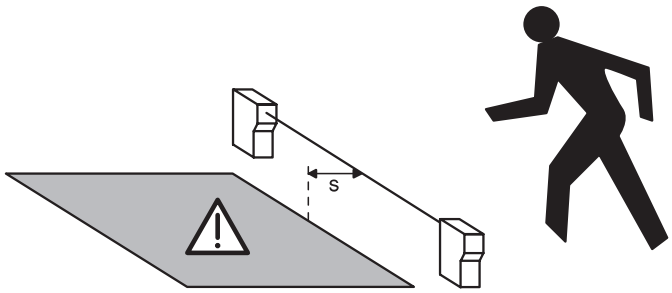


Figure 3.1: Safety distance S between photoelectric sensor and hazardous area

Calculation of the safety distance

The safety distance S between photoelectric sensor and hazardous area is calculated acc. to EN 999 using the following formula:

S = K * T+C

S Safety distance between photoelectric sensor and hazardous area

K Grip and approach speed

T Time delay between interruption of the light beam and stand-still of the machine

C Safety constant

1200mm with single-axle installation,

850mm with multi-axle installation

Example for the calculation of the safety distance

A machine with a system response time of 500ms has to be equipped with a two-beam safeguarding. The response time of the two-beam AOPD and the test monitoring unit TMC 66 is 20ms.

Application of the formula: S = K * T+C

Assigned is:

S: the minimum distance of the two-beam AOPD from the hazardous area

K: approach speed 1600mm/s (EN 999)

T: sum made of system response time of the machine and response time of the AOPD

C: 850 mm multi-axle installation

Result:

S = (1600mm/s * (500ms+20ms)) + 850mm

S = 1682 mm

3.2.1 Multi-axle installation

The safeguarding heights and the number of light beams are determined in EN 999 or through a risk analysis acc. to EN 954-1 for safeguarding of hazardous areas.

With multi-axle installation, parallel light beams always have to run in opposite directions. Otherwise the light beams can cause mutual interference and disturb the safe functioning.

Depending on the number of photoelectric sensor pairs, the single systems have to be mounted in different heights acc. to EN 999. The number of used systems results from the corresponding type C standard or risk evaluation.

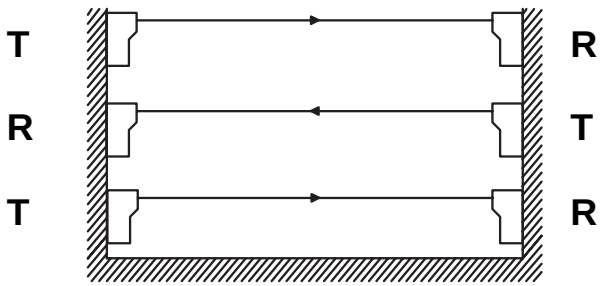


Figure 3.2: Multi-axle installation

Deflection mirrors

A number of important factors has to be observed with application of deflection mirrors:

- With any light beam deflection, a loss of operating range occurs. Per deflection mirror, the loss is approx. 15%.
- Contamination of the deflection mirrors should be avoided.
- Environmental conditions such as steams and dust-containing air heavily limit the operating range.
- When installing deflection mirrors it has to be observed that the optical axis of the photoelectric sensor runs centered to the mirror.
- A laser alignment aid made by Leuze, e.g. ARH 2 facilitates the alignment over great distances and if using deflection mirrors.

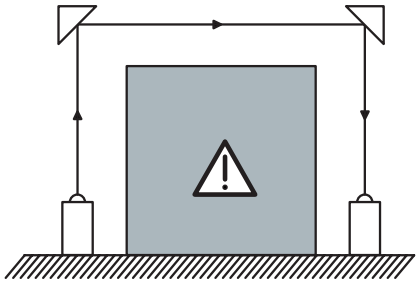
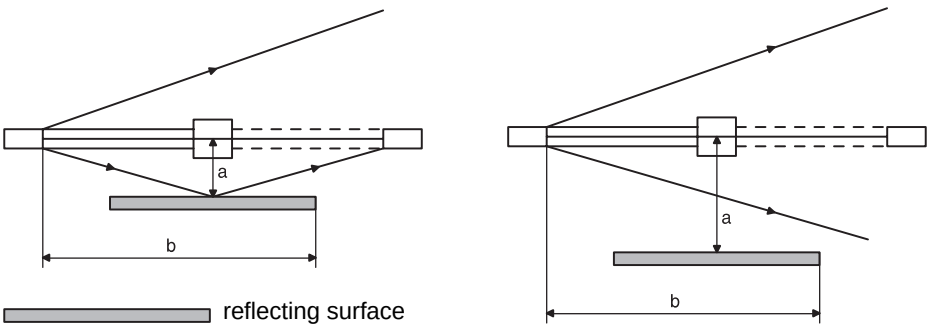


Figure 3.3: Arrangement of the deflection mirrors

Reflection bypass

Surfaces located parallel to the light beam can cause a reflection bypass. An object within the light path is then no longer detected.

The photoelectric sensor has to be mounted with a minimum lateral distance to the reflecting surface. This distance results from the opening angle (±4°) and the distance between transmitter and receiver.



Wrong arrangement Correct arrangement

Figure 3.4: Reflection bypass

Minimum distance to the reflecting surface						
To transmitter (b)	2m	3m	4m	5m	6m	10m
To light beam (a) approx.	0,20m	0,30m	0,40m	0,50m	0,60	1,0m

4 Test Monitoring Unit TNT 33

4.1 Function and Commissioning

4.1.1 Function characteristics of the safety system

The complete safety system consists of a TNT 33 and accompanying protective photoelectric sensors or light barriers.

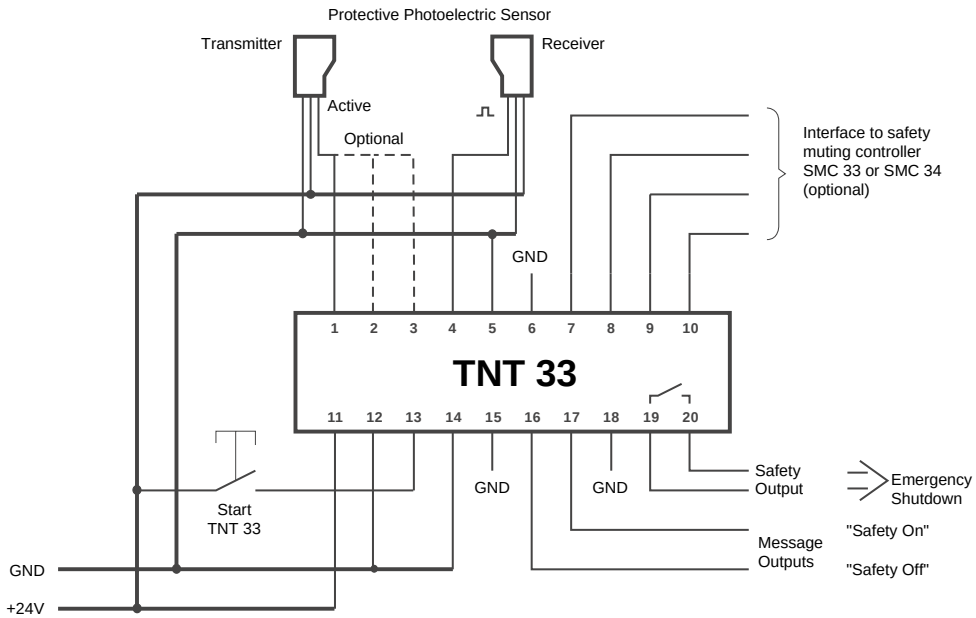


Figure 4.1: Installation of the complete safety system

After the TNT 33 is switched on via the activation input, the functionality of the protective photoelectric sensors or the muting controller connected is monitored in two-second cycles.

The electrical integration into the control has to be performed acc. to the corresponding safety category acc. to EN 954-1. The floating safety relay output (a series circuit of two normally open contacts of two safety relays with forced opening) may be used for an immediate shutdown of the hazardous movement.

A startup lock and a restart lock are integral parts of the test monitoring unit TNT 33.

4.1.2 Display and operating instruments

The test monitoring unit TNT 33 features integrated LEDs to indicate the state of the system.

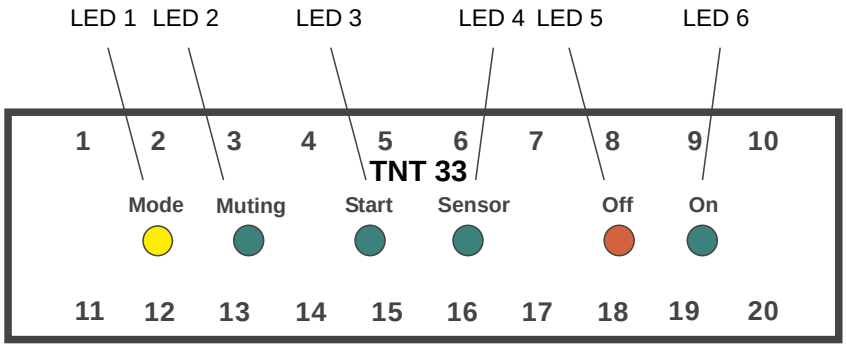


Figure 4.2: Display elements TNT 33

Overview - Display and Operating Elements

LED no.	LED description	Function characteristics
LED 1	Mode	Status display start and restart interlock
LED 2	Muting	Status display muting input
LED 3	Start	Status display activation input
LED 4	Sensor	Status display protective field state
LED 5	Off	Status display safety circuit open
LED 6	On	Status display safety circuit closed

4.2 Electrical Installation

The electrical installation is only to be performed by specialized personnel. During installation it has to be observed that supply and signal lines have to be installed separately from power lines. Inside the switching cabinet, suitable spark extinction has to be provided if using contactors. In connection with driving motors and breaks, the corresponding manuals have to be observed.

4.2.1 Supply wiring

The test monitoring unit TNT 33 is supplied with 24VDC +/-15%.
Current consumption is max. 200mA.

Figure 4.3: Supply wiring

4.2.2 Activation input wiring

The TNT 33 expects a "high-low" signal (rising and falling edge on the activation input) as a switch-on signal on terminal 13. After startup testing is complete, the unit switches the safety output on, provided the light path is uninterrupted.

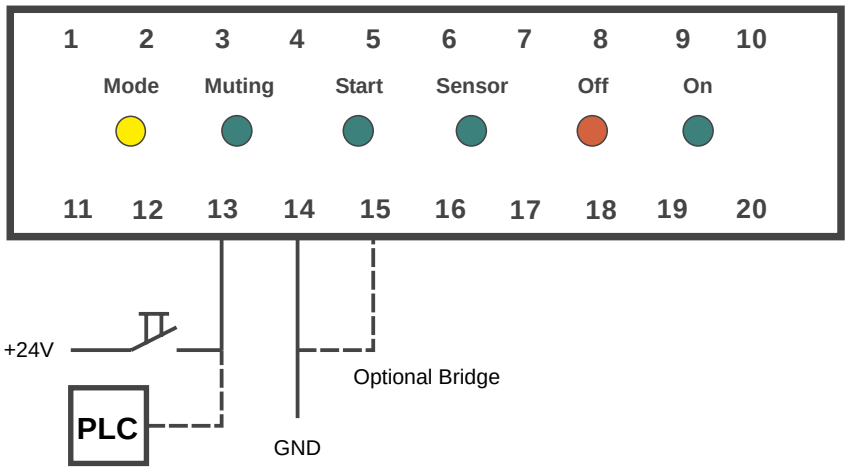


Figure 4.4: Activation input wiring

The activation input is a potential-free optical coupler input. It is essential that terminal 14 is connected to GND potential. For this purpose, you can install a bridge from terminal 14 to terminal 15 on the unit, or connect terminal 14 to GND.

Attention!
The start button connected to the activation input must be installed such that the danger area can be monitored visually during activation. It must be impossible to operate the button from within the danger area.

Notice!

*The safety output does **not** switch on, as long as the signal is present at the activation input.*

4.2.3 Wiring of single-beam protective photoelectric sensors (1)

Transmitter - active high (PNP)

The activation input of the protective photoelectric sensor can be directly connected to terminal 1 on the TNT 33. The switching output of the receiver can be directly connected to terminal 4.

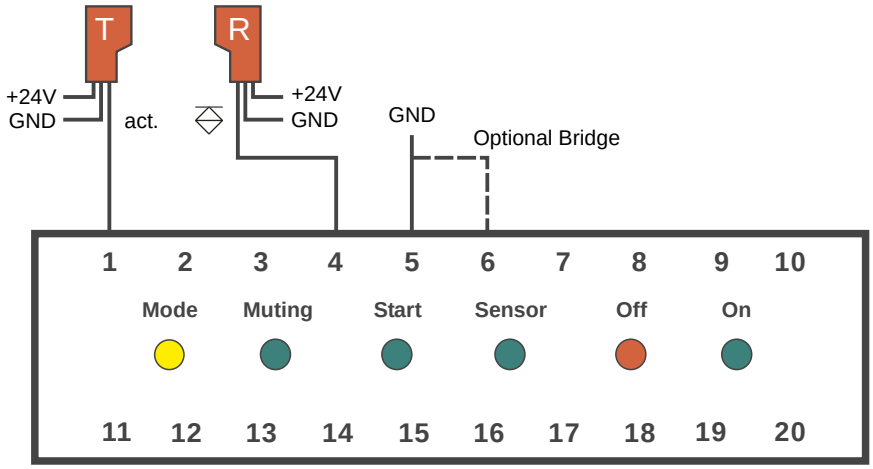


Figure 4.5: Wiring of single-beam protective photoelectric sensors (1)

The receiver input is a potential-free optical coupler input. It is essential that terminal 5 is connected to GND potential. For this purpose, you can install a bridge from terminal 5 to terminal 6 on the unit, or connect terminal 5 to GND. The supply of the protective photoelectric sensors comes directly from the 24V power supply unit.

possible sensors (selection): SLS 95, SLS 96, SRK 96, SLS 46, LS 763, ROBUST RRT 22, ROBUST RRT 23, ECO

4.2.4 Wiring of single-beam protective photoelectric sensors (2)

Transmitter - active low (NPN)

The activation input of the protective photoelectric sensor can be directly connected to terminal 2 on the TNT 33. The switching output of the receiver can be directly connected to terminal 4.

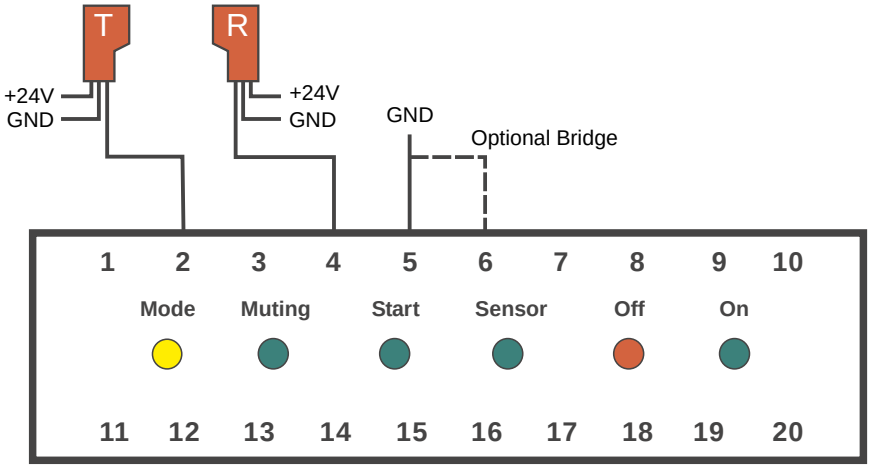


Figure 4.6: Wiring of single-beam protective photoelectric sensors (2)

The receiver input is a potential-free optical coupler input. It is essential that terminal 5 is connected to GND potential. For this purpose, you can install a bridge from terminal 5 to terminal 6 on the unit, or connect terminal 5 to GND. The supply of the protective photoelectric sensors comes directly from the 24V power supply unit.

possible sensors: TLS 85, TLS 72

4.2.5 Wiring of single-beam protective photoelectric sensors (3)

Transmitter - active high (NPN):

The activation input of the protective photoelectric sensor can be directly connected to terminal 3 on the TNT 33. The switching output of the receiver can be directly connected to terminal 4. The receiver input is a potential-free optical coupler input. It is essential that terminal 5 is connected to GND potential.

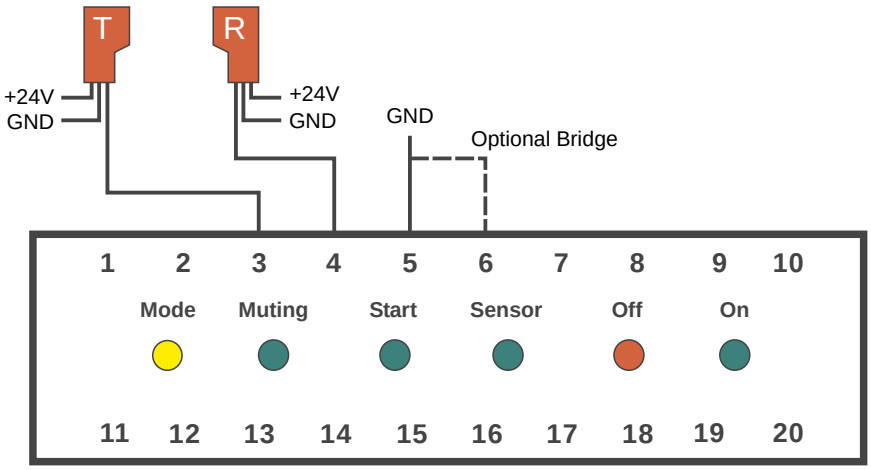


Figure 4.7: Wiring of single-beam protective photoelectric sensors (3)

4.2.6 Wiring protective photoelectric sensors in series (with active high (PNP) sensors only)

Several photoelectric sensor pairs can be wired in series on the TNT 33 if multi-axis safeguarding needs to be installed on a machine or system. The figure below illustrates a three-axis photoelectric sensor installation. It is possible to operate up to six photoelectric sensor pairs on one TNT 33.

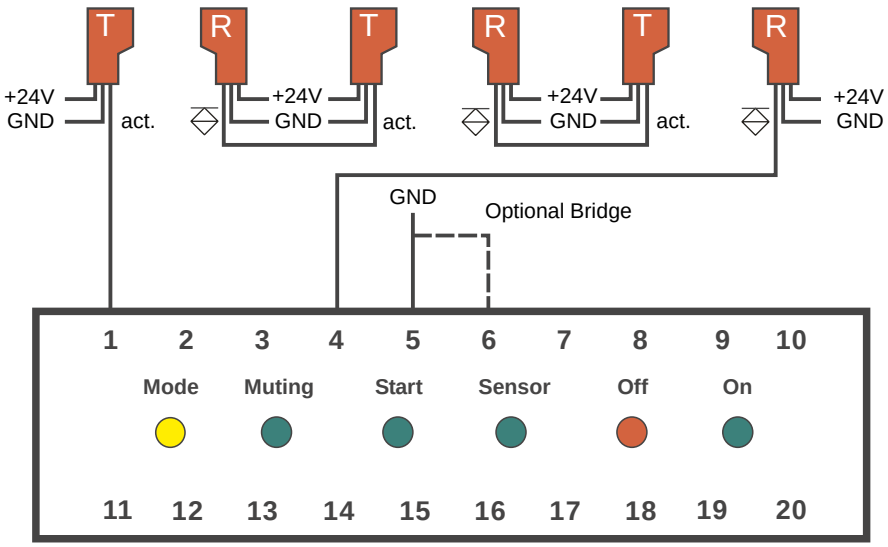


Figure 4.8: Wiring of protective photoelectric sensor in series connection

Function characteristics

The TNT 33 (terminal 1) activates the first photoelectric sensor transmitter. The receiver is activated via the first optical path and, by using its output activates the second photoelectric sensor transmitter. The supply has to provided on each photoelectric transmitter and receiver. The feedback to the TNT 33 (terminal 4) is done by the last photoelectric sensor receiver within the series connection. When an arbitrary light axis is interrupted, the series circuit always signals this to the TNT 33. When testing, the series circuit causes each transmitter and receiver to be tested for functionality.

4.2.7 Wiring the muting interface

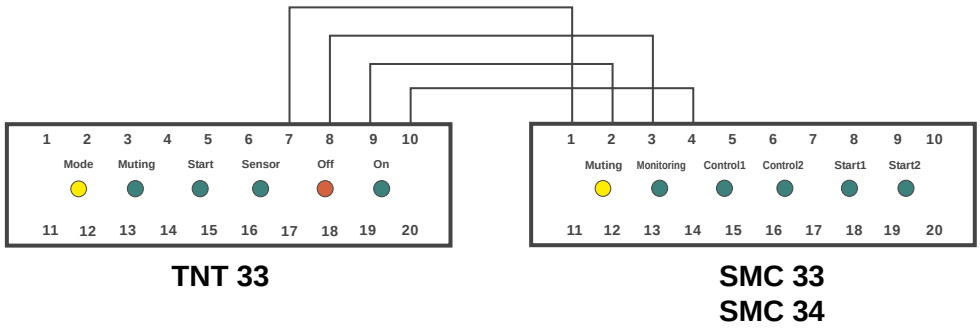


Figure 4.9: Wiring the muting interface

The test monitoring unit TNT 33 is designed for direct connection of the safety muting controller SMC 33 or SMC 34. Throughout the duration of the muting, the TNT 33 tests the safety muting controller in regular intervals.

Sequence

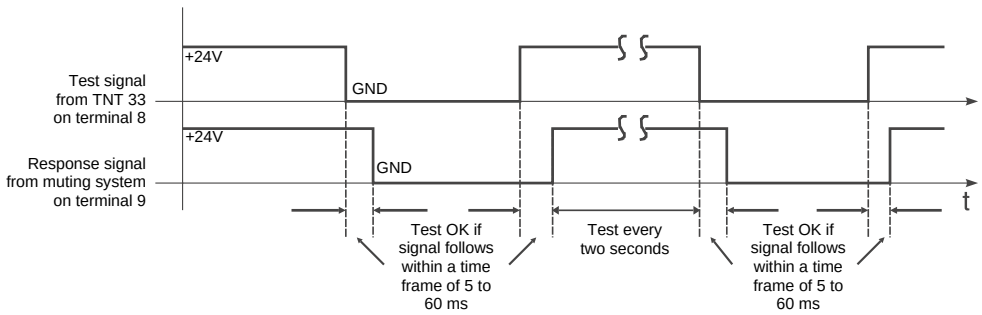


Figure 4.10: Testing sequence

The TNT 33 initiates the test by changing the signal on terminal 8 from high (+24V) to low (GND). The muting controller conected now has between 5 and 60 milliseconds to react to the test request by changing the signal on terminal 9 from high to low. This completes the first part of the test sequence.

The second part of the test begins with a signal change from low to high on terminal 8. Once again, the muting controller connected is given between 5 and 60 milliseconds to react to the request for signal change by changing the signal on terminal 9 from low to high.

Note that when using a muting controller, the muting controller must satisfy safety category 2. The safety muting controllers SMC 33 and SMC 34 satisfy the requirements of safety category 2 according to the respective standards and regulations.

Notice!
If the TNT 33 is operated without a muting function, this interface is not connected.

4.2.8 Wiring the safety output

Integration without relay monitoring, single-channel release circuit

In the test monitoring unit TNT 33, two safety relay outputs are connected in series and are available as a potential-free, normally open contact on terminal 19 and 20. The release circuit can be connected to further components which are then wired to a common EMERGENCY SHUTDOWN device.

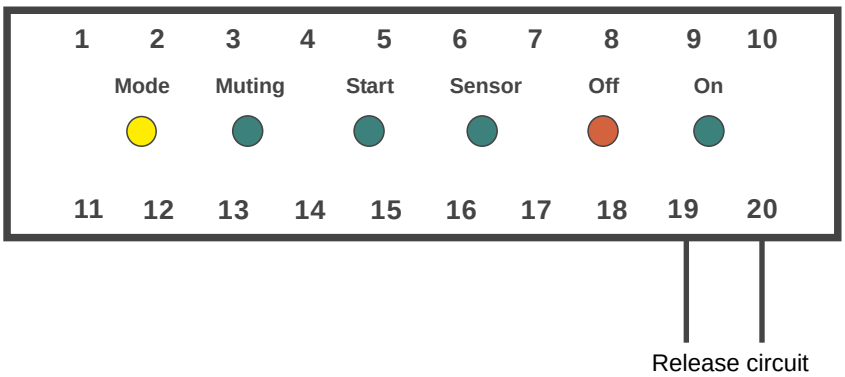


Figure 4.11: Wiring of the safety output without relay monitoring

Integration with relay monitoring as EMERGENCY SHUTDOWN device

The motor contactors for dangerous movement are connected to both safety relay outputs. For this purpose, forced contactors have to be used. In the connection diagram, no fuses are included. However, for correct function those are absolutely required. The maximum contact load of the safety relay outputs is 4A with $24V_{DC}$.

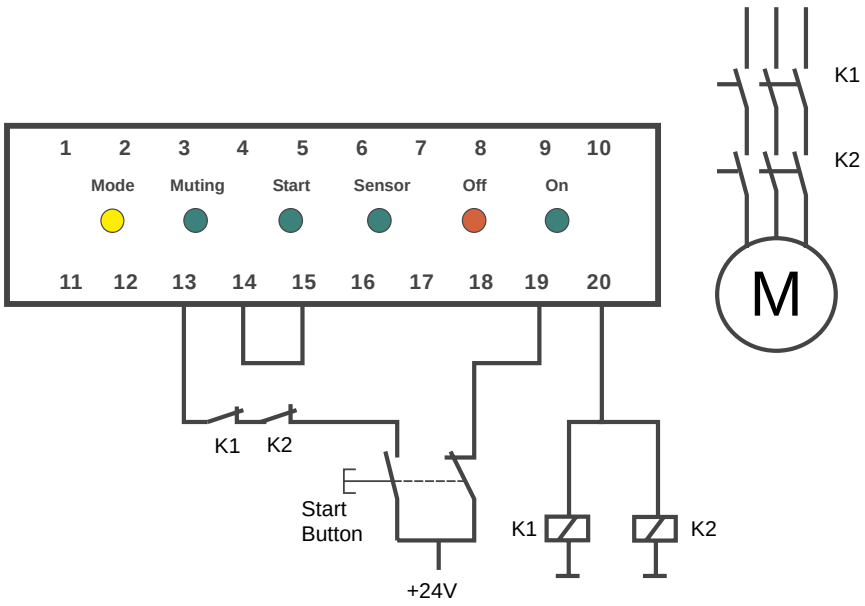


Figure 4.12: Wiring of the safety output with relay monitoring

The motor relays are controlled via K1 and K2. If a contact of K1 or K2 should fuse, this is reported to the TNT 33 by the normally closed contacts that are connected in series with the start button. The start button is also integrated into the control circuit for the motor relays. The normally closed contact prevents a startup of the machine or plant while the start button is pressed.

4.2.9 Wiring of the message outputs

Two message outputs are integrated in the TNT 33. Both are HIGH active, positive switching semi-conductor outputs and can be either directly connected to a PLC or control a status display of a machine. When using standard light bulbs, the resistance of the cold filament must not be less than 2.4kOhm.

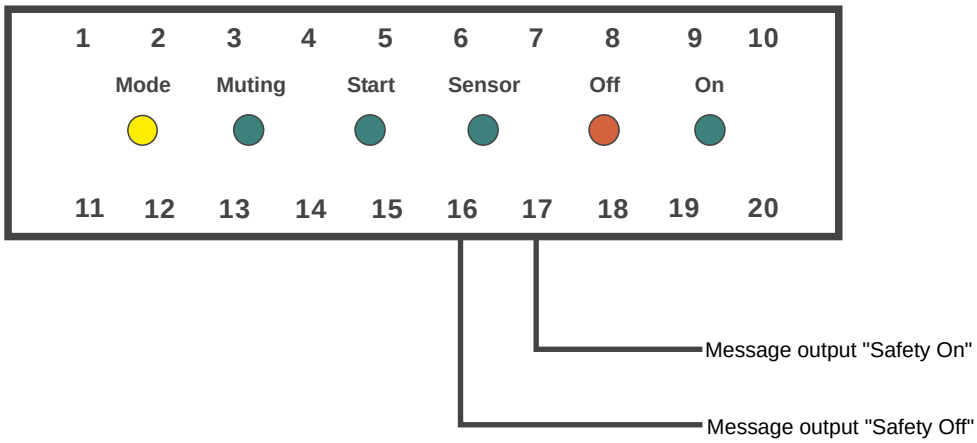


Figure 4.13: Wiring of the message outputs

The signal output "Safety off" is active whenever the safety relay output is open. The signal output "Safety on" has the opposite function, i.e., it is active whenever the safety relay output is closed.

4.3 TNT 33 without Muting Function

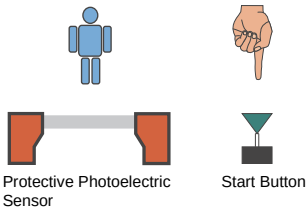
Stand-by mode:

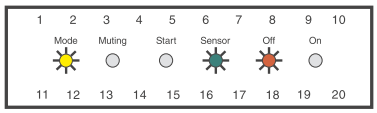
After the operating voltage has been switched on, or after a safety shut-down following safety field violation, the unit is in stand-by mode.

During stand-by, the protective photoelectric sensor is clear (green LED „Sensor“).

The activation input has not been activated.

The safety output is open. This state is displayed by the red LED "Off". The yellow LED "Mode" displays the lock of the start- restart disable.



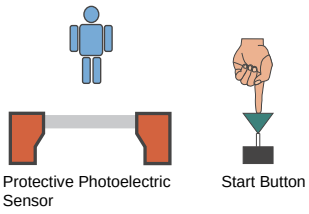


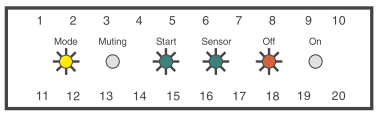
Test operation:

The functionality of the test monitoring unit and the protective photoelectric sensor are tested during test operation.

To induce the test operation, the activation input is activated (green LED "Start").

After successful completion of the startup test, the TNT 33 changes from test operation to protection operation.

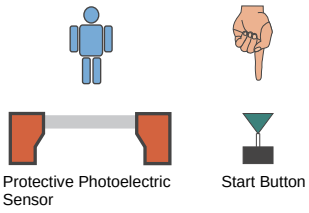


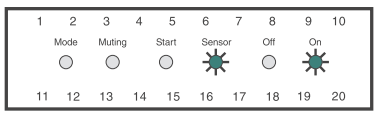


Safety operation:

In safety operation, the function of the protective photoelectric sensor is cyclically tested every two seconds. The free safety field is displayed by the green LED "Sensor".

The safety output is closed which is displayed by the green LED "On".





Notice!

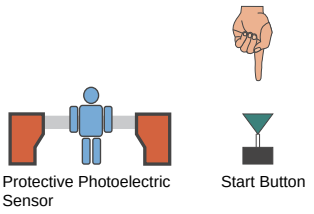
A repeated operation of the start button has no effect during protection operation. The TNT 33 remains in protection operation, and the cyclic test is carried out every two seconds.

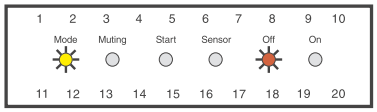
Safety field interruption:

The safety output of the TNT 33 is opened (green LED "On" off, red LED "Off" on) if during safety operation the light beam of the protective photoelectric sensor is interrupted.

The restart-disable inside the TNT 33 becomes active and avoids an automatic restart of the machine. The yellow LED "Mode" displays the function of the restart-disable.

The TNT 33 is in waiting state and can be restarted by pressing the start button after the safety field is free.





4.4 Error Messages on the TNT 33

The test monitoring unit TNT 33 tests the internal functions of the unit and the periperals connected in two-second intervals.

Faults in the periphery (e.g., protective photoelectric sensor or muting controller) are indicated by the flashing of the LED associated with the input in question. E.g., if a fault in the muting controller is detected, the LED "Muting“ will flash.

After the fault has been rectified, the locked state may be reset by briefly removing the operating voltage.

Equipment faults that are caused by an internal defect result in the unit going into locked state. This locked state may also be reset by interrupting the operating voltage.

4.5 Technical Data

Electrical data	
Operating voltage U_b	24VDC +/-15%
Residual ripple	< 15%
Current consumption	approx. 200 mA
Response time	< 20ms
Delay before start-up	approx. 2s

Sensors	
Transmitter activation	PNP (active high, terminal 1) NPN (active low, terminal 2) NPN (active high, terminal 3)
Receiver activation	potential free optical coupler input, input current approx. 10mA

Muting	
Muting test output	PNP (HIGH active)
Muting signal input	Optical coupler input, input current approx. 10mA

In and outputs	
Activation input	potential free optical coupler input (HIGH active) input current approx. 10mA
Message output Safety off	PNP transistor output, 100mA short circuit- and polarity reversal protection
Message output Safety on	PNP transistor output, 100mA short circuit- and polarity reversal protection
Safety output	voltage free make-contact max. current load 4A
Fuse protection	externally with max. 4A slow blow
Overvoltage category according to VDE 0110 part 1	3 for rating voltage 300VAC

Environmental data	
Ambient temperature	-20°C - +60°C
Air humidity	humidity class G acc. to IEC 68 part 2-3
Storage temperature	-30°C - +70°C
Protection class	IP 40 (only for application in electrical operating rooms / switching cabinet with minimum protection class IP 54 is suitable)

Impact resistance / Vibration resistance	
EMC	acc. to EN 61496-1
Contact protection	acc. to VBG 4 and VDE 0106 part 100

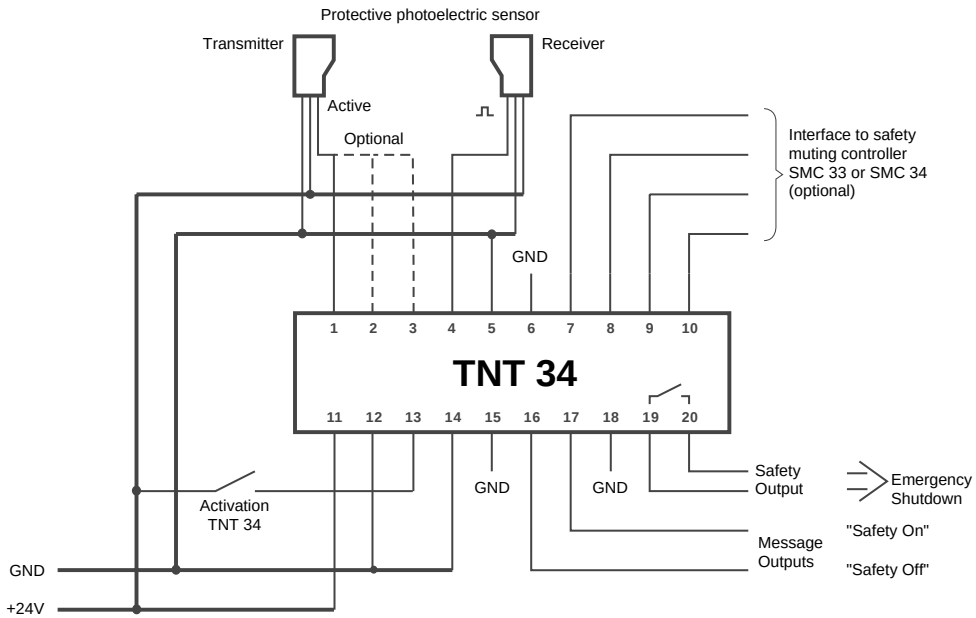
Mechanical data	
Housing	polycarbonate, cover ABS / v-o grey
Connection	screw terminals, max. connection cross-section 2x 2,5mm acc. to DIN 46288
Mounting	snap-on mounting for standard rail
Weight	approx. 200g
Dimensions (H x W x D)	100mm x 78mm x 114mm

5 Test Monitoring Unit TNT 34

5.1 Function and Commissioning

5.1.1 Function characteristics of the safety system

The complete safety system consists of a TNT 34 and accompanying protective photoelectric sensors or light barriers.



After the TNT 34 is switched on via the activation input, the functionality of the protective photoelectric sensors or the muting controller connected is monitored in two-second cycles.

The electrical integration into the control has to be performed acc. to the corresponding safety category acc. to EN 954-1. The floating safety relay output (a series circuit of two normally open contacts of two safety relays with forced opening) may be used for an immediate shutdown of the hazardous movement.

Attention!

*The test monitoring unit TNT 34 features **no** start or restart lock, i.e., after the safety field is cleared, the safety relay output switches automatically to on again.*

5.1.2 Display and operating instruments

The test monitoring unit TNT 34 features integrated LEDs to indicate the state of the system.

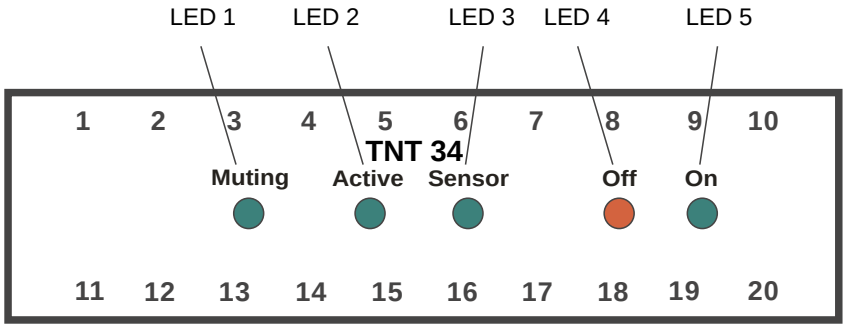


Figure 5.1: Display elements TNT 34

Overview - Display and Operating Elements

LED no.	LED description	Function characteristics
LED 1	Muting	Status display muting input
LED 2	Active	Status display activation input
LED 3	Sensor	Status display protective field state
LED 4	Off	Status display safety circuit open
LED 5	On	Status display safety circuit closed

5.2 Electrical Installation

The electrical installation is only to be performed by specialized personnel. During installation it has to be observed that supply and signal lines have to be installed separately from power lines. Inside the switching cabinet, suitable spark extinction has to be provided if using contactors. In connection with driving motors and breaks, the corresponding manuals have to be observed.

5.2.1 Supply wiring

The test monitoring unit TNT 34 is supplied with 24VDC +/-15%.
Current consumption is max. 200mA.

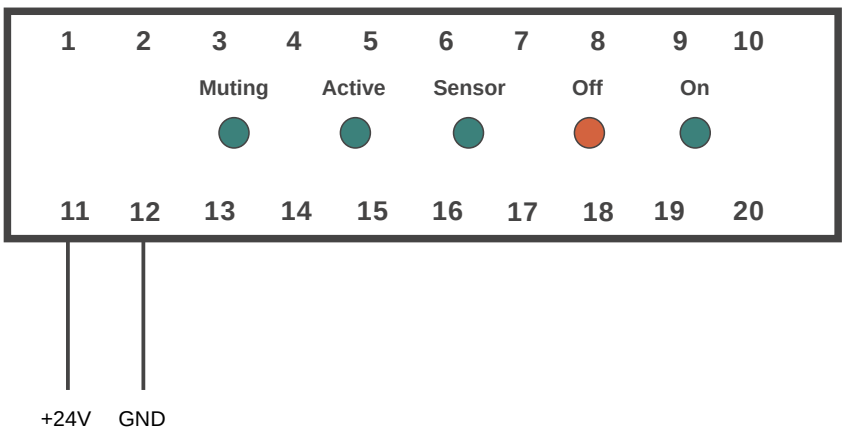


Figure 5.2: Supply wiring

5.2.2 Wiring the activation input

The TNT 34 expects a "high" signal (rising edge on the activation input) as a switch-on signal on terminal 13. After startup testing is complete, the unit switches the safety output on, provided the light path is uninterrupted and the start signal is still active.

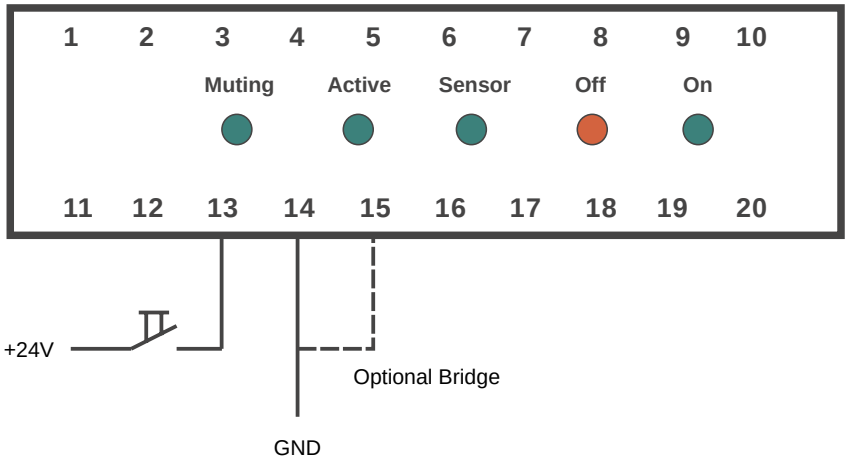


Figure 5.3: Wiring the activation input

The activation input is a potential-free optical coupler input. It is essential that terminal 14 is connected to GND potential. For this purpose, you can install a bridge from terminal 14 to terminal 15 on the unit, or connect terminal 14 to GND.

Notice!
The safety output will not switch to on unless the activation input is permanently switched to +24V!

5.2.3 Wiring of single-beam protective photoelectric sensors (1)

Transmitter - active high (PNP)

The activation input of the protective photoelectric sensor can be directly connected to terminal 1 on the TNT 34. The switching output of the receiver can be directly connected to terminal 4.

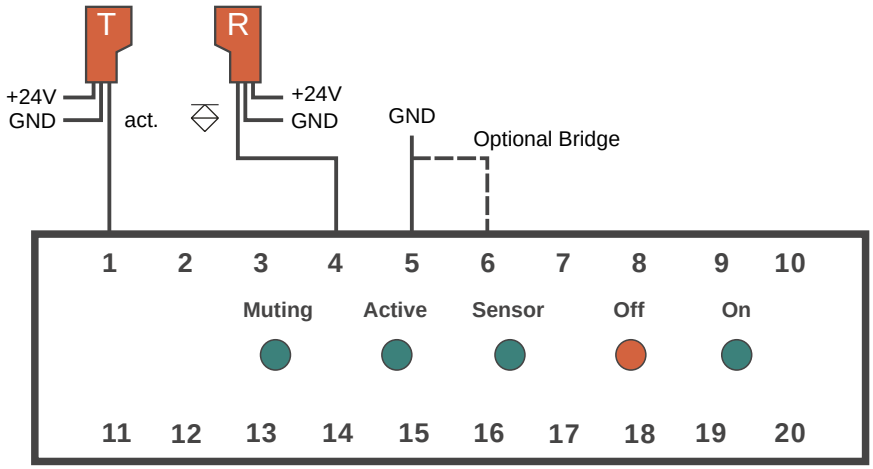


Figure 5.4: Wiring of single-beam protective photoelectric sensors (1)

The receiver input is a potential-free optical coupler input. It is essential that terminal 5 is connected to GND potential. For this purpose, you can install a bridge from terminal 5 to terminal 6 on the unit, or connect terminal 5 to GND. The supply of the protective photoelectric sensors comes directly from the 24V power supply unit.

possible sensors (selection): SLS 95, SLS 96, SRK 96, SLS 46, LS 763, ROBUST RRT 22, ROBUST RRT 23, ECO

5.2.4 Wiring of single-beam protective photoelectric sensors (2)

Transmitter - active low (NPN)

The activation input of the protective photoelectric sensor can be directly connected to terminal 2 on the TNT 34. The switching output of the receiver can be directly connected to terminal 4.

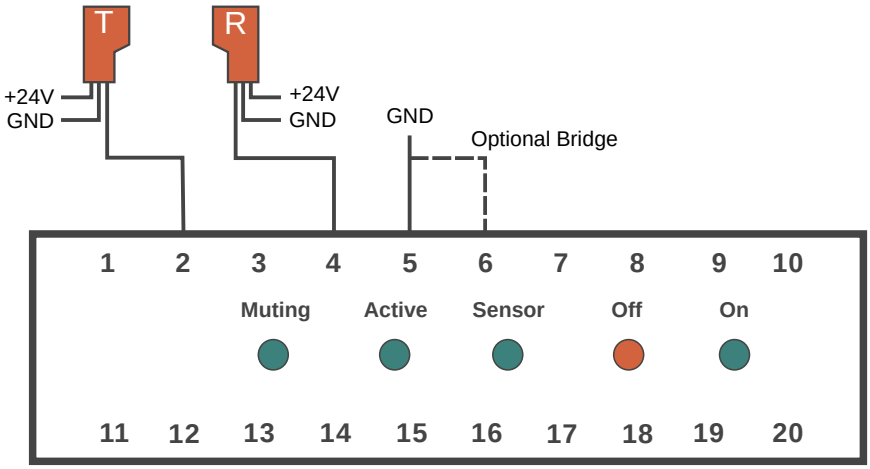


Figure 5.5: Wiring of single-beam protective photoelectric sensors (2)

The receiver input is a potential-free optical coupler input. It is essential that terminal 5 is connected to GND potential. For this purpose, you can install a bridge from terminal 5 to terminal 6 on the unit, or connect terminal 5 to GND. The supply of the protective photoelectric sensors comes directly from the 24V power supply unit.

possible sensors: TLS 85, TLS 72

5.2.5 Wiring of single-beam protective photoelectric sensors (3)

Transmitter - active high (NPN):

The activation input of the protective photoelectric sensor can be directly connected to terminal 3 on the TNT 34. The switching output of the receiver can be directly connected to terminal 4. The receiver input is a potential-free optical coupler input. It is essential that terminal 5 is connected to GND potential.

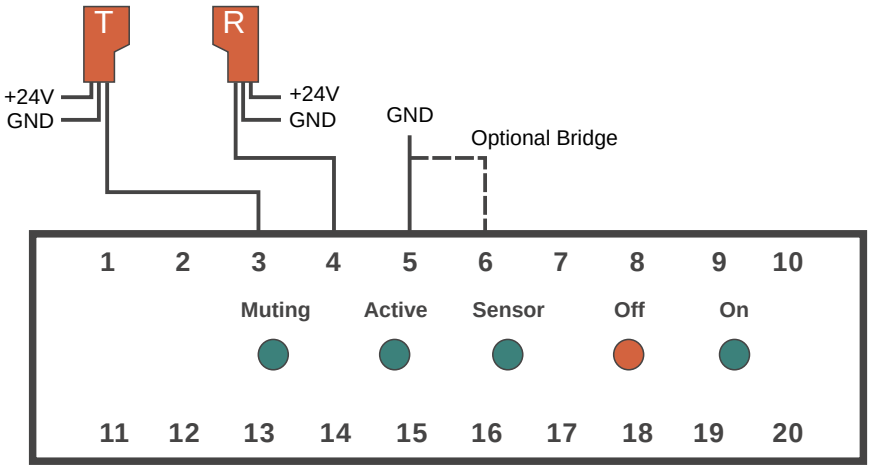


Figure 5.6: Wiring of single-beam protective photoelectric sensors (3)

5.2.6 Wiring protective photoelectric sensors in series (with active high (PNP) sensors only)

Several photoelectric sensor pairs can be wired in series on the TNT 34 if multi-axle safeguarding needs to be installed on a machine or system. The figure below illustrates a three-axle photoelectric sensor installation. It is possible to operate up to six photoelectric sensor pairs on one TNT 34.

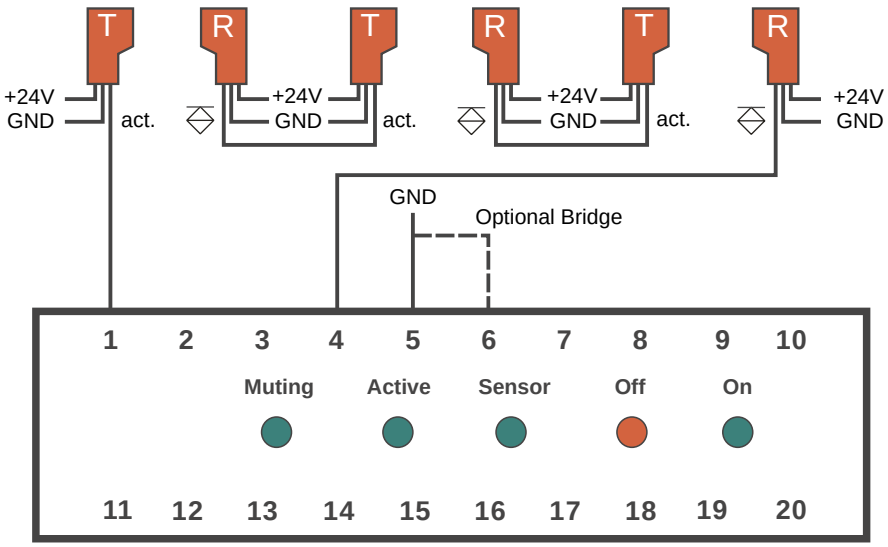


Figure 5.7: Wiring of protective photoelectric sensors in series connection

Function characteristics:

The TNT 34 (terminal 1) activates the first photoelectric sensor transmitter. The receiver is activated via the first optical path and, by using its output activates the second photoelectric sensor transmitter. The supply has to provided on each photoelectric transmitter and receiver. The feedback to the TNT 34 (terminal 4) is done by the last photoelectric sensor receiver within the series connection. When an arbitrary light axis is interrupted, the series circuit always signals this to the TNT 34. When testing, the series circuit causes each transmitter and receiver to be tested for functionality.

5.2.7 Wiring the muting interface

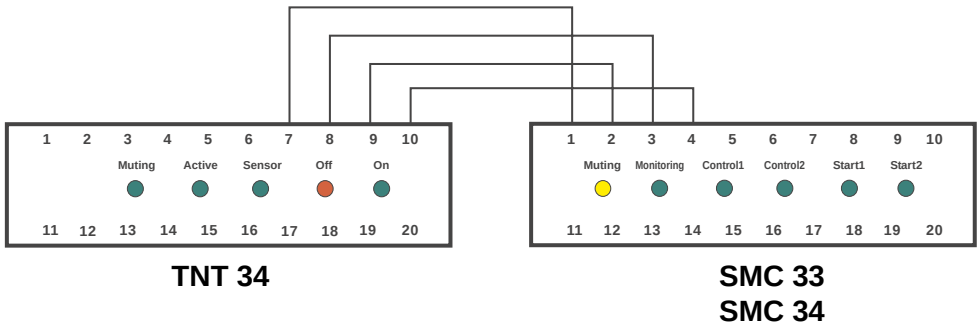


Figure 5.8: Wiring the muting interface

The test monitoring unit TNT 34 is designed for direct connection of the safety muting controller SMC 33 or SMC 34. Throughout the duration of the muting, the TNT 34 tests the safety muting controller in regular intervals.

Sequence:

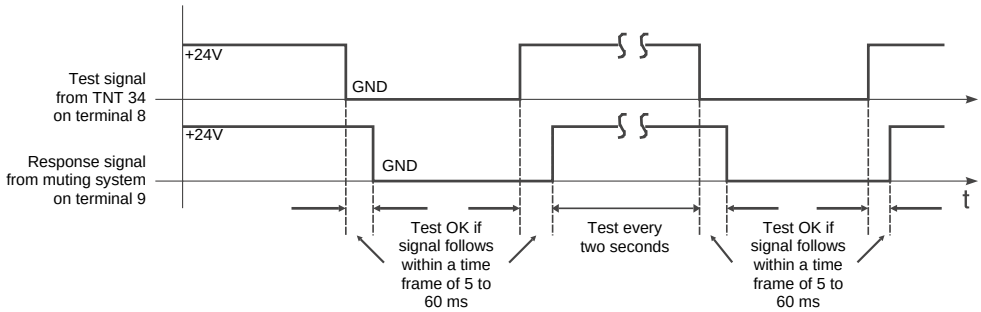


Figure 5.9: Testing sequence

The TNT 34 initiates the test by changing the signal on terminal 8 from high (+24V) to low (GND). The muting controller conected now has between 5 and 60 milliseconds to react to the test request by changing the signal on terminal 9 from high to low. This completes the first part of the test sequence.

The second part of the test begins with a signal change from low to high on terminal 8. Once again, the muting controller connected is given between 5 and 60 milliseconds to react to the request for signal change by changing the signal on terminal 9 from low to high.

Note that when using a muting controller, the muting controller must satisfy safety category 2. The safety muting controllers SMC 33 and SMC 34 satisfy the requirements of safety category 2 according to the respective standards and regulations.

Notice!

If the TNT 34 is operated without a muting function, this interface is not connected.

5.2.8 Wiring safety output

In the test monitoring unit TNT 34, two safety relay outputs are connected in series and are available as a potential-free, normally open contact on terminal 19 and 20. The release circuit may be connected to further components that are then wired to a common EMERGENCY SHUTDOWN unit. If required, this EMERGENCY SHUTDOWN unit must implement the function "lock startup and restart".

Attention!
If the TNT 34 is used, the functionality of the startup and restart lock must be provided by a supervising EMERGENCY SHUTDOWN unit or the machine's control system.

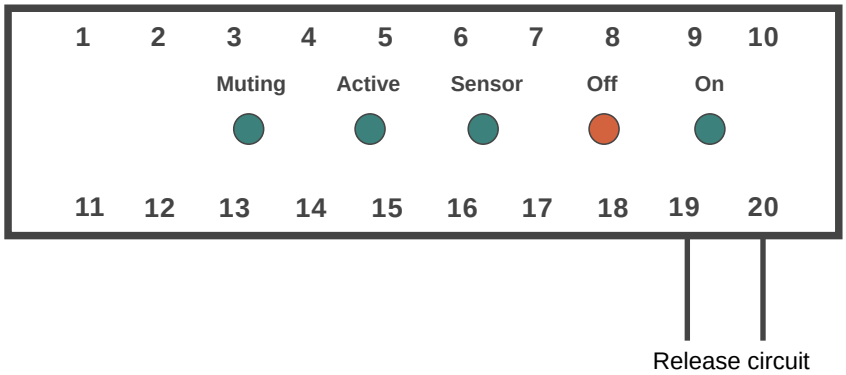


Figure 5.10: Wiring of the safety output without relay monitoring

5.2.9 Wiring of the message outputs

Two message outputs are integrated in the TNT 34. Both are HIGH active, positive switching semi-conductor outputs and can be either directly connected to a PLC or control a status display of a machine. When using standard light bulbs, the cold resistance of the filament must not be less than 2.4kOhm.

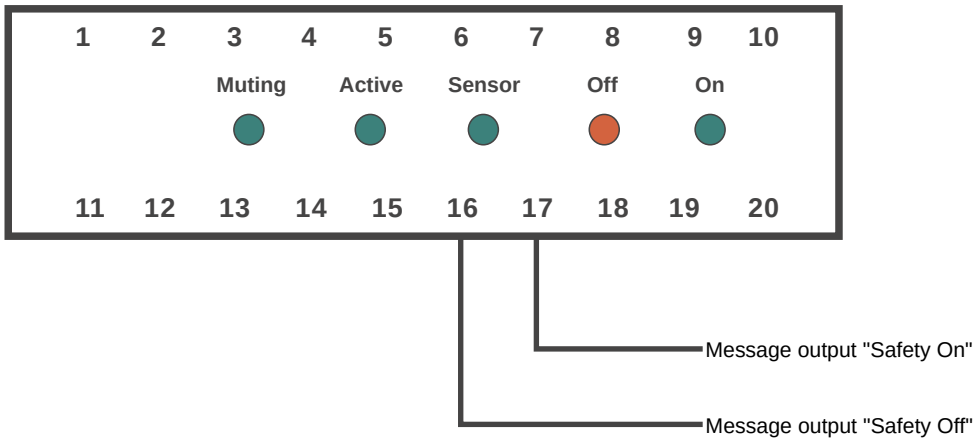


Figure 5.11: Wiring of the safety output with relay monitoring

The signal output "Safety off" is active whenever the safety relay output is open. The signal output "Safety on" has the opposite function, i.e., it is active whenever the safety relay output is closed.

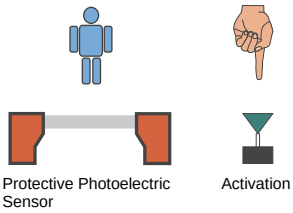
5.3 TNT 34 without Muting Function

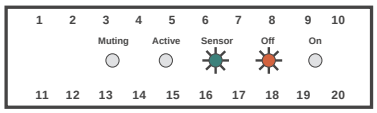
Stand-by operation:

During stand-by operation, the protective photoelectric sensor is clear (green LED "Sensor").

Activation is not used.

The safety output is open. This state is displayed by the red LED "Off".



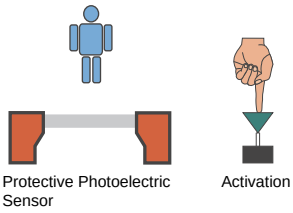


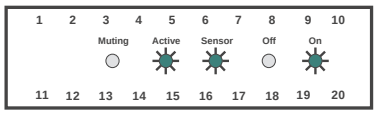
Safety operation:

In safety operation, the function of the protective photoelectric sensor is cyclically tested every two seconds. The free safety field is displayed by the green LED "Sensor".

The activation signal for the TNT 34 is present. This is also indicated by the green LED ("Active“).

The safety output is switched on. This is indicated by the green LED ("On“).

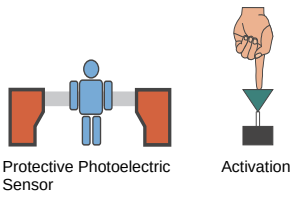


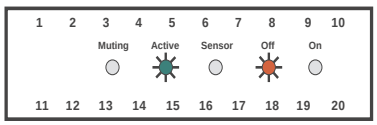


Safety field interruption:

If, during protection operation, the protective optoelectronic safety sensor's beam is interrupted, or the +24 V potential at the activation input is switched off, the safety output of the TNT 34 is opened (green LED "On“ is off, red LED "Off“ is on).

After the safety field has been cleared again and the startup test has been completed, the TNT 34 automatically switches the safety relay output back on again.





5.4 Error Messages on the TNT 34

The test monitoring unit TNT 34 tests the internal functions of the unit and the periperals connected in two-second intervals.

Faults in the periphery (e.g., protective photoelectric sensor or muting controller) are indicated by the flashing of the LED associated with the input in question. E.g., if a fault in the muting controller is detected, the LED "Muting“ will flash.

After the fault has been rectified, the locked state may be reset by briefly removing the operating voltage.
Equipment faults that are caused by an internal defect result in the unit going into locked state. This locked state may also be reset by interrupting the operating voltage.

5.5 Technical Data

Electrical data	
Operating voltage U_b	24VDC +/-15%
Residual ripple	< 15%
Current consumption	approx. 200 mA
Response time	< 20ms
Delay before start-up	approx. 2s

Sensors	
Transmitter activation	PNP (active high, terminal 1) NPN (active low, terminal 2) NPN (active high, terminal 3)
Receiver activation	potential free optical coupler input, input current approx. 10mA

Muting	
Muting test output	PNP (HIGH active)
Muting signal input	optical coupler input, input current approx. 10mA

In and outputs	
Activation input	potential free optical coupler input (HIGH active) input current approx. 10mA
Message output Safety off	PNP transistor output, 100mA short circuit- and polarity reversal protection
Message output Safety on	PNP transistor output, 100mA short circuit- and polarity reversal protection
Safety output	voltage free make-contact max. current load 4A
Fuse protection	externally with max. 4A slow blow
Overvoltage category according to VDE 0110 part 1	3 for rating voltage 300VAC

Environmental data	
Ambient temperature	-20°C - +60°C
Air humidity	humidity class G acc. to IEC 68 part 2-3
Storage temperature	-30°C - +70°C
Protection class	IP 40 (only for application in electrical operating rooms / switching cabinet with minimum protection class IP 54 is suitable)

Impact resistance / Vibration resistance	
EMC	acc. to EN 61496-1
Contact protection	acc. to VBG 4 and VDE 0106 part 100

Mechanical data	
Housing	polycarbonate, cover ABS / v-o grey
Connection	screw terminals, max. connection cross-section 2x 2,5mm acc. to DIN 46288
Mounting	snap-on mounting for standard rail
Weight	approx. 200g
Dimensions (H x W x D)	100mm x 78mm x 114mm

6 Safety Muting Controller SMC 33 / 34

6.1 Muting Basics

It is necessary to suppress the function of the protective photoelectric sensor for a certain period, if material has to be transported from or into the hazardous area. This suppression procedure is called muting.

The safety muting controllers SMC 33 and SMC 34 have two muting preparation signals Control 1 and Control 2, as well as two muting signals Start 1 and Start 2 for the muting function.

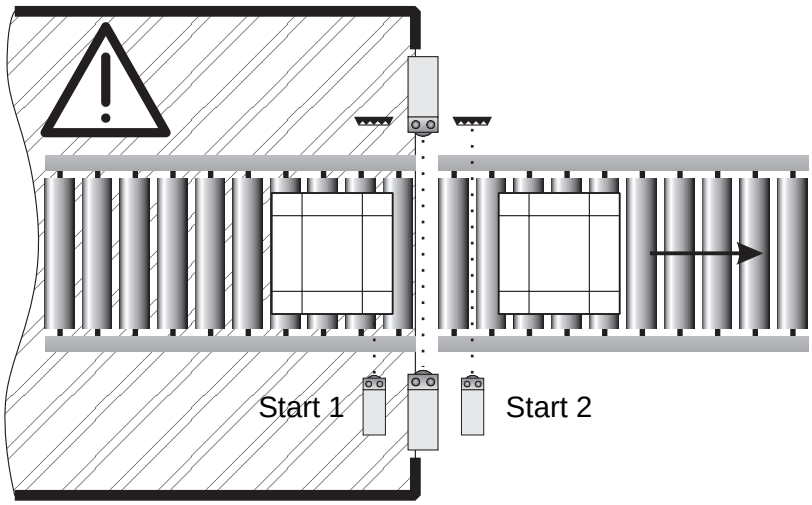


Figure 6.1: Muting signals Start 1 and Start 2

Notice!
The SMC 33 and SMC 34 differ only in the maximum test response time admissible, i.e., the SMC 33 is suitable for all applications in which sensors are directly connected to the safety muting controller as muting actuators (test response time 120 ms).

As the SMC 33's successor, the SMC 34 is also suitable for applications where an existing PLC takes over the function of the muting sensor, thanks to a doubled test response time of 240ms.

Both are equipped with a direction detection to avoid manipulation. The inputs Start 1 and Start 2 have to be activated in the correct order. During the muting procedure, both signals have to be permanently present. An interruption causes immediate abortion of the muting function (drop-off of safety relays).

The diagram illustrates the signal flows during the muting cycle.

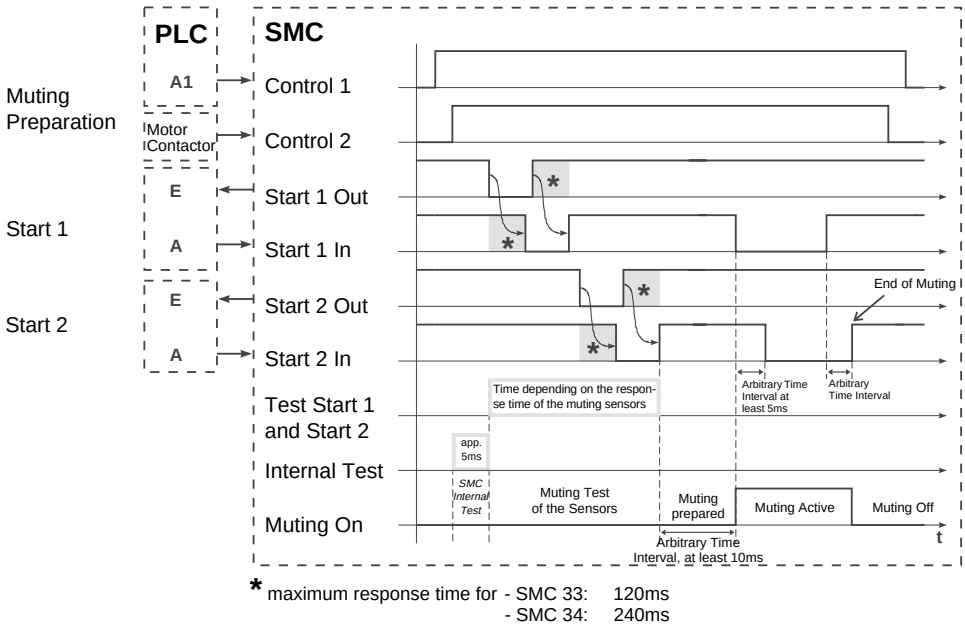


Figure 6.2: The diagram illustrates the signal flows during the muting cycle.

First, the two control signals on the SMC are activated by the control unit. Note that the control signals might originate from different signal sources. In the example above, the Control 1 signal comes from the PLC, the Control 2 signal has to be deduced from the pallet transport (contactor or NC drive).

For the function of the SMC, the connection order of the control signals is without meaning. The time period between connection of the first and second control signal can be between 0ms and an infinitely long time period. Only after both signals have been activated, the internal test of the SMC starts. The control signals have to be permanently active during the whole muting procedure.

The internal circuit and the connected muting light signals are tested during a time period of 5ms.

After a successful internal test, the connected muting sensors are tested. The SMC takes over the control function. The SMC "expects" a reaction to the issued signal changes from the signals of "Start 1" and "Start 2".

Each time when a change of potential is requested, the sensors are allowed a maximum response time of 120ms for the SMC 33 or 240ms for the SMC 34. After successful test completion of "Start 1" and "Start 2", the muting function is prepared - the SMC hands over the controlling function to the sensors.

As soon as the first muting sensor is darkened, that means the signal ("Start 1") switches off, the protective photoelectric sensor output signal is suppressed (muted). After a minimum time period of 5ms, the second photoelectric muting sensor can be interrupted, that means "Start 2" can be switched off. A maximum time period for this signal change is not monitored by the device, however, this procedure must be performed before a new activation of "Start 1" (direction detection).

"Start 1" can be re-activated after switching off of signal "Start 2" (direction detection).

The next step in the procedure is the completion of the muting function. This can be done in three different ways:

Switching off of the control signals

- deactivation of Control 1 (signal change from High to Low)
- deactivation of Control 2 (signal change from High to Low)

Switching on of Start 2

- activation of Start 2 (signal change from Low to High)

As soon as the SMC detects one of the mentioned signal changes, the suppression of the protective photoelectric sensor signals is immediately removed.

Case 1: End of muting through switching-off of Start 2.

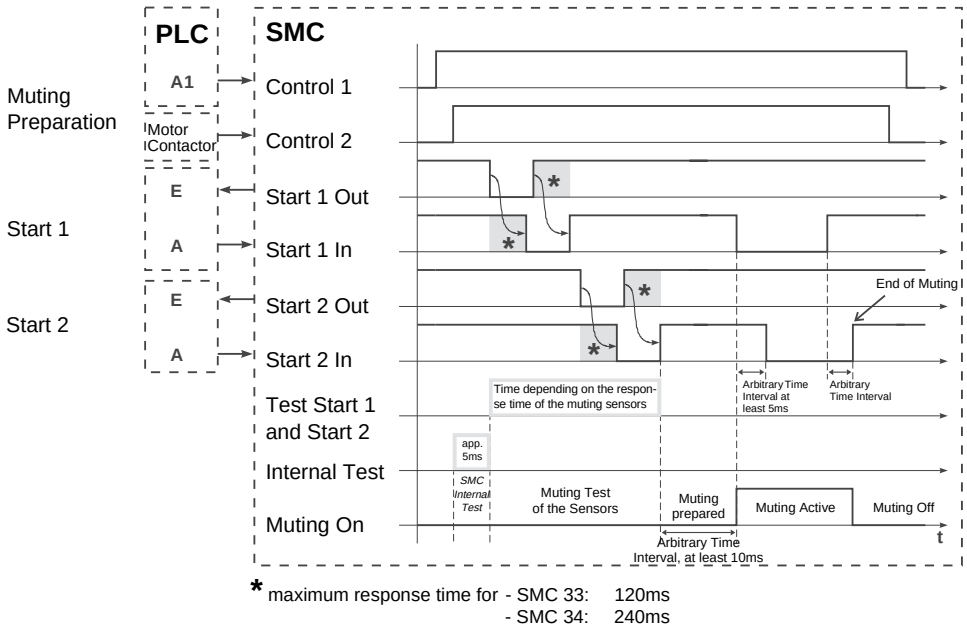


Figure 6.3: End of muting through switching-off of Start 2 (Diagram)

Case 2: End of muting through switching-off of "Control 1"

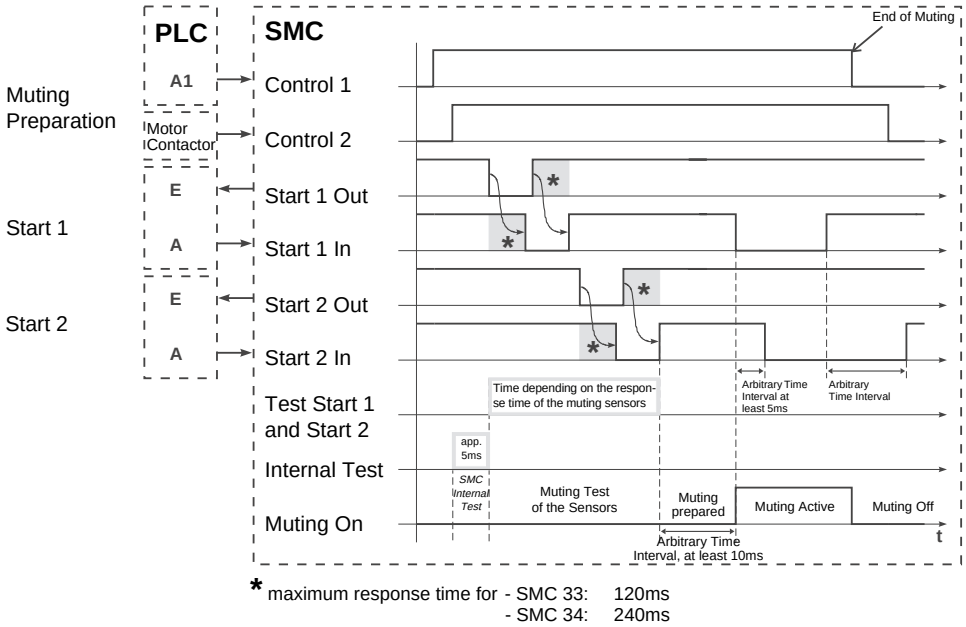


Figure 6.4: End of muting through switching-off of "Control 1" (Diagram)

Case 3: End of muting through switching-off of Control 2

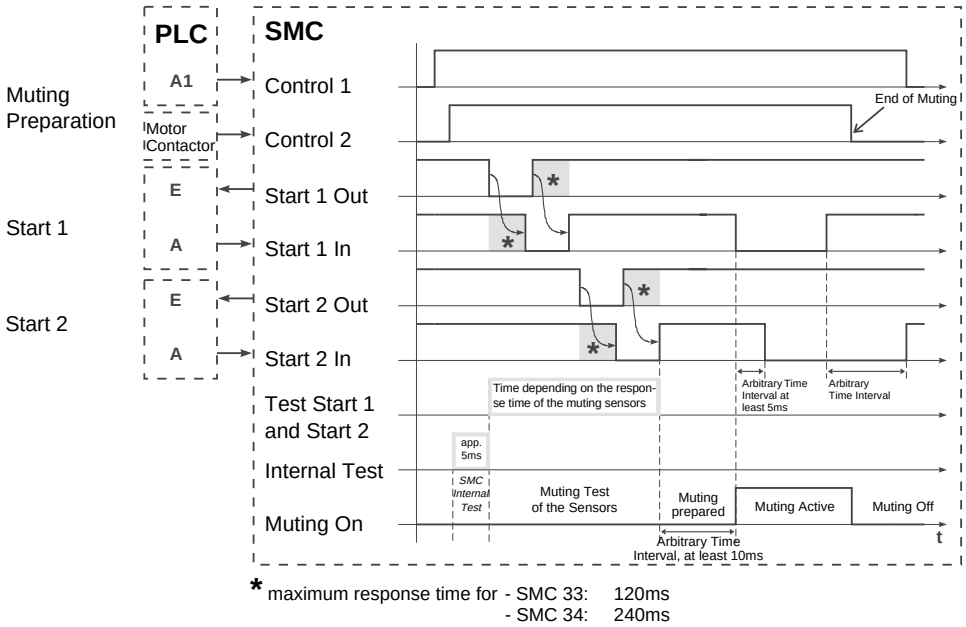


Figure 6.5: End of muting through switching-off of "Control 2" (Diagram)

6.1.1 New muting

A new activation of the muting function is only possible after completion of the basic state. The following conditions have to be fulfilled:

- Signal "Control 1" on LOW - potential
- Signal "Control 2" on LOW - potential

photoelectric sensor "Start 1" free

- Signal "Start 1 IN" on HIGH - potential

photoelectric sensor "Start 2" free

- Signal "Start 2 IN" on HIGH - potential

After that the muting can be restarted through activation of the two control signals.

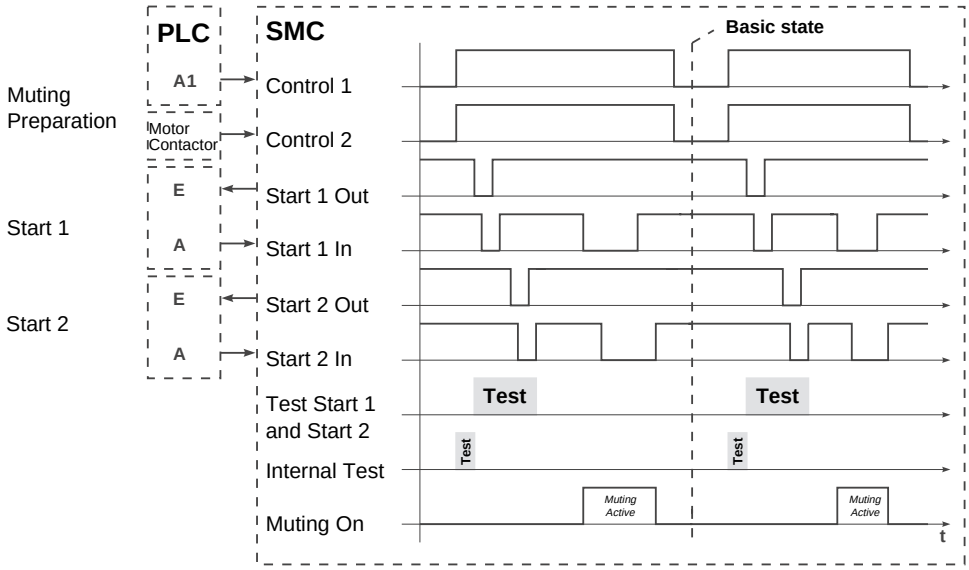


Figure 6.6: Flow diagram for repeated muting

6.2 Function and Commissioning

The entire muting system consist of the muting controller, a test monitoring unit, e.g., a TNT 33, and the associated muting sensors.

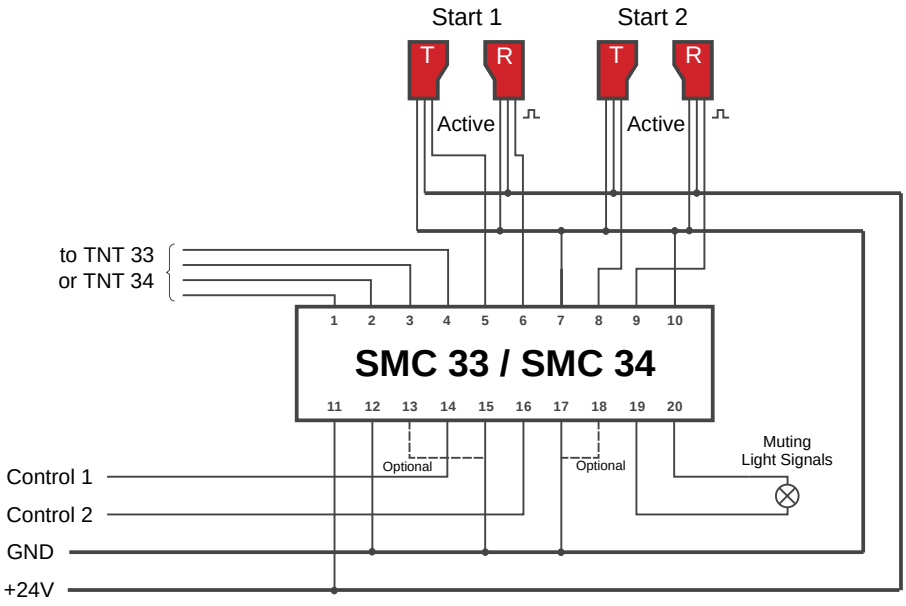


Figure 6.7: Complete muting system

6.2.1 Monitored muting indicator lamps

According to EN61496-1, it is required that one or more monitored indicator lamps with a luminance of at least 200 cd/m^2 and an area of at least 1 cm^2 must be used to show when a contactless safety system is in override. The indicator lamp can be connected directly to terminals 19 and 20 of the SMC. Conventional 24V indicator lamps may be used.

Notice!
The indicator lamps must be connected under any circumstances - otherwise it is impossible to initiate a muted state.

In combination with a test monitoring unit, e.g., TNT 33, the SMC 33 and SMC 34 satisfy the requirements of safety category 2 according to EN 61496-1 or EN 954-1.

6.3 Display and Operating Instruments

The safety muting controllers SMC 33 und SMC 34 feature LEDs as system status indicators.

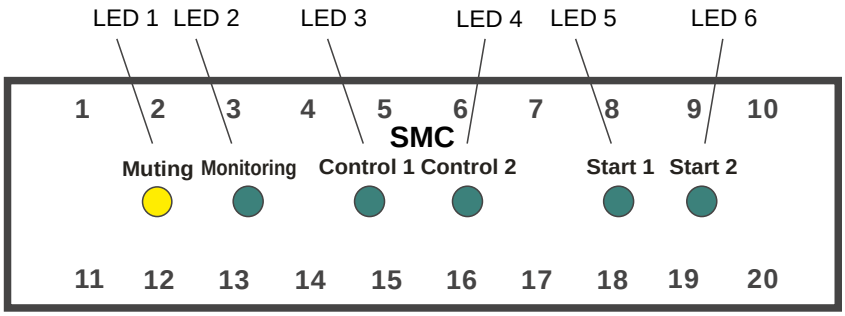


Figure 6.8: Display elements SMC 33 / 34

Overview - Display and Operating Elements

LED no.	LED description	Function characteristics
LED 1	Muting	Status display muting activated
LED 2	Monitoring	Status display muting lamp
LED 3	Control 1	Status display muting preparation "Control 1"
LED 4	Control 2	Status display muting preparation "Control 2"
LED 5	Start 1	Status display muting sensor "Start 1"
LED 6	Start 2	Status display muting sensor "Start 2"

6.4 Electrical Installation

The electrical installation is only to be performed by specialized personnel. During installation it has to be observed that supply and signal lines have to be installed separately from power lines. Inside the switching cabinet, suitable spark extinction has to be provided if using contactors. In connection with driving motors and breaks, the corresponding manuals have to be observed.

6.4.1 Supply wiring

The safety muting controllers SMC 33 and SMC 34 are supplied with 24VDC +/-15%. Current consumption is max. 100mA (without active muting light signals).

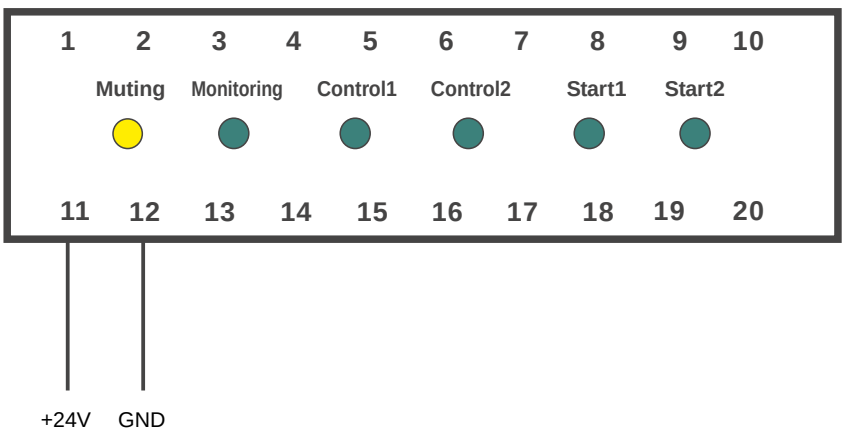


Figure 6.9: Supply wiring

6.4.2 Wiring control signals

Before every muting procedure, a muting preparation signal has to be connected to the inputs Control 1 (terminal 14) and Control 2 (terminal 16). Control 1 and Control 2 are HIGH active. The control signals can be connected to the SMC 33 and SMC 34 in any order. The test of the muting sensors is performed as soon as both signals are connected. The control signals have to be generated by two different signal sources. That means either two contactor contacts or one contactor contact and one PLC output can be used.

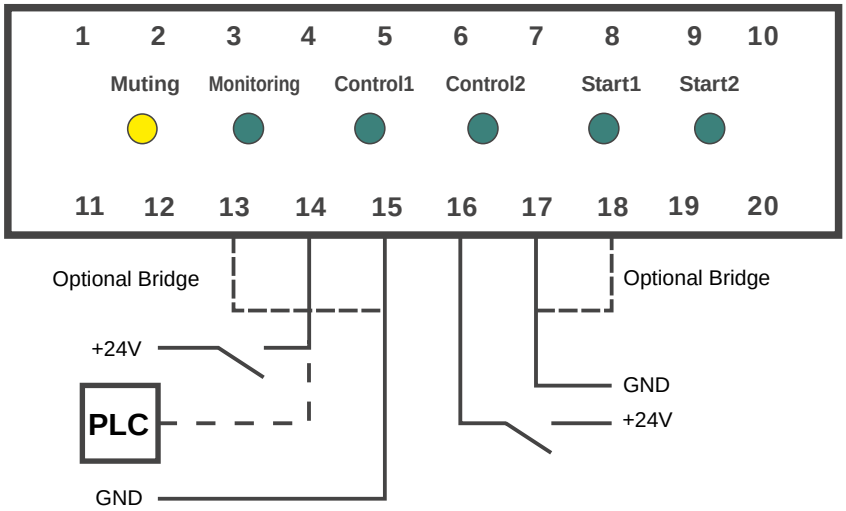


Figure 6.10: Wiring control signals

Terminals 15 and 17 must be wired to GND potential under any circumstances, as the Control inputs have been implemented as potential-free optical coupler inputs. For convenience, the GND potential present at terminals 13 and 18 may be used for this purpose.

6.4.3 Wiring of the muting light signal

According to EN 61496-1, one or more monitored muting light signals with a light density of at least 200 cd/m^2 and an area of at least 1 cm^2 have to be used to display the muting state. The SMCs offer a direct connection for a light indicator.

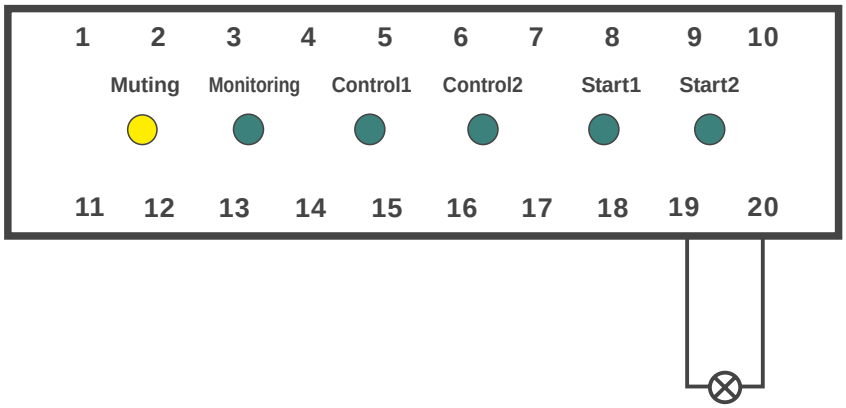


Figure 6.11: Wiring of the muting light signal

Notice!
This light indicator is absolutely essential for the muting function. If the indicator fails, an error message is generated (LED "Monitoring" flashes). No further muting process is possible until the bulb has been replaced or the fault has been rectified.

6.4.4 Wiring of the muting signals Start 1 and Start 2

Muting sensors: Throughbeam- or retro-reflective photoelectric sensors with activation input (PNP HIGH active) can be used as muting sensors on the SMC 33 and SMC 34.

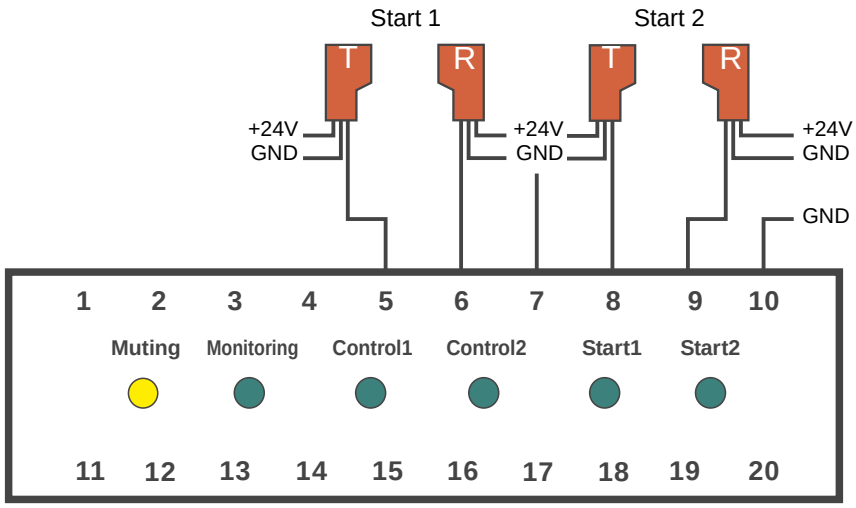


Figure 6.12: Wiring of the muting signals Start 1 and Start 2

The activation inputs of the sensors are connected directly to terminals 5 and 8, the switching outputs are wired to terminals 6 and 9. Terminals 7 and 10 must be connected to the sensors' GND potential; the inputs for Start 1 and Start 2 are floating optical coupler inputs.

Control signals: For the bypass function of the protective photoelectric sensor, PLC control signals can be used. For this purpose, inputs and outputs of the PLC are used as muting senders. The functions muting start and muting stop are then induced by the PLC. The PLC is programmed to react on the test request of the SMC. The test of the PLC inputs and outputs is induced before every muting procedure while connecting the control signals.

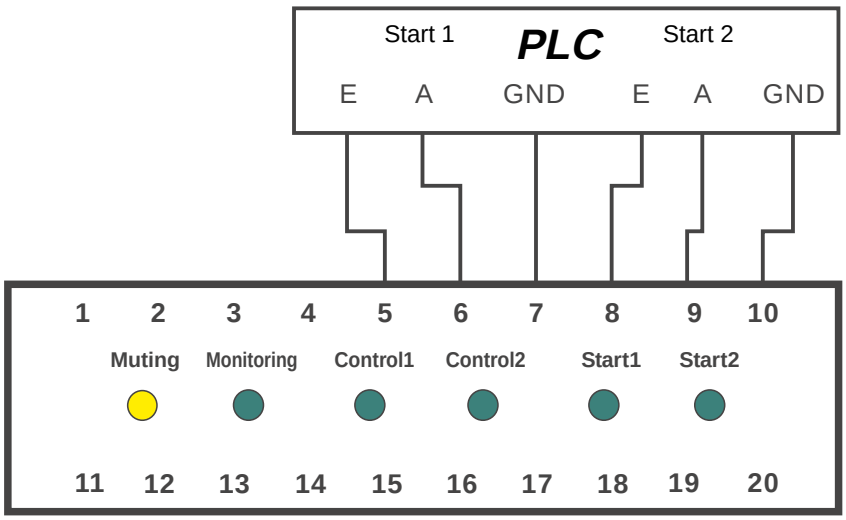


Figure 6.13: Wiring an SMC 33 / 34 in conjunction with a PLC

Attention!
The control signals control 1 and control 2 have to be generated by two different signal sources if a PLC is used as muting sender. Control 1 can come from the PLC, whereas control 2 will be deduced from a contactor which switches the conveyor belt on and off.

6.4.5 Wiring the muting interface

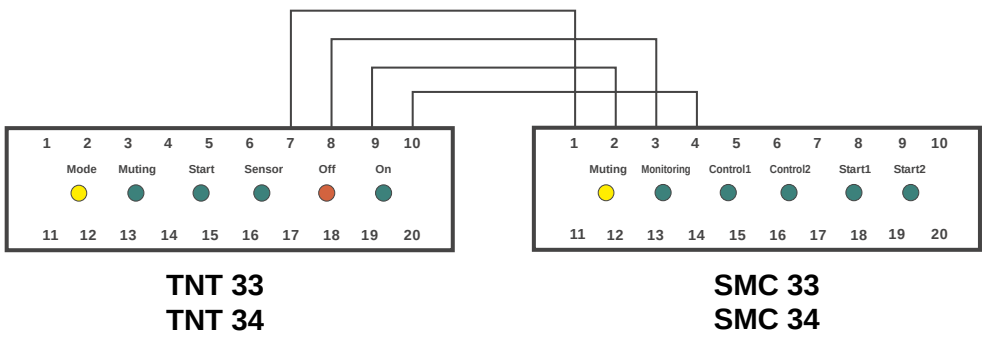


Figure 6.14: Wiring the muting interface

The safety muting controllers SMC 33 and SMC 34 are designed for connection to the test monitoring units TNT 33 and TNT 34. Throughout the duration of the muting, the safety muting controller is tested at regular intervals by the test monitoring unit. This includes the internal evaluation circuit, the muting sensors, and the muting light indicator connected.

6.4.6 Operating states with muting function

The muting process of the SMC 33 and SMC 34 may be divided into a total of eight phases.

Phase 1:	Activation of muting preparation through connection of the control signals
Phase 2:	Activation of muting through interruption of Start 1
Phase 3:	The protective photoelectric sensor is interrupted
Phase 4:	Continuation of muting through interruption of Start 2
Phase 5:	Continuation of muting through release of Start 1
Phase 6:	Protective photoelectric sensor is released
Phase 7:	End of muting through release of Start 2
Phase 8:	Basic state is again obtained through deactivation of control signals

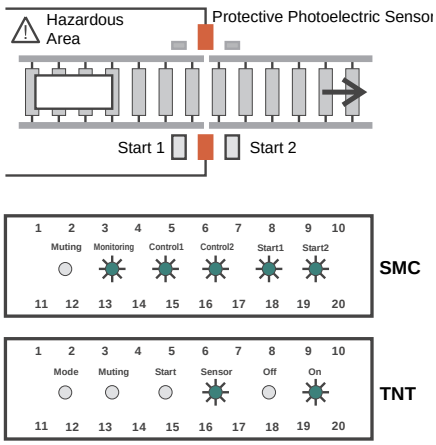
The following figures show the muting process phase-by-phase with the associated display status on the TNT and SMC.

Muting phase 1:

The control signals are activated. The first muting phase is displayed through the LEDs for control 1 and control 2.

The muting sensors "Start 1" and "Start 2" are tested in this state. If an error occurs during this test, it is indicated by the flashing LEDs "Start 1" and/or "Start 2".

The muting light signal is also tested. If a fault in the light indicator or the cabling is detected, the "Monitoring" LED on the muting controller will flash.

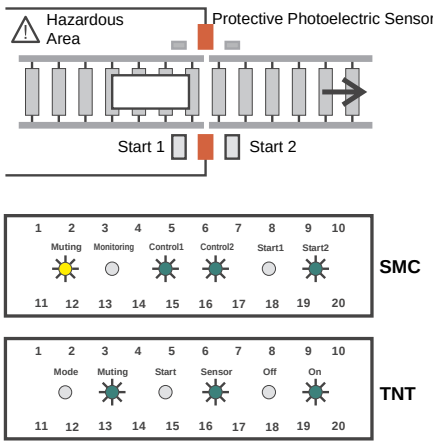


Muting phase 2:

Activation of muting through interruption of Start 1.

The indicator diode for "Start 1" goes off, the LEDs for "Control 1" and "Control 2" remain active.

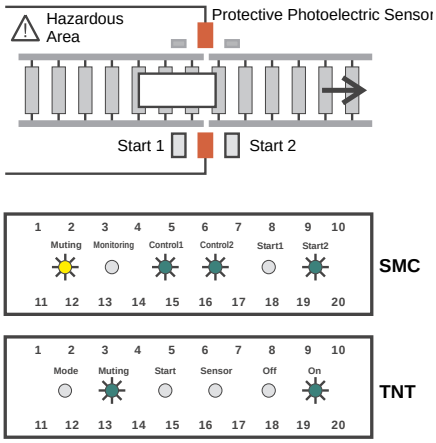
The muting status is indicated on both SMC and TNT by active "Muting" LEDs.



Muting phase 3: The protective photoelectric sensor is interrupted.

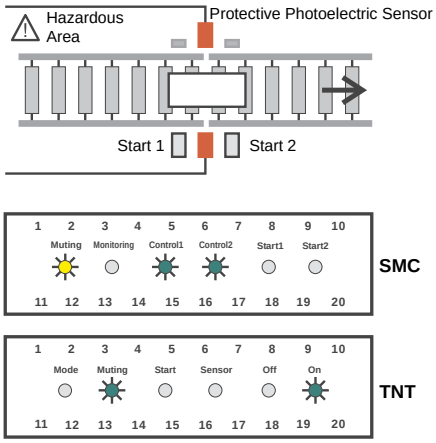
The indicator LED for "Sensor" on the TNT is turned off; the LEDs for "Control 1" and "Control 2" remain active.

The safety output remains switched on.



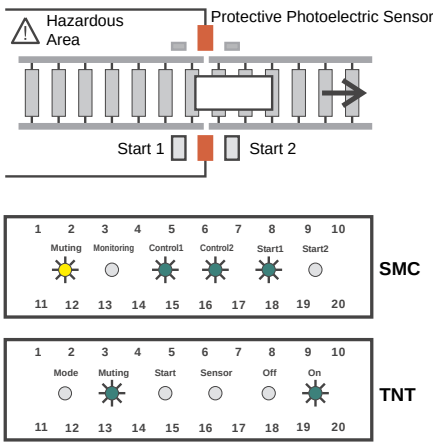
Muting phase 4: Continuation of muting through interruption of Start 2.

The indicator diode for "Start 2" goes off, the LEDs for "Control 1" and "Control 2" remain active.



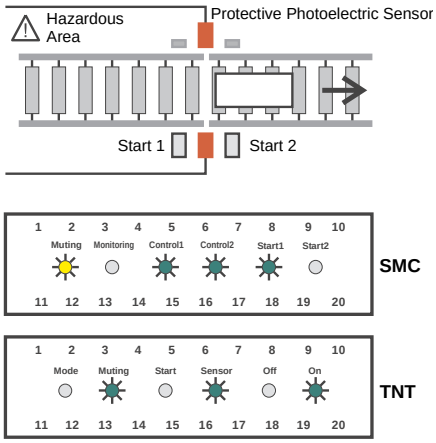
Muting phase 5: Continuation of muting through release of Start 1.

The indicator diode for "Start 1" lights up, the LEDs for "Control 1" and "Control 2" remain active.



Muting phase 6: Muting is continued through release of the protective photoelectric sensor.

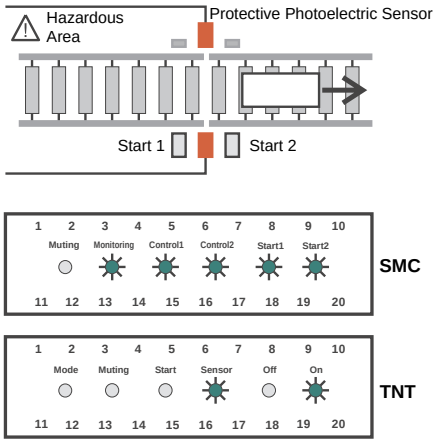
The indicator diode for "Sensor" on the TNT lights up; the LEDs for "Control 1" and "Control 2" remain active.



Muting phase 7: End of muting through release of Start 2

The indicator diode for "Start 2" lights up, the LEDs for "Control 1" and "Control 2" remain active.

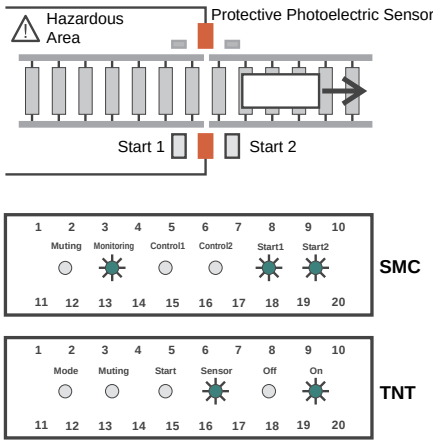
The "Muting" LEDs on both TNT and SMC are switched off.



Muting phase 8: Basic state is again obtained through deactivation of control signals.

The indicator diodes for "Control 1" and "Control 2" go off.

A new muting cycle can be started by activating the control signals.



6.5 Applications

In the following section, a number of examples of applications are given, which illustrate the wide application areas of the SMC 33 and SMC 34.

Notice!
In all examples the transport direction is given via the set-up of the muting sensors Start 1 and Start 2. The transported material must always pass the muting sensor Start 1 first.

Attention!
The muting sensors should be set-up in the immediate vicinity of the separating safety system. After the muting process has been triggered by the muting sensors, there must be no access to the hazardous area for persons, i.e., the access must be "blocked" by the goods in transit.

6.5.1 Application with throughbeam photoelectric sensors

Throughbeam photoelectric sensors may be connected directly to the SMC 33 and SMC 34 if the transmitters of the photoelectric sensors are equipped with an activation input (PNP active high).

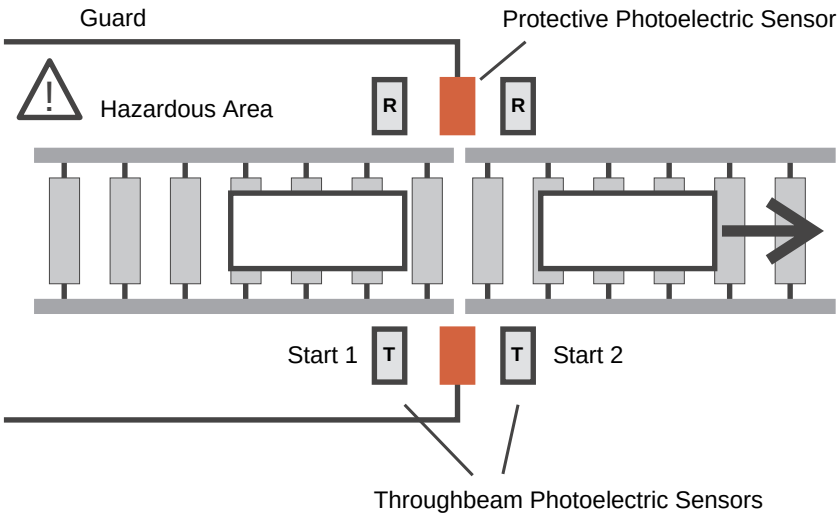


Figure 6.15: Safety system for a palletiser (loader) with throughbeam photoelectric sensors as muting sensors

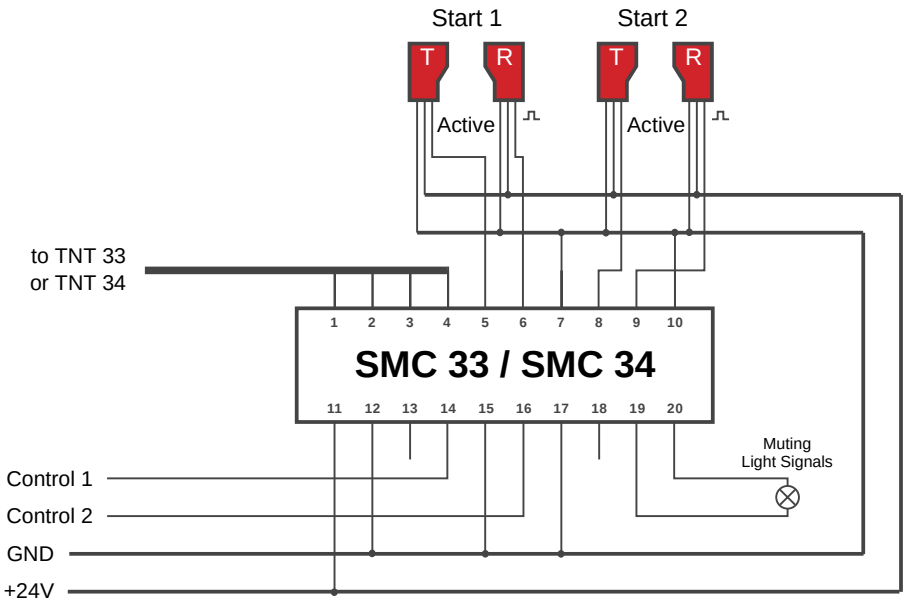


Figure 6.16: Wiring the SMC and the sensors

6.5.2 Application with retro-reflective photoelectric sensors

Retro-reflective photoelectric sensors may be connected directly to the SMC 33 and SMC 34 if the sensors are equipped with an activation input (PNP active high).

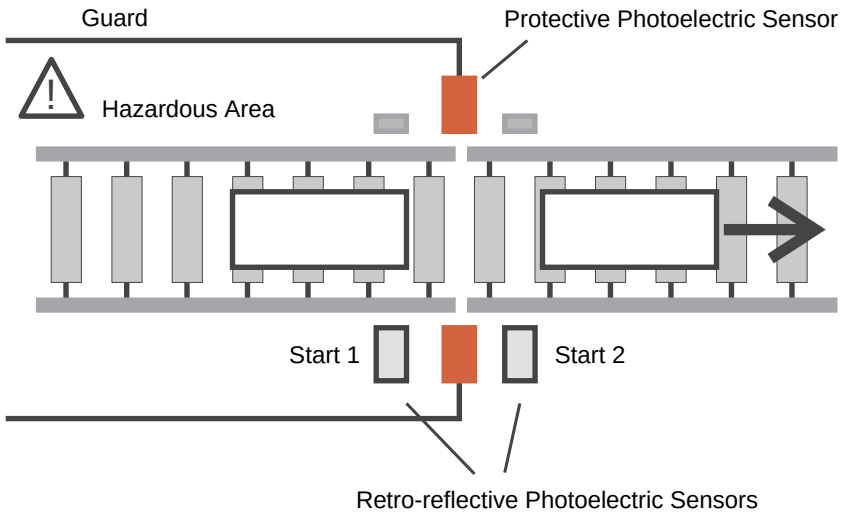


Figure 6.17: Safety system for a palletiser (loader) with retro-reflective photoelectric sensors as muting sensors

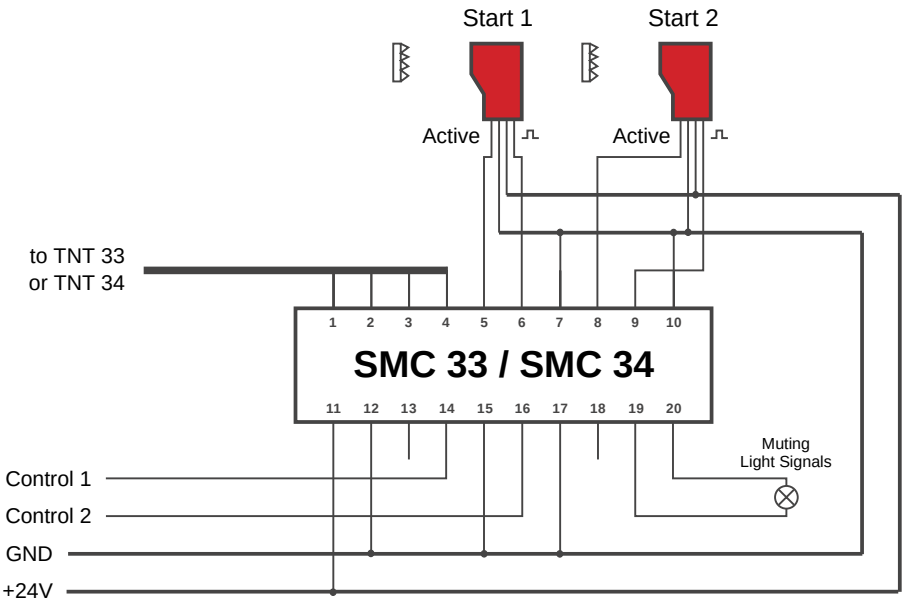


Figure 6.18: Wiring the SMC and the sensors

6.5.3 Application with safety switches

With the SMC 33 and SMC 34, it is possible to use forced-open safety switches with NO/NC combination according to EN 60947 as muting sensors.

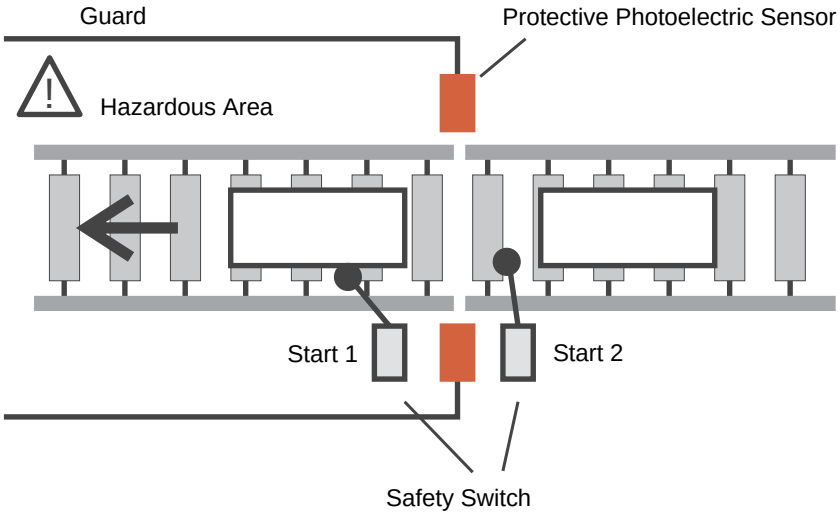


Figure 6.19: Safety system for a depalletiser with safety switches according to EN 60947

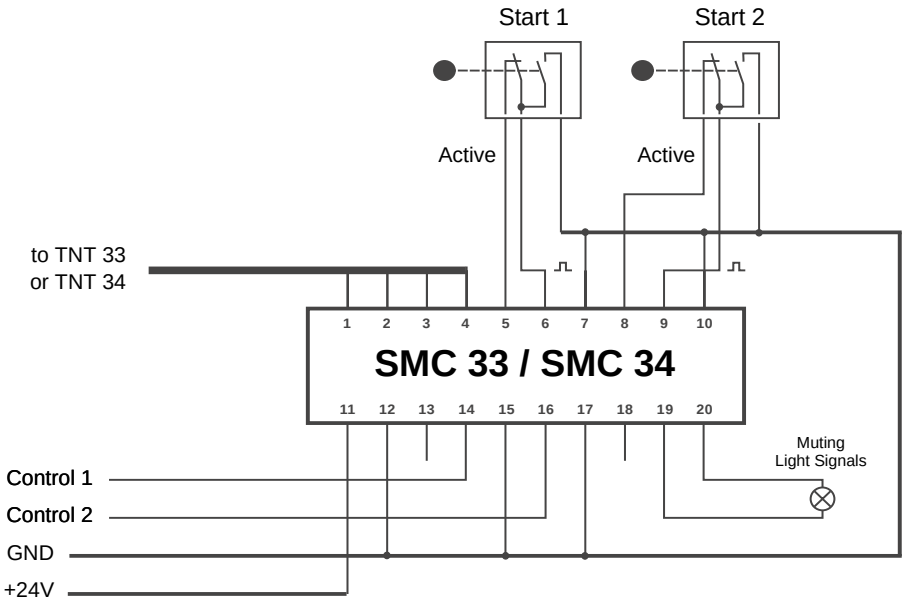


Figure 6.20: Wiring the SMC and the sensors

6.5.4 Application with PLC

It is possible to use an existing PLC for the muting control, provided that the following conditions are met:

For the muting preparation and the muting sensors, signals from the PLC are used exclusively. In the following example application, the activation of conveyor belt 1 serves as muting preparation. The muting is activated while conveyor belt 2 is active. When conveyor belt 3 is activated, the muting is deactivated.

Attention!
When PLC signals are used, it may be impossible to determine the exact location of the goods in transit, i.e., the access to the danger area may be open when the muting starts, instead of being blocked by the transported material. Leuze therefore recommends the use of a lock for the transported material, which covers the access to the danger area during the entire muting process. The switching of the conveyor belts and the layout of the guard system used as the material lock must be compatible with the muting controller.

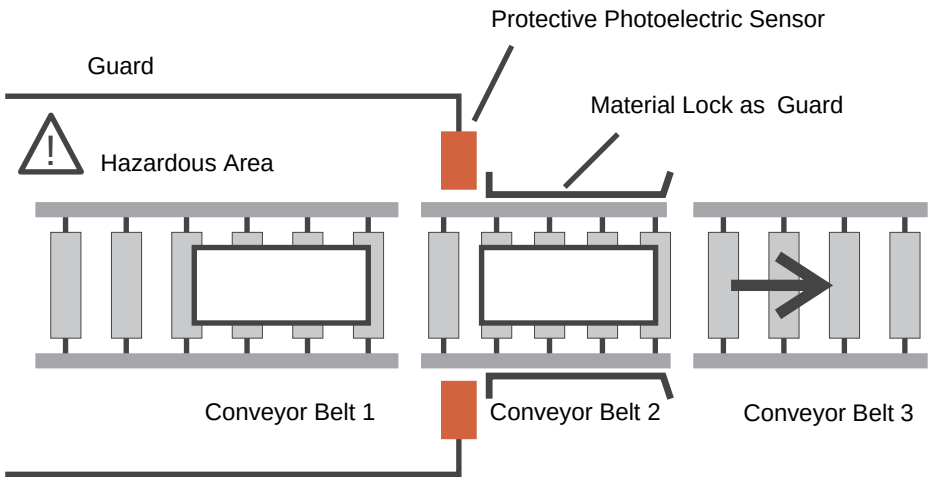


Figure 6.21: Safety system for a palletiser (loader), using PLC control signals as muting sensor signals, and a lock guard.

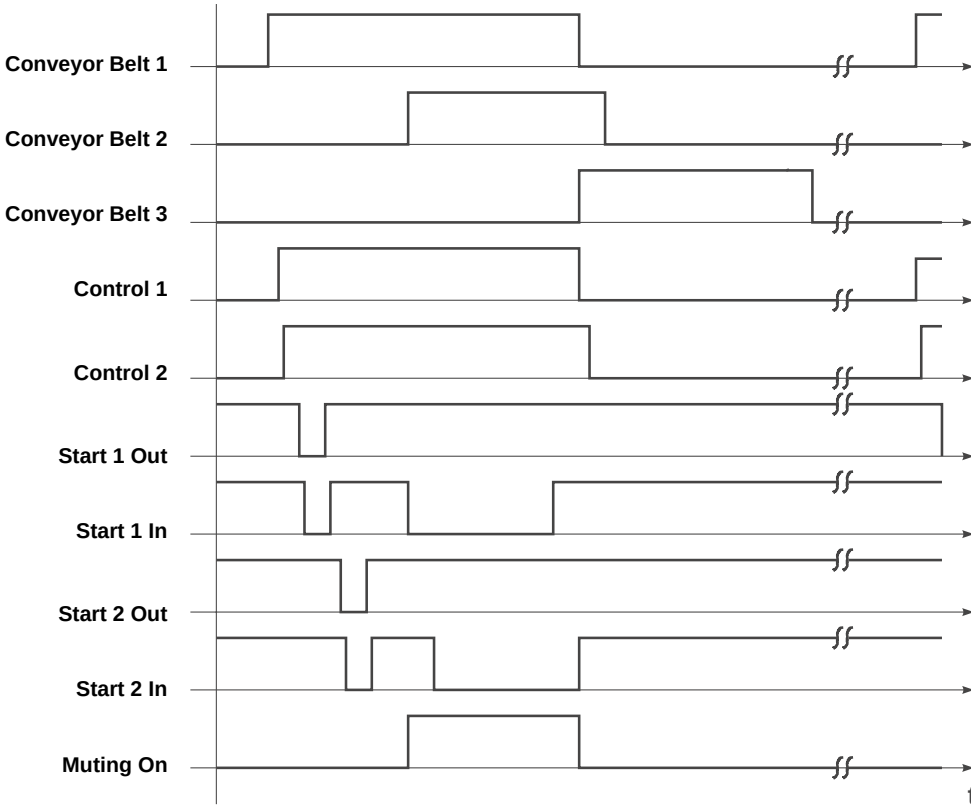


Figure 6.22: General flow of the muting process and its associated control signals (timing diagram)

6.5.5 Application - continuous transport system

In the case of a continuous transport system, it is not possible to derive the signals Control 1 and Control 2 from the conveyor belt control system. Instead, they may be provided by a retro-reflective photoelectric sensor that is arranged as shown in the following figure.

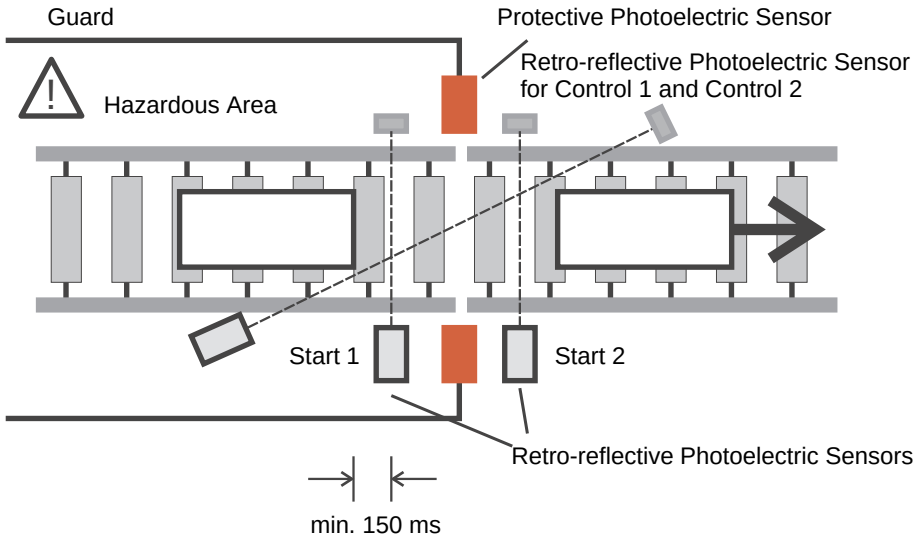


Figure 6.23: Safety system for a palletiser (loader), with retro-reflective photoelectric sensors as muting sensors and for the provision of the control signals for a continuous transport system

Notice!

The retro-reflective photoelectric sensor[1)] for Control 1 and Control 2 must be positioned in such a way that the signal is present at the SMC at least 150ms before the muting signal Start 1. In this case, the inputs Control 1 and Control 2 are connected in parallel.

Inbetween pallets on the continuous transport belt, the retro-reflective photoelectric sensor for Control 1 and Control 2 must briefly switch to "clear". Exception: the pallets arrive immediately after one another **without gaps**.

[1)] *The switching output of the retro-reflective photoelectric sensor must **switch when dark**, i.e., when the light beam is blocked, the switching output must be on high.*
***suitable sensors:** PRK 96 K/P... , PRK 96 M/P... , PRK 46/44-S12*

6.5.6 Application - bidirectional muting

In certain applications, it is necessary to transport the goods into the hazardous area using a conveyor and then remove them along the same path after processing. This may be the case, e.g., for a foil wrapper.

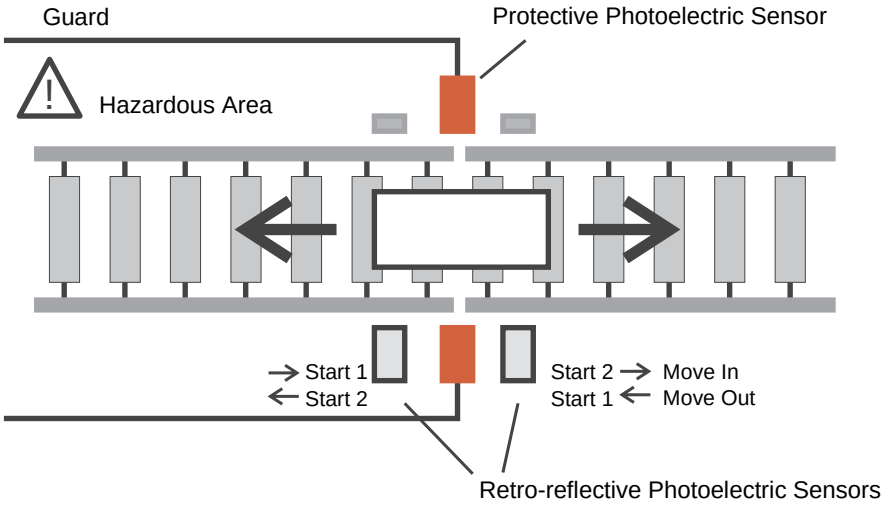


Figure 6.24: General arrangement for bidirectional muting

The detection of direction in the muting controller requires external direction switching for the muting sensors. For this purpose, a relay with four toggle contacts is used.

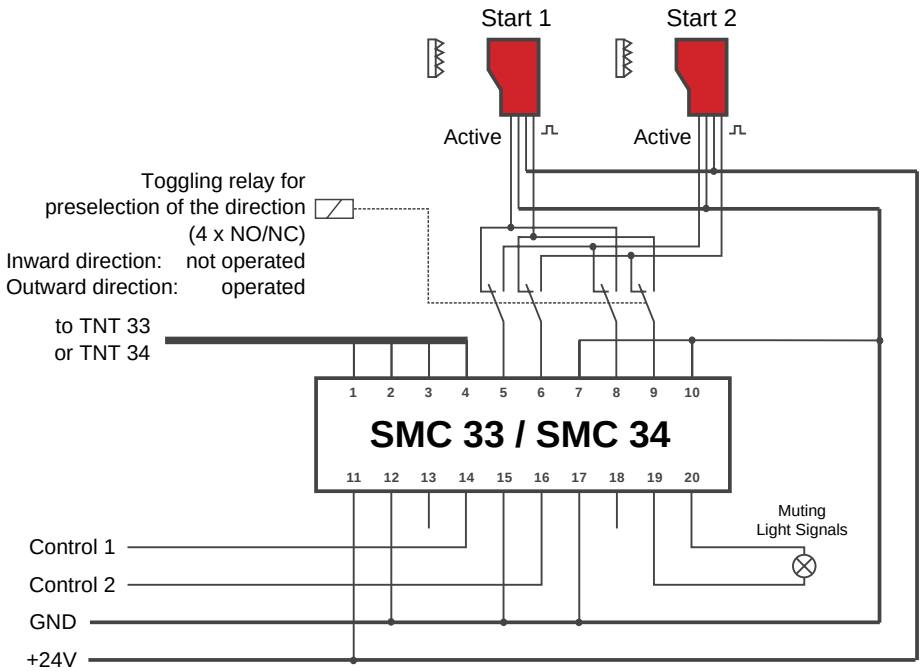


Figure 6.25: Wiring of the muting sensors, relay, and muting controller

Notice!

Note that the direction must have been preselected before the muting preparation signals Control 1 and Control 2 are applied.

6.6 Starting the Plant while the Photoelectric Safety Sensor is Darkened

If, for example, after an emergency stop of the plant, the goods in transit darken the photoelectric safety sensor, it is still possible to clear the test monitoring units TNT 33 and TNT 34 with the safety muting controllers SMC 33 oder SMC 34 connected.

To enter this "clearing mode", the power supply to the SMC must be switched off first. It can then only be activated if the power to the SMC returns.

The "clearing mode" is used when the SMC is used together with through-beam or retro-reflective photoelectric sensors. When a PLC is used, the safety system may be cleared without switching off the supply.

"clearing mode" procedure:

1. Plant in EMERGENCY STOP	Switch off power supply to SMC
2. Switch the supply on again, wait for two seconds until ready	
3. Activate the muting preparation Control 1 and Control 2 to high	SMC activates the muting output
4. Push TNT start button	TNT closes the release circuit
5. Switch plant back on	protective photoelectric sensor is clear again as the transported goods are removed
6. Plant reverts to automatic operation	

6.7 Error Messages on the SMC

The safety muting controllers indicate faults relating to the signals connected by flashing the LED associated with the input in question. The flashing stops once the fault has been remedied and the supply has been interrupted for a brief period.

Equipment faults that are caused by an internal defect result in the unit going into locked state. This locked state may be reset by briefly interrupting the operating voltage.

Faults relating to the muting light indicator are reported by a flashing "Monitoring" LED. Only after the fault has been rectified, the locked state may be reset by briefly removing the operating voltage.

6.8 Technical Data

Electrical data	
Operating voltage U_b	24VDC -10% / +15%
Residual ripple	< 15%
Current consumption	approx. 100 mA
Delay before start-up	approx. 2s

Sensors	
Activation of the muting sensors	PNP (HIGH active)
Muting sensor input	potential free optical coupler input, input current approx. 10mA

In and outputs	
Muting preparation	optical coupler inputs (HIGH active) input current approx. 10mA
Muting light signals	make-contact, 24V, max. 2A integrated spiral-wound filament monitoring

Environmental data	
Ambient temperature	-20°C - +60°C
Air humidity	Humidity class G acc. to IEC 68 part 2-3
Storage temperature	-30°C - +70°C
Protection class	IP 40 (only for application in electrical operating rooms / switching cabinet with minimum protection class IP 54 is suitable)

Impact resistance / Vibration resistance	
EMC	acc. to EN 61496-1
Contact protection	acc. to VBG 4 and VDE 0106 part 100

Mechanical data	
Housing	polycarbonate, cover ABS / v-o grey
Connection	screw terminals, max. connection cross-section 2x 2,5mm acc. to DIN 46288
Mounting	snap-on mounting for standard rail
Weight	approx. 200g
Dimensions (H x W x D)	100mm x 78mm x 114mm

6.9 Muting Sensors for Use with the SMC 33 and SMC 34

6.9.1 Throughbeam photoelectric sensors

Article no.	Model	Operating range	Light source	Output	Voltage	Connection	Feature
	Series 96						
	LS 96M/P-1130-2	50m	IR	PNP	10 - 30 V	terminals	Activation input
50025223	LSS 96M-1090-24						Transmitter
50025201	LSE 96M/P-1130-22						Receiver
	Series 46						
	LS 46/44.8-S12	30m	IR	PNP	10 - 30 V	12 m	Activation input
50081245	LSS 46.8-S12						Transmitter
50081248	LSE 46/44-S12						Receiver
	Series 3						
	LSR 3/44.8	6m	Red light	PNP	10 - 30 V	Cable	Activation input
50030996	LSSR 3.8						Transmitter
50031276	LSER 3/44						Receiver
	LSR 3/44.8-S8	6m	Red light	PNP	10 - 30 V	M8	Activation input
50030995	LSSR 3.8-S8						Transmitter
50031275	LSER 3/44-S8						Receiver
	Series 95						
	ILS 95/44.8-L.1	8m	IR	PNP	10 - 30 V	12 m	Activation input
50026835	LS 95/2.8 SE-L.1						Transmitter
50026836	ILS 95/44 E-L.1						Receiver
	ILSR 95/44.8-L	8m	Red light	PNP	10 - 30 V	12 m	Activation input
50025606	LSR 95/2.8 SE-L						Transmitter
50025608	ILSR 95/44 E-L						Receiver
	Series 92						
	LS 92/4.8-L	12m	IR	PNP	10 - 30 V	12 m	Activation input
50022703	LS 92/2.8 SE-L						Transmitter
50022704	LS 92/4 E-L						Receiver
	LS 92/4.8-L.5	12m	IR	PNP	10 - 30 V	12 m	Activation input Stainless steel
50022688	LS 92/2.8 SE-L.5						Transmitter
50022689	LS 92/4 E-L.5						Receiver
	LS 92/4.8-S	12m	IR	PNP	10 - 30 V	Plug	Activation input
50011218	LS 92/2.8 SE-S						Transmitter
50011217	LS 92/4 E-S						Receiver
	LS 92/4.8, 6000	12m	IR	PNP	10 - 30 V	Cable	Activation input
50023960	LS 92/2.8 SE, 6000						Transmitter
50023961	LS 902/4 E, 6000						Receiver
	Series 97						
	LS 97/4.8	3m	IR	PNP	10 - 30 V	Cable	Activation input
50006881	LS 97/2.8 SE						Transmitter
50006882	LS 97/4 E						Receiver

6.9.2 Retro-reflective photoelectric sensors

Article no.	Type	Operating range	Light source	Output	Voltage	Connection	Feature
	Series 96						
50080476	PRK 96 K/P-1361-29	8m	Red light	PNP	10 - 30 V	terminals	polarized Activation input
50080475	PRK 96 K/P-1361-47	8m	Red light	PNP	10 - 30 V	12 m	polarized Activation input
	Series 46						
50060920	PRK 46/4.8-S12	12m	Red light	PNP	10 - 30 V	12 m	polarized Activation input
	Series 3						
50030919	PRK 3/4.8-S8	2,5m	Red light	PNP	10 - 30 V	12 m	polarized Activation input
	Series 95						
50030257	IPRK 95/4.8 L.2	3m	Red light	PNP	10 - 30 V	12 m	polarized Activation input Warning output
	Series 92						
50014199	IPRK 92/4.8 S	6m	Red light	PNP	10 - 30 V	Plug	polarized Warning output Activation input
	Series 97						
50080474	PRK 97/4.8 L	2,5m	Red light	PNP	10 - 30 V	12 m	polarized Activation input

7 Appendix

7.1 Remaining Risks (EN 292-1)

The circuit proposals as shown in this manual have been tested and checked with the highest possible care. The current standards and guidelines are fulfilled if using the shown components and the corresponding wiring. Remaining risks are present if:

- the proposed circuit concept is changed and the connected safety-relevant components or protective devices are possibly not or insufficiently included in the safety circuit.
- the user did not comply with the current safety regulations for operation, adjustment and maintenance of the machine. Strict compliance with the intervals for checking and maintenance of the machine is mandatory.

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