




## Notes on connection and operating instructions

These instructions contain information on the efficiency in the use of MSI Safety Interfaces in accordance with their intended applications. These instructions constitute a part of the scope of delivery.

Warning and safety notes are indicated by the symbol .

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# 1 System Overview and Range of Applications

## 1.1 General Information

The Modular Safety Interface (MSI) serves as a link between one or more active optoelectronic protective devices (AOPD), Type 2, Type 3 or Type 4, and the machine controls. All MSI safety components include restart interlock and external device monitoring functions that can be activated and deactivated. They are also equipped with a series of status outputs and LED displays as well as a diagnosis interface to a PC.

In addition, MSI-i/R and MSI-i/T offer a selection between guard only operation and cyclical operation. During cycli-

cal operation, the machine is controlled by means of the interruption and subsequent release of the protected field. It is also possible to use the muting function to suppress the protective function of an AOPD, e.g. during the return motion of the tool, if no danger is caused by this movement. Special safety regulations for cyclical operation are described in Section 2.4 below.

All MSI safety components are available with either relay outputs or with safety-oriented pnp semiconductor outputs.

## 1.2 Approvals

Europe	North America
Type Examination in accordance with EN IEC 61496, Section 1 B I A Berufsgenossenschaftliches Institut für Arbeitssicherheit (Trade Association Institute for Industrial Safety) 53757 Sankt Augustin Germany	UL and C(UL) Approval pending

### 1.3 Terminology

AOPD	Active Optoelectronic Protective Device
Clear	Clearance of Cycles, Test
Diagn.	Diagnosis Function
EDM	External Device Monitoring
ESPE	Electro-sensitive Protecting Equipment
Fault	Relay Fault
Locked	Start/Restart Interlock active
N.O.	Normal Open Contact
OSSD	Output Signal Switching Device Safety-Related Switch Output
Reset	Start/Restart Interlock Initiator
RS 232	Interface RS 232
S1 - S2	Safety input 1 - 2
S1 & S2	Indication protected fields free/interrupteded
Select	Selection of Cycling Operation
Test	Test Signal Outputs
T1, T2	Test signal output 1, 2

## 1.4 Nomenclature MSI-i/R and MSI-i/T

MSI	Modular Safety Interface
i	with modes of operation Guard only, Single break or Double break This version offers the following standard functions for either 1 AOPD, Type 4, or up to 2 AOPDs, Type 2: – Restart interlock – External device monitoring – Diagnosis function and the following special functions for 1 AOPD Type 4 or 1 AOPD Type 2: – Cyclical operation – Displays and status outputs for guard, cyclical and muting operation
/R	Relay output: – two normal open safety contacts, OSSD 1 and OSSD 2
/T	Transistor output: – two safety-oriented pnp semiconductor outputs, OSSD 1 and OSSD 2

## 2 Safety Precautions



### 2.1 General Hazards Caused by Non-Observance of Safety Precautions

Leuze lumiflex products are developed and produced with careful attention to recognized codes of engineering practice. However, the protective function of the equipment can be impaired if the devices are not used for their

intended purpose or if they are used improperly. Such instances can jeopardize the health and lives of the personnel operating the machinery.

### 2.2 Operating Conditions and Proper Use

The relevant regulations for machine safety apply for the use of the Modular Safety Interface. The responsible local authorities (e.g. the German Berufsgenossenschaft [trade association] or OSHA) are available to answer questions related to safety issues. In general, the following conditions for use must be complied with:

- The electrical connection is to be performed only by experienced, expert personnel. Familiarity with the safety precautions in this operating manual constitutes part of this expert knowledge.
- Depending on the external cabling, the switch outputs can have dangerously high voltages. Before any work is done on the MSI safety interface, these outputs as well as the supply voltage must be switched off and safeguarded against being switched on again.
- The MSI is designed to be installed in an electronics cabinet or in a protective housing with an enclosure rating of at least IP 54.

- The supply voltage of 24 V DC  $\pm$  20% must exhibit a safe mains separation and be able to bridge brief power outages of 20 ms.
- The MSI fulfills the requirements of Safety Category 4 in accordance with EN 954-1. However, if an AOPD from a lower safety category is connected, the overall category for that path of the controls cannot be higher than that of the connected AOPD.
- As a rule, at least two switch contacts or safety-related pnp-semiconductor outputs must be connected into the switch-off circuit of the machine. In order to prevent the relay switch contacts from welding together, they must be externally fused as specified in the Technical Data, Chapter 6.
- It is not allowed to use status outputs to switch safety-related signals.
- Cross circuits between S1 and S2 are detected by the MSI safety component only if the two time-displaced test signal outputs T1 and T2 are used for the connected AOPD(s) with relay outputs. Type 4 AOPDs with

safety-related semiconductor outputs and their own cross circuit monitoring can be connected directly to S1 and S2.

- The "Reset" button for resuming operation following a restart interlock must be placed in a location from which the entire danger area can be clearly watched.
- The safety distance between the AOPD and the danger point must be maintained. It is calculated according to the formulas in the specific machine-related C-Standards or in the general B1 Standard EN 999. The

### 2.3 No EMERGENCY STOP button to be connected

- It must be secured that the EMERGENCY STOP function is always and immediate effective. EMERGENCY STOP buttons must not be connected at sensor inputs which provide for muting or cycling control functions. Since MSI-i does not provide for

### 2.4 Additional Safety Precautions for the Special Function "Cyclical Control"

- Special safety precautions must be followed for controlling protective devices. For example, it must be impossible to step behind the protective device on the side facing the danger point. Stepping into or through the protected field would automatically cause the dangerous movement to be enabled!
- More specific regulations can be found in the European Standard EN 292-2 in Section 4.2.2.5, Control guards.

response time of the MSI (Chapter 6, Technical Data), the response time of the protective device, and the stopping time of the machine must all be taken into consideration when calculating the safety distance.

- AOPDs are not suitable in applications where a danger of throwing out pieces or splashing out hot or dangerous liquids exists. Also they are not suitable for machines with extended stopping times. For these or similar applications Leuze lumiflex offers interlocking devices (safety switches) from leuze lumiflex GmbH + Co. KG with or without guard locking.

additional sensor inputs without special functions, no EMERGENCY STOP buttons must be connected. If an EMERGENCY STOP button is needed, the use of the extended version MSI-ix is recommended.

In addition, the European Standard for Hydraulic Presses EN 693 contains restrictions on the minimum height of the press table and on the maximum dimensions of the access (window) opening. If these stipulations cannot be complied with, additional measures must be taken to reliably monitor the interior of the machine.

## 3 System Configuration and Functions

### 3.1 System Configuration

Two microprocessors handle the redundant processing of the signal sequences within the intelligent Modular Safety Interface MSI. The results of the two processors are continuously compared. If any deviations are found, the safety-related outputs are immediately switched off and the LED indicating an MSI failure lights up.

Sensor signals at inputs S1 and S2 are checked. Depending on which of the functions (as described below) are selected, when the protected fields of all connected AOPDs are free the MSI outputs switch automatically to the ON state (without restart interlock) or remain in the

### 3.2 DIP Switch Settings

#### 3.2.1 DIP Switch Settings for the MSI-i Module

Cut off the voltage supply to the interface (see safety precautions in Section 2.2) loosen the subassembly with

OFF state until the reset button has been pressed and released (with restart interlock = standard operating mode).

MSI-i is available with two output options: the MSI-i/R has two positive-guided normal open contacts, while the MSI-i/T has two safety-oriented pnp semiconductor outputs.

The MSI safety interface comes in a 35 mm-wide slide-in housing that holds the MSI-i module and the /R or /T output module. It is suitable for mounting on a grounded 35 mm standard rail.

the imprint "MSI-i" and pull this module partly out of the housing before resetting the DIP switches:



Functions **only** in conjunction with external wiring, see Section 3.3:

DIP Switch	DS4	DS3	DS2	DS1
Function	None	Locking	External Device Monitoring	Cycle Time-limit
Up		restart interlock only	Static•- none**	30 min.
Down		start/restart interlock* - none**	dynamic	30 sec.

Factory setting: all switches down

\* See 3.3.1.1 – 3.3.1.3

\*\* See 3.3.1.4

• See 3.3.1.2

•• See 3.3.1.3 – 3.3.1.5

### 3.3 Operating Modes and Functions

- MSI-i/R and MSI-i/T permit the following modes of operation and functions:
- Guard function offers the possibility of combining start/restart interlock and external device monitoring (see below).
- Five operating modes can be selected by means of external wiring and the DIP switches DS2 and DS3 on the MSI-i module.
- Cyclical operation as single break or double break operation with guard function. In cyclical operation, the

AOPD connected at S1 controls the process. Special safety precautions are required as described in Section 2.3, Safety Precautions. Start/restart interlock is a necessary precondition for cyclical operation. Whenever cyclical operation is selected, terminal 13 must be connected to 24 V DC by way of a reset button! See more in Section 3.3.3. A three-point keyed switch is used to select among the operating modes. Changes at this keyed switch may only be made by trained specialists. If just one of the available operating modes is going to be required, we recommend permanently wiring this mode using a bridge.

### 3.3.1 Operating Modes Interlocking Functions and External Device Monitoring

The following 5 combinations can be selected by externally wiring the MSI Safety interface and/or by changing

the settings of the DIP switches DS2 and DS3 in the MSI Module:

OPERATING MODES			
Section	Type of Locking	Type of External Device Monitoring	Cyclical Function
3.3.1.1	With start/restart interlock	with dynamic ext. device monitoring	possible
3.3.1.2	With start/restart interlock	with static ext. device monitoring	possible
3.3.1.3	With start/restart interlock	without external device monitoring	possible
3.3.1.4	Without start/restart interlock	without external device monitoring	not possible
3.3.1.5	With start/without restart interlock	without external device monitoring	not possible



MSI safety interface is factory-set for the operating mode "with start/restart interlock and dynamic external device monitoring". If this setting is changed, these functions (i.e. the appropriate safety level) must be guaranteed by other means.

- Types of interlocking functions

The „start interlock function“ ensures that when the system is switched on or when the supply voltage returns, even if the protected field is free the safety-related output contacts or semiconductor outputs (OSSDs) do not automatically go into ON state, but rather wait until the reset button has been pressed and let go. The „restart interlock function“ prevents the OSSDs from automatically entering the ON state when the protected fields of one or more of the connected AOPDs are released again after an interruption. Here as well, the reset button must be pressed and let go to

initiate the system. Cyclical operation and muting are not possible if there is no locking (and hence no reset button) since the start button is also used to perform the function of the cyclical and muting reset.

- Types of External Device Monitoring

The function „dynamic external device monitoring“ monitors the relays connected downstream from the MSI safety interface. Each time before the OSSDs switch to the ON state, a check is made of whether the subsequent circuit elements have closed and reopened. If they have not, the OSSDs of the MSI safety interface remain in the OFF state. If the function „static external device monitoring“ is selected, a check is merely made of whether the subsequent circuit elements are in an open state. If they are, the start/restart interlock can be initiated.

### 3.3.1.1 Operating Mode: With Start/Restart Interlock – With Dynamic External Device Monitoring

External wiring requirements:

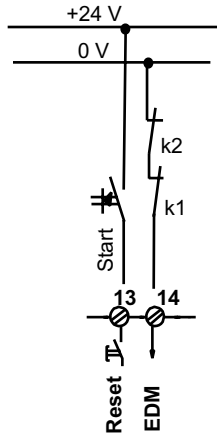
Terminal 13 connected to +24 V "Reset" by way of a start button

Terminal 14 connected to 0 V by way of feedback contacts of the positive-guided downstream relay

Required DIP switch settings in the MSI module (Section 3.2):

DS3 down DS2 down (factory setting at delivery)

Start/restart interlock is no longer active when the protected fields of all connected AOPDs are free, the downstream relays have returned to their original state, and the reset button is pressed and released.



### 3.3.1.2 Operating Mode: With Start/Restart Interlock – With Static External Device Monitoring

External wiring requirements:

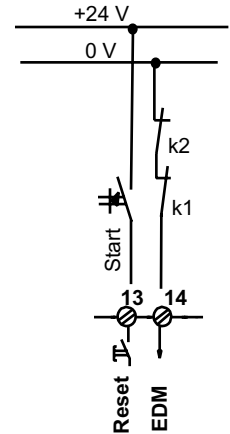
Terminal 13 connected to +24 V "Reset" by way of a start button

Terminal 14 connected to 0 V by way of feedback contacts of the positive-guided downstream relay

Required DIP switch settings in the MSI module (Section 3.2):

DS3 down DS2 up

In this operating mode, if the protected fields are free, a check is merely made of whether the downstream circuit elements have returned to their original state. If so, a release is issued by pressing and letting go of the reset button.



The dynamic monitoring of the downstream relays, which may be required in order to maintain the safety category, must be performed by other means.

### 3.3.1.3 Operating Mode: With Start/Restart Interlock – Without External Device Monitoring

External wiring requirements:

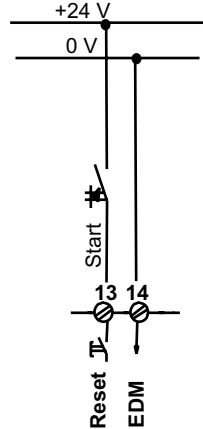
Terminal 13 connected to +24 V by "Reset" way of a start button  
Terminal 14 connected to 0 V "EDM"

Required DIP switch settings in the MSI module (Section 3.2):

DS3 down DS2 up



The dynamic monitoring of the downstream relays, which may be required in order to maintain the safety category, must be performed by other means.



### 3.3.1.4 Operating Mode: Without Start/Restart Interlock – Without External Device Monitoring

Cyclical operation not possible in this operating mode!

External wiring requirements:

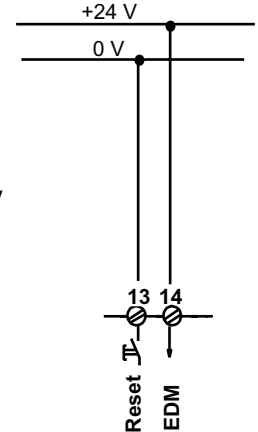
Terminal 13 connected to 0 V "Reset"  
Terminal 14 connected to +24 V "EDM"

Required DIP switch settings in the MSI module (Section 3.2):

DS3 down DS2 up



After the supply voltage is applied, the OSSDs immediately go into the ON state if all of the protected fields of the connected AOPDs are free. In this case, the start/restart interlock function and the dynamic monitoring of the downstream relays, which may be required in order to maintain the safety category, must be performed by other means.



### 3.3.1.5 Operating Mode: With Start/Without Restart Interlock – Without External Device Monitoring

Cyclical operation is not possible in this operating mode!

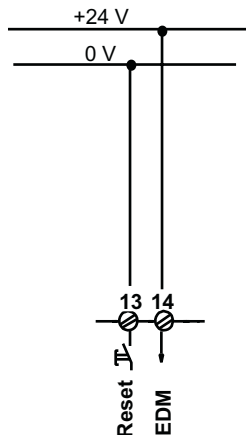
External wiring requirements:

Terminal 13 connected to 0 V  
"Reset"

Terminal 14 connected to +24 V  
"EDM"

Required DIP switch settings in the MSI module (Section 3.2):

DS3 up      DS2 up



After the supply voltage is applied, the OSSDs remain in the OFF state even if all of the protected fields of the connected AOPDs are free.

When the protected fields of all connected AOPDs are initially free, the OSSDs first enter the ON state when the protected field of the AOPD connected at S1 (for Type 4: S1 and S2) is interrupted and released. Only then do the rest of the connected AOPDs respond to the interruption and release of their own protected fields by switching the OSSDs directly to the OFF and ON states.

In this case, the restart interlock function and the dynamic monitoring of the downstream circuit elements, which may be required in order to maintain the safety category, must be performed by other means.

### 3.3.2 Guard Operation, Test Function

If the protected fields are free, it is possible to simulate an interruption of the protected field of the AOPD connected at S1 (for Type 4: S1 and S2) by way of the "Clear" input. During this procedure, the safety-related outputs will switch to the OFF state. Test is activated if 24 V at Pin 20 is disconnected via a normal closed contact.

If operating mode "Start Interlock only" (as in 3.2.1.5) is selected, the "Clear" input also serves as the remote start for the AOPD connected at S1 (for Type 4: at S1 and S2). In this case, it is no longer necessary to initiate the first start by interrupting the protected field.

### 3.3.3 Cyclical Operation as Single Break or Double Break with Guard Function

Special safety precautions must be taken when the protective device is used to control the machine. These are described in Safety Precautions, Section 2.4.

At terminal 21 "Select" you can choose the operating modes "guard only", "single break operation" or "double break operation". Start/restart interlock is a necessary

precondition for cyclical operation, which means that terminal 13 must always be connected to +24 V by way of the start button. There are some options available with regard to external device monitoring. It can be performed either dynamically or statically, or it can be dispensed with completely if the requirements for maintaining the safety category are fulfilled by other means.

*Cyclical Operation:*

The start interlock ensures that the OSSDs remain in the OFF state after the supply voltage has been switched on. The display "restart interlock" (symbol: lock) is constantly lit.

*The following applies for single break operation:*

When the start button is pressed, the readiness for cyclical operation is achieved, and the display "restart interlock" emits a single blink which is repeated in short intervals. The controls remain in this condition and wait for a controlling interruption of the protected field for at least 300 ms.

*The following applies for double break operation:*

When the start button is pressed, the readiness for cyclical operation is achieved, and the display "restart interlock" emits a double blink which is repeated in short intervals. After the first interruption for at least 300 ms, the display emits a repeated single blink. The controls remain in this condition and wait for the second controlling interruption of the protected field.

*Cycling Operation Time monitoring*

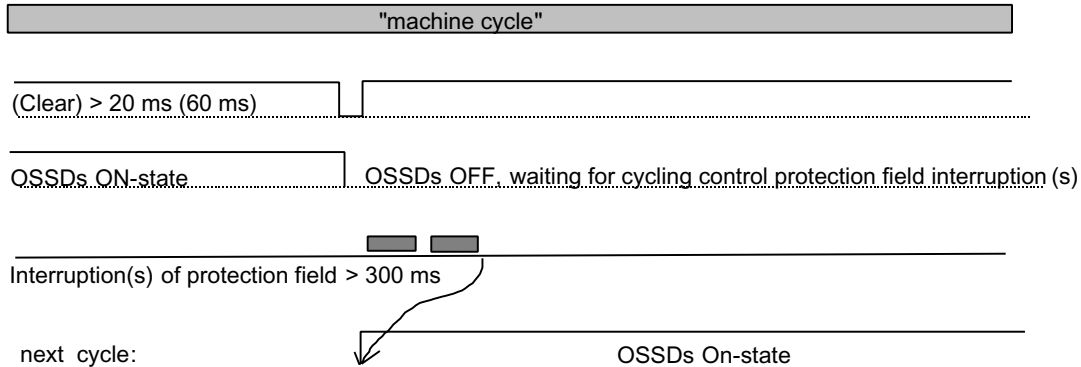
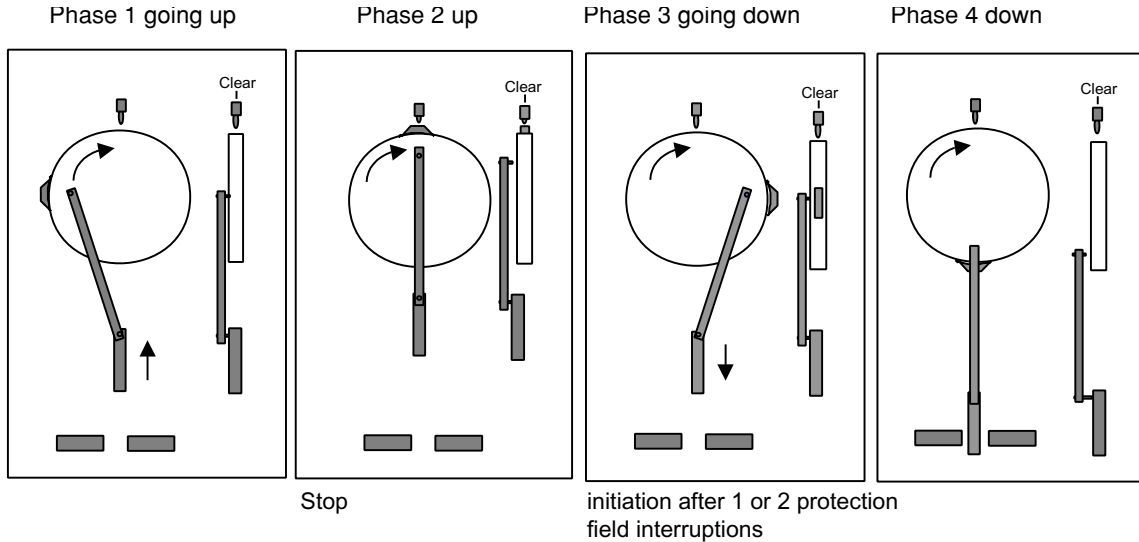
A time monitoring function prevents other controlling interruptions of the protected field after a period of 30 s following the "readiness" or the last controlling interruption of the protected field. After this 30-second period the start/restart interlocking function is automatically actuated, and the yellow LED lights constantly. By a press of the reset button, the "readiness" for further controlling interruptions may be restored.

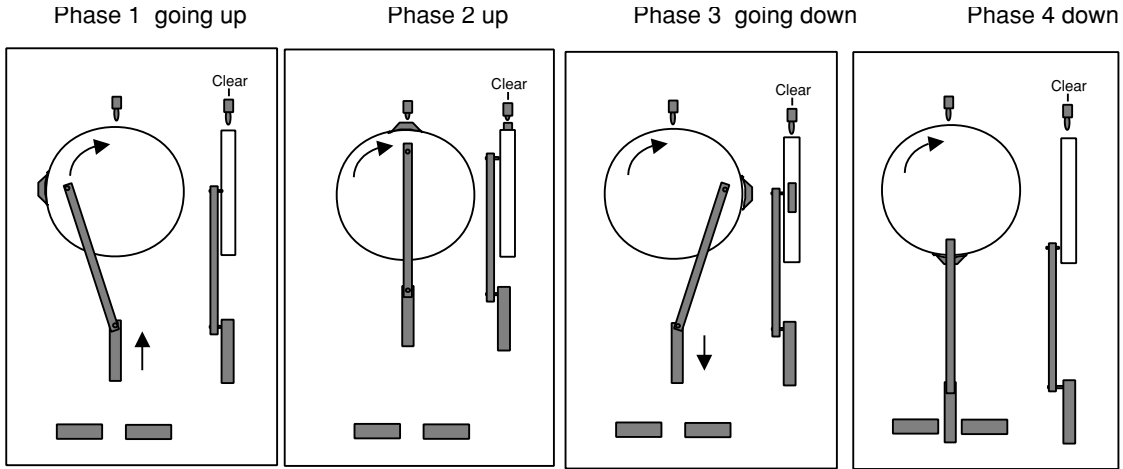
This function safeguards against the unintentional and unexpected initiation of a processing cycle after a longer standstill. In justified cases only, and if this does not create any additional danger to the operating personnel, the time monitoring function can be switched to 30 min. by the way of the DIP switch DS1. See Section 3.2.1.

*Combination of Cyclical and Muting Operation*

When properly installed, MSI-i provides protection during the entire processing stroke. Sometimes, however, it is important for reasons of safety or operating sequence not to interrupt the production process during certain phases, such as when a stamp perforates the material. For this reason, Leuze lumiflex offers MSI-mi or MSI mix safety interfaces which combine the cycling and the muting function. In this case, the muting function can be used to deactivate the protective function for the duration of the non-dangerous part of the processing movement. Muting could, for instance, take effect when the stamp has come to within 6 mm of the material and if there is no danger posed by other machine parts during the perforation and return motion of the tool.

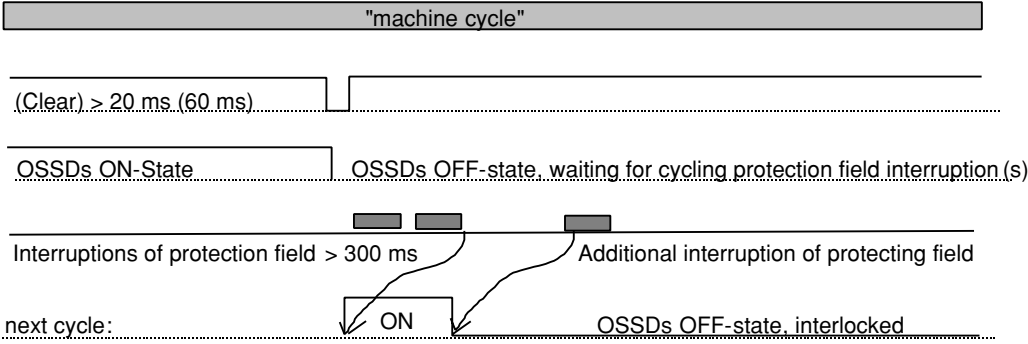
### 3.3.4 Cycling operation, Diagram





Stop

initiation after 1 or 2 protection field interruptions

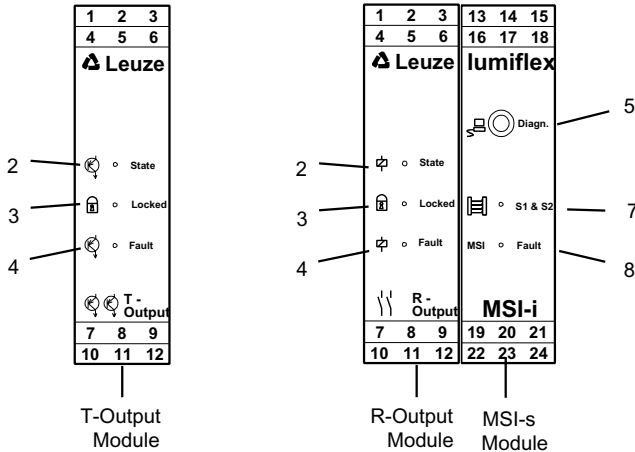


Response- and stopping performance times have to be taken in account

### 3.4 Displays

A number of LEDs of various colors indicate the operating status of the MSI modular safety interface. It is also possible to show the LED displays on the PC monitor

using the integrated RS 232 interface and diagnosis connector.



Output /R /T					
Position	Display/Function	Symbol	Status	LED	Color
1	not applicable	–	–	–	–
2	Safety-related switch output	relay/trans. State	on off	on on	green red
3	Restart interlock – Wait for 2 cycles – Wait for 1 cycle	lock	locked locked locked not locked	on impulse 2x impulse 1x off	yellow yellow yellow yellow
4	Fault in output module	relay/trans. Fault	fault no fault	on off	red

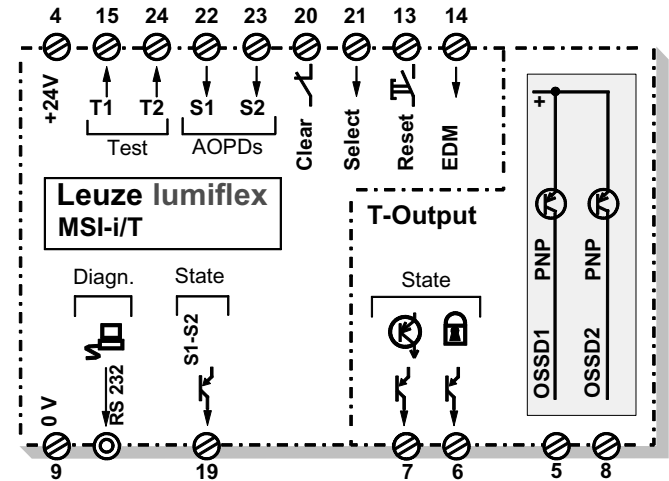
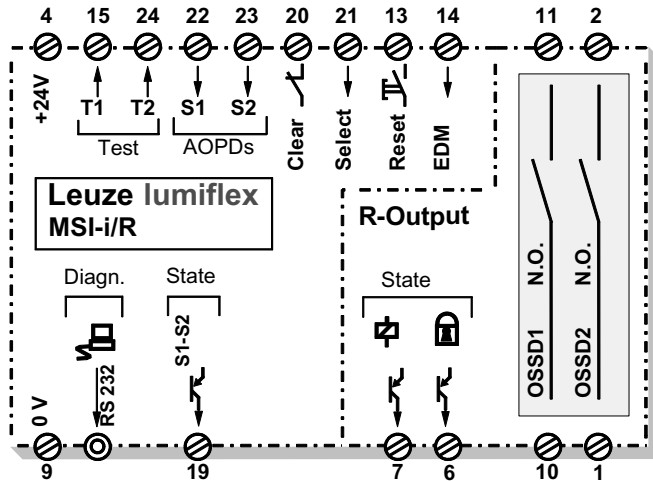
MSI-i Module					
Position	Display/Function	Symbol	Status	LED	Color
5	Diagnosis, RS 232 See status outputs	jack diagn.	none	none	none
6	not applicable	–	–	–	–
7	Protected field	AOPDs S1 & S2	protected field free not free	on off	green
8	MSI fault	MSI Fault	fault no fault	on off	red

### 3.5 Status Outputs



Status outputs are not allowed to be used as safety-related signals in release circuits

(see also Section 2. Operating Conditions and Proper Use)



Output /R /T				
Terminal	Message Function	Symbol	Status	Status Output
6	Restart interlock – Wait for 2 cycles – Wait for 1 cycle	lock	locked locked locked not locked	active high impulse 2 x impulse 1 x active low
7	Safety-related switch status	relay/ transistor	ON OFF	active high active low

MSI-i Module				
Terminal	Message Function	Symbol	Status	Status Output
Front jack	Diagnosis, RS 232 2.5 mm round connector	–	–	connected to PC with diagnosis program
19	Protected field(s)	S1 - S2	free not (all) free	active high active low

### 3.6 Diagnosis Function

Requirements for running the diagnosis system: a standard PC or laptop operating under Windows (Version 3.1 or higher) and the MSI software, Version 01, on 3 1/2 " diskette, as well as a serial connection cable and a 2.5 mm jack plug.

- Simultaneous display of all input and output statuses as well as all LED displays on the MSI

With its diagnosis interface, the intelligent modular safety interface MSI offers a convenient way to visualize all of the input and output statuses simultaneously on the monitor.

The connection circuit diagram as well as display fields in different colors can be shown on the screen via the connection terminals. A graphic representation of the MSI front design with the display elements as described in 3.4 also appears on the screen.

Example:

This enables the sequences at individual screw-type terminals to be tracked without the use of additional measuring instruments. The diagnosis function is equip-

ped with online help and can be operated in either English or German.

## 4 Electrical Connection

### 4.1 Installation Regulations



The general safety precautions in Chapter 2 must be observed. The electrical installation may be performed only if there is no voltage applied, and it must be performed by trained specialists.



In the /R versions, it is possible that high voltages may be present at the output contacts. A no-voltage state is achieved only when the 24 V DC supply voltage as well as the supply lines to the switch contacts are safely

### 4.2 Power Supply Requirements



The supply voltage of 24 V DC must guarantee safe mains separation and be able to bridge an interruption in voltage of 20 ms at full load. The MSI-AC 115 or MSI-AC 230 from Leuze lumiflex have these capabilities up to 0.8 Amps. The ground connection of the MSI is made when it

### 4.3 Connecting AOPDs, Type 4 or Type 2

The examples below show possibilities for connecting and combining AOPDs of various safety categories and with various output features (relays, safety-oriented semiconductor outputs, cross circuit monitoring within and outside the AOPD).

AOPDs Type 4 with semiconductor outputs and cross connection monitoring function can directly be connected to the safety inputs S1 and S2. See Example 1.

switched off and secured against being switched on again.



Coded plug-in terminal blocks allow a connection cross-section of up to 2.5 mm<sup>2</sup>. The supply voltage must be externally fused against excess current with a fuse of 2.5 A. The switch contacts must also be externally fused against excess current with a maximum of 5 A. This prevents the safety-related contacts from welding together if the current load is too high!

snaps up to the metallic, grounded mounting rail by means of the rear clamping device.

The lead for the supply voltage must be externally fused against excess current with a maximum of 2.5 A.

AOPDs Type 4 with relay outputs must be connected so that the odd-numbered test signal T1 are directed via the non-delaying contacts to an odd-numbered safety input (T1=>S1) and vice versa (T2=>S2). See Example 2.

AOPDs Type 2 are periodically tested using the time-displaced test signals T1 or T2. The odd-numbered test signal must be directed to an even-numbered safety input by the way of the time-delaying AOPD (T1=>S2) and vice

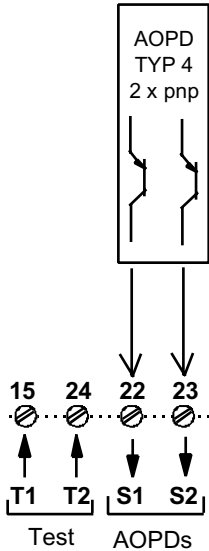
versa (T2=>S1). The AOPD response time to a test request must be in a range of 2 to 18 ms. See Example 3.

**All available safety inputs must be occupied!** In case no components are connected, the remaining inputs

must be connected to the corresponding test signal using bridges. In doing so, please note that the odd-numbered test signal must be connected to the odd-numbered safety input via the non-delaying bridge (T1 => S1) and vice versa (T2 => S2). See Example 4.

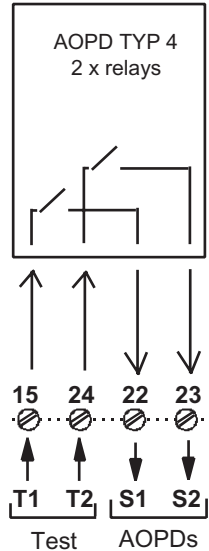
**Example 1**

1 AOPD Type 4 with 2 safety-related semiconductor outputs and internal cross connection monitoring function.



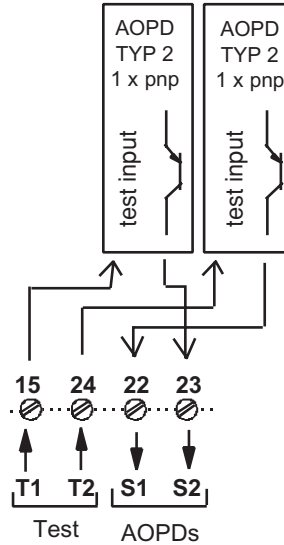
**Example 2**

1 AOPD Type 4 with 2 normally open relay contacts. Cross connection monitoring by using the test signals T1 and T2.



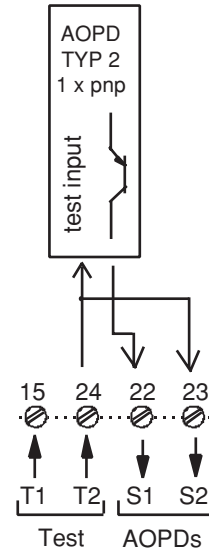
**Example 3**

2 AOPDs Type 2 with one safety-related semiconductor output each. Cross connection between the leads will be detected.



**Example 4**

1 AOPD Type 2 with one safety-related semiconductor output.



## 4.4 Connecting Machine Controls



The safety-related parts of the controls comprise more than the MSI-i/R or MSI-i/T described above. They also include successive control elements and even power transmission elements which must be safely and promptly shut down. Particular attention must be paid to maintaining the safety category requirements. Important information in this regard can be found in the harmonized European standard EN 954-1.



Essential prerequisites for safe operation are the abilities to electrically influence the interruption of the dangerous movement and to bring the machine to a standstill as quickly as possible. These factors, as well as the response times of AOPDs and the MSI, must be taken into consideration when calculating the safety distance.

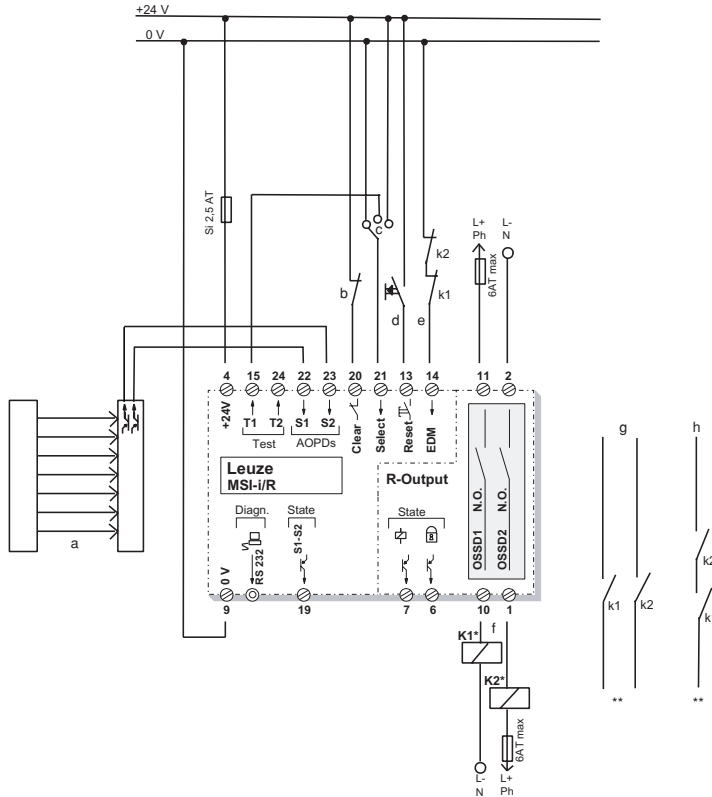
The response times depend on the type of AOPD selected (see Section 6, Technical Data). Other parameters, such as hand/arm/body approach speed or additional safety distance, depend on the particular application and the resolution of the AOPD being used. The European standard EN 999 contains equations and examples for a variety of configurations.

Before starting the next cycle the MSI Safety Interface demands the automatic feedback of the machine cycle. The normal closed contact between +24 V and terminal 20 (Clear) must be interrupted for a minimum duration according to the Technical Data below. This causes all fed-in cycles to be cleared. The output contacts enter the OFF state when the cycle clearance procedure is performed.

# 5 Connection Circuit Diagram, Examples

The connection examples below show one wiring suggestion each for the MSI-i/R and the MSI-i/T

ENGLISH

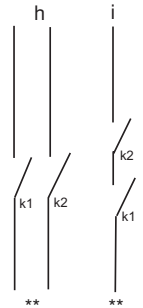
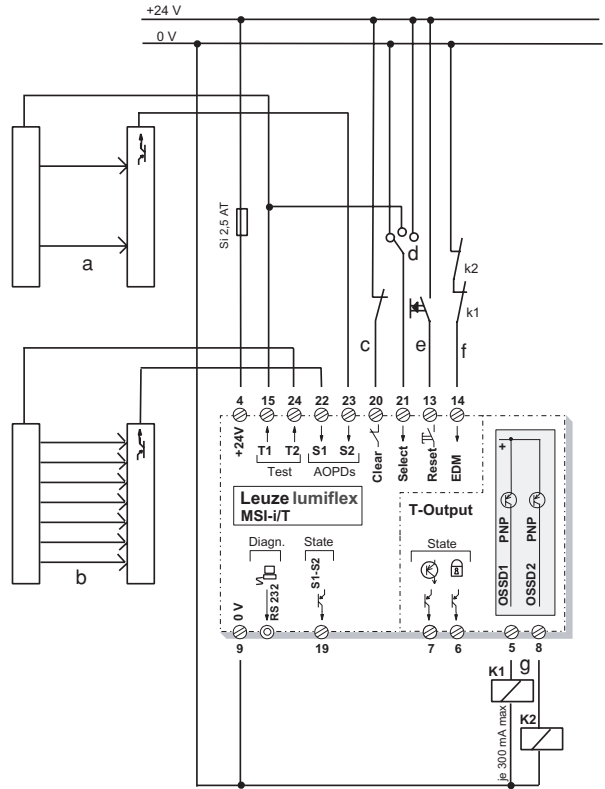


Connection example MSI-i/R with one AOPD Type 4

- a = AOPD Type 4 with guarding and control function
- b = Normally closed machine contact for cycle clearance
- c = Operating mode keyed switch (guard only = 0 V, single-break = T1, double-break = 24 V)
- d = Command device for releasing the start/restart interlock
- e = Feedback loop for external device monitoring
- Pin 19 = Indicating output "sensor status"
- Pin 7 = Indicating output "status safety outputs"
- Pin 6 = Indicating output "status start/restart interlock"
- f = Output Signal Switching Devices (OSSDs)
- g = Switching off path with two-channel control
- h = Switching off path with one-channel control
- \* = Suitable spark suppression required
- \*\* = In general, both of the contacts must be used in the subsequent machine control path.  
Use relays or contactors with positive-driven contacts only.

**All available safety inputs must be occupied!**

See Section 4.3.



Connection example MSI-i/T with two AOPDs Type 2

- a = AOPD Type 2 with guarding function
- b = AOPD Type 2 with guarding and control function
- c = Normally closed machine contact for cycle clearance
- d = Operating mode keyed switch (guard only = 0 V, single-break = T1, double-break = 24 V)
- e = Command device for releasing the start/restart interlock
- f = Feedback loop for external device monitoring
- Pin 19 = Indicating output "sensor status"
- Pin 7 = Indicating output "status safety outputs"
- Pin 6 = Indicating output "status start/restart interlock"
- g = Output Signal Switching Devices (OSSDs)
- h = Switching off path with two-channel control
- i = Switching off path with one-channel control
- \*\* = In general, both of the contacts must be used in the subsequent machine control path.  
Use relays or contactors with positive-driven contacts only.

**All available safety inputs must be occupied!**

See Section 4.3.

## 6 Technical Data and Ordering Information


### 6.1 MSI-i/R, MSI-i/T

Version, Type Modular Safety Interface	MSI-i
Relevant standards, Safety category	TYPE 4 in accordance with EN IEC 61496 T1 see also Section 2, Safety Precautions EN 954-1 (12/96). Category 4 IEC, DIN EN 60204-1 (11/98), Stop 0 DIN V VDE 0801 and A1, Specification Class 6
Connectable safety switches and command units at S1-S2	Safety switches according to EN 1088 Area Emergency-Stop button according to EN 418
Test outputs T1 and T2, Test interval Test impulses, time-displaced Response time AOPD Type 2 to a test request	200 ms 24 ms each 2 to 18 ms
Available functions	Start/restart interlock External device monitoring Guard only, single break and double break operation
Minimum sensing field interruption for cycling control	300 ms
Control input Start/restart interlock (Reset)	Potential-free normal open contact (button or key button)
Control input External device monitoring (EDM)	Feedback of positive-guided contacts from downstream relays (see connection diagram)
Control input Operating mode (Select)	Operating mode keyed switch or bridge for permanent operating mode
Control input Cycle clearance (Clear) for AOPDs Type 4 with semiconductor outputs for AOPDs Type 4 with relay outputs for AOPDs Type 2	Normal closed contact to +24 V in the machine cycle, at least 20 ms opening time at least 60 ms opening time at least 60 ms opening time


Status outputs Status protected fields S1- S4	pnp – Semiconductor output All protected fields free not free	active high,+24 V, 60 mA max. active low
Safety outputs (Technical Data, see below)	Relay outputs Semiconductor outputs	via /R-Output via /T-Output
Supply voltage	24 V DC, $\pm 20\%$ , external power supply with safe mains separation and equalization for 20 ms voltage interruption required, e.g. MSI-AC 115 or MSI-AC 230 0.8 A max. from Leuze lumiflex	
Current consumption	approx. 200 mA without external load	
External fusing	2.5 A m	
Housing Enclosure rating	IP 20; must be installed in electronics cabinet or housing with an enclosure rating of at least IP 54 Mounting at 35 mm DIN standard rail	
Protective class	II	
Ambient temperature, Operation	0 ... + 55 °C.	
Ambient temperature, Storage	-25 ... + 70 °C	
Relative humidity	93 % max.	
Connection type	pluggable, coded screw-type terminals up to 2.5 mm <sup>2</sup>	
Dimensions	See dimensional drawing	

## 6.2 /R-Output

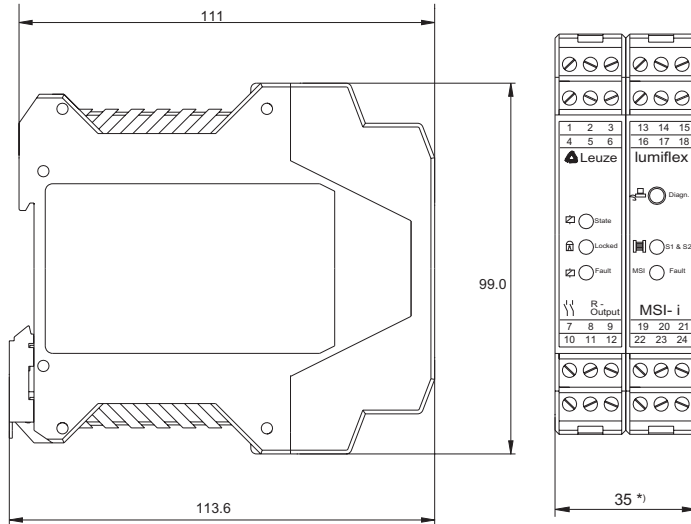
OSSD safety outputs switching voltage/switching current	2 safety-related normal open contacts 60 V DC, 250 V AC, 5 A max. Minimum switching current 20 mA	
OSSD external fusing	5 A mT	
OSSD response time MSI (without AOPD)	for AOPD Type 4, semiconductor outputs	18 ms
	for AOPD Type 4, relay outputs	54 ms
	for AOPD Type 2	54 ms
	for safety switches	54 ms
OSSD reset time	100 ms	

OSSD suitable spark extinguishing over the coils of the downstream relays	Required
 Status output "Status switch outputs" not to be used for safety circuit!	<p>pnp semiconductor output</p> <p>OSSDs ON-state: active high, +24 V, 60 mA max.</p> <p>OSSDs OFF-state: active low</p>
Status output "Status start/restart interlock"	<p>pnp semiconductor output: guard only</p> <p>OSSD locked: active high, + 24 V, 60 mA max.</p> <p>OSSD not locked: active low</p>
	<p>pnp semiconductor output: wait for 2 cycles</p> <p>OSSD locked: impulse 2x</p> <p>OSSD not locked: active low</p>
	<p>pnp semiconductor output: wait for 1 cycles</p> <p>OSSD locked: impulse 1x</p> <p>OSSD not locked: active low</p>

### 6.3 /T-Output

OSSD safety outputs	2 safety-related pnp semiconductor outputs
switching voltage/switching current	with cross connection monitoring 24 V DC, 300 mA max.
OSSD response time MSI (without AOPD)	<p>for AOPD Type 4, semiconductor output 8 ms</p> <p>for AOPD Type 4, relay output 44 ms</p> <p>for AOPD Type 2 44 ms</p> <p>for safety switches 44 ms</p>
OSSD reset time	100 ms
 Status output "Status switch outputs" not to be used for safety circuit!	<p>pnp semiconductor output</p> <p>OSSDs ON-state: active high, +24 V, 60 mA max.</p> <p>OSSDs OFF-state: active low</p>
Status output "Status start/restart interlock"	<p>pnp semiconductor output</p> <p>locked: active high, + 24 V, 60 mA max.</p> <p>not locked: active low</p>

## 6.4 Dimensional Drawing



\*) Stringing together without distance possible

## 6.5 Ordering Information

Type	Part No.
MSI-i/R	549902
MSI-i/T	549922
MSI-AC 115 (power supply 24V DC, 0.8 A)	549940
MSI-AC 230 (power supply 24V DC, 0.8 A)	549908

MSI diagnosis software	549930
diagnosis cable 3 m	549953
diagnosis cable 5 m	549955
/R output subassembly (replacement part)	509210
/T output subassembly (replacement part)	509202



## EC-Declaration of Conformity

**Leuze Lumiflex**

according to EC Machinery Directive 98/37/EC

We herewith declare,

Leuze lumiflex GmbH + Co. KG  
Leibstr. 4  
D-82256 Fürstenfeldbruck  
GERMANY

that the following described safety components in our delivered version complies with the appropriate basic safety and health requirements of the EC Machinery Directive 98/37/EC based on its design and type, as brought into circulation by us. In case of alteration of the safety components, not agreed upon by us, this declaration will lose its validity.

Description of the safety component:

**Safety interface to evaluate safety related signals and to create safety related output switching signals according to EN 954-1 Cat. 4 based on two micro-processors (redundant).**

**MSI (-s, -sx), (-l, -lx), (-m, -mx), (-ml, -mlx) with outputs /R/, /Rx and /T/, /Tx**

see type plate

Safety interface to monitor several safety sensors and to create safety related output switching signals.

Serial number:  
Safety function:

Applicable EC Directives, Basics:

EC Machinery Directive 98/37/EC  
EMC-Directive 89/336/EEC and modifications 91/263/EEC and 92/31/EEC  
Low Voltage Directive 73/23/EEC and modification 93/68/EEC.  
EN 954-1: 12-96 Safety of machinery, safety related parts of control  
DIN EN 61496-1 Electro-sensitive protective device – part 1  
DIN EN 60204-1; (June 1998) Electrical equipment for machinery, part 1 General requirements  
DIN V VDE 0801 (January 1990) with DIN V VDE 0801/A1 (October 1994) Basics for computer systems with safety functions

Notified body according to annex VII:

BIA, Berufsingenossenschaftliches Institut für Arbeitssicherheit  
Alte Heerstr. 111  
D-53757 St. Augustin  
GERMANY  
No. 1999 20206

Charged to do:

EC - type examination

CE-marking:

Examination certificate No. **993023**  
**The compliance with the Directives 73/23/EEC and 98/37/EC is certified by the CE-mark.**

Fürstenfeldbruck, May 27<sup>th</sup> 2002

ppa. Dr. Holger Lehnitz  
Manager/ Product Unit  
Safety/atl Work

ppa. Werner Lehner  
Manager/ Product Management



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BLZ 700 100 100  
847 990 100  
847 990 500  
DE 529 999 527

185 734 407

Konformitätserklärung, Stz. Fürstenfeldbruck, Amtsgericht  
München/184-0447/1, ppa. Werner Lehner, Amtsgericht  
Fürstenfeldbruck/184-550, Geschäftsführer Dr. Holger Drinzel  
Vizepräsident des Verwaltungsrates, Michael Heilmann