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# Passenger Detection System for escalators

## TL04

### Documentation



Version C1.C  
THL01.05

## Index

<b>GENERAL INFORMATION .....</b>	<b>3</b>
<b>TECHNICAL DATA .....</b>	<b>4</b>
Schematic Diagram of central unit .....	6
<b>Modular Ribbon-cable System .....</b>	<b>7</b>
Assembly of ribbon-cable sections .....	7
Ribbon-cable section .....	8
<b>Technical Description .....</b>	<b>10</b>
Introduction .....	10
Central unit .....	11
Light Curtain .....	11
Installation .....	12
<b>Connecting to the central unit .....</b>	<b>15</b>
"ENABLE" .....	15
"TRANSMITTER" .....	15
"RECEIVER" .....	15
"OUTPUT" (OK1/OK2) .....	15
"POWER" .....	15
"FAIL OUT" .....	15
"POSITION OUT" .....	16
<b>Function of the Operating and Indicating Elements .....</b>	<b>17</b>
<b>Initial Set-up .....</b>	<b>18</b>
Switch-on procedure .....	18
Reset and Restart .....	18
Activating the System .....	18
Interruption of the Detection Field .....	19
Care and maintenance .....	19
Exchanging Modules .....	20

# Passenger Detection System for escalators

TL04

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|--|---|
| ■ No functional deterioration through weathering | ■ Minimal installation costs            |
| ■ Not sensitive to external light sources        | ■ Fault location system in central unit |
| ■ Up to 99 sensor modules per light curtain      | ■ Low power consumption                 |
| ■ No adjustments necessary                       | ■ Continuous use without wearing        |
| ■ Optional distance between modules              | ■ Protected to IP 67                    |

## GENERAL INFORMATION

The passenger detection system (PDS) TL04 serves to monitor stationary escalators and moving floors. (Ready to start).

Due to the high dynamics (typically 30dB), the system operates safely in extreme environmental conditions.

The PDS is only sensitive to its own transmitted infra-red signals. The function will, therefore, not be disturbed even if sunlight falls directly on the receivers.

Pre-assembled cable sections simplify installation.

Cable sections are simply plugged into each other. Wiring is only necessary at the central-unit. The sensor modules are connected together by a protected 7-pole, halogenfree ribbon-cable and can easily be exchanged.

Adjustment of the modules is not necessary.

Up to 99 sensors can be operated with one central unit

The distance between transmitters and receivers can be up to 1.5 metres.

The minimum distance between the optical axes (module to module) is optional and limited only by the physical dimensions of the modules.

The required minimum spacing of 75mm in France can be achieved without problem.

The PDS is suitable for permanent operation without restriction.

Due to the very low transmitter output, no faults should occur as a result of ageing.



Fig. 1-1

CENTRAL UNIT TLCU

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**TL04**



## TECHNICAL DATA

### Light Curtain

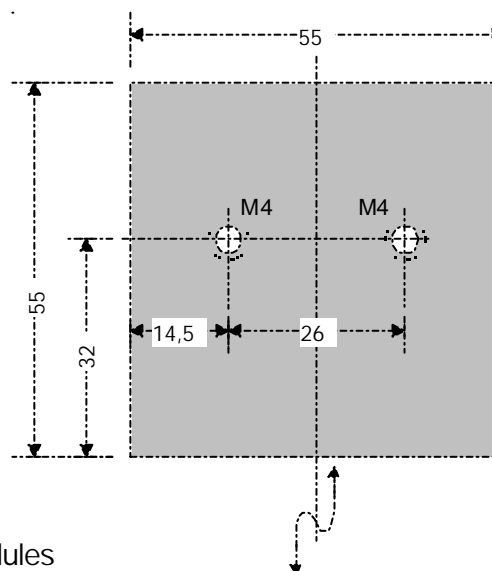
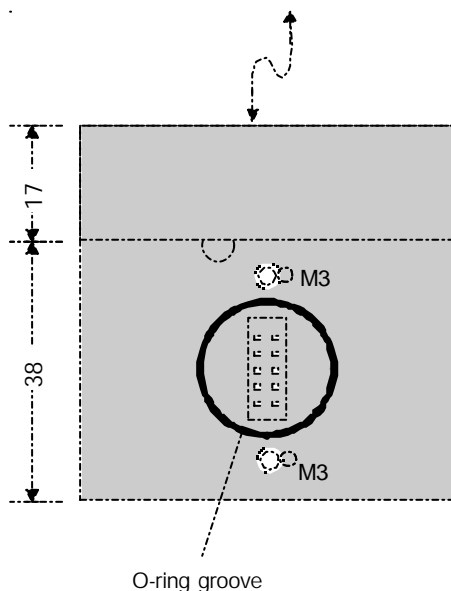
Interval between transmitter and receiver  
Interval between optical axes  
Permissible de-adjustment of the optical axis, (Tx)  
Permissible de-adjustment of the optical axis, (Rx)  
Permissible working temperature range  
Manufacturing standard  
Dimensions of the modules (W x L x D)  
Regulations

0 to 1,5 m; inside 0 to 4 m  
optional  
max. 22°  
max. 30°  
-25° to 65° C  
IP 67  
55 x 55 x 25 mm  
EN 115 02.98

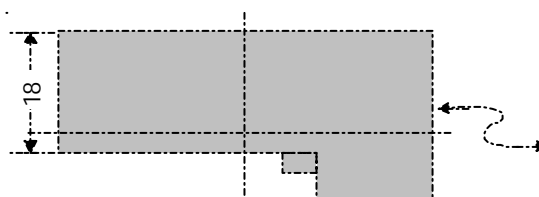
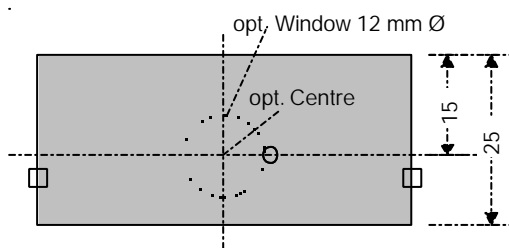
### Central unit TLCU

Length of light curtain per central unit  
Max. permissible switching current of the O/P relays  
Supply voltage  
Power consumption (99 modules)  
Case dimensions(W x H x D)  
Overall dimensions, including connecting plugs (W x H x D)  
Regulations

1 to 99  
2 A  
110 to 265VAC, 40...60 Hz  
typically 50 VA  
285 x 64 x 208 mm  
285 x 66 x 235 mm  
EN 115 02.98

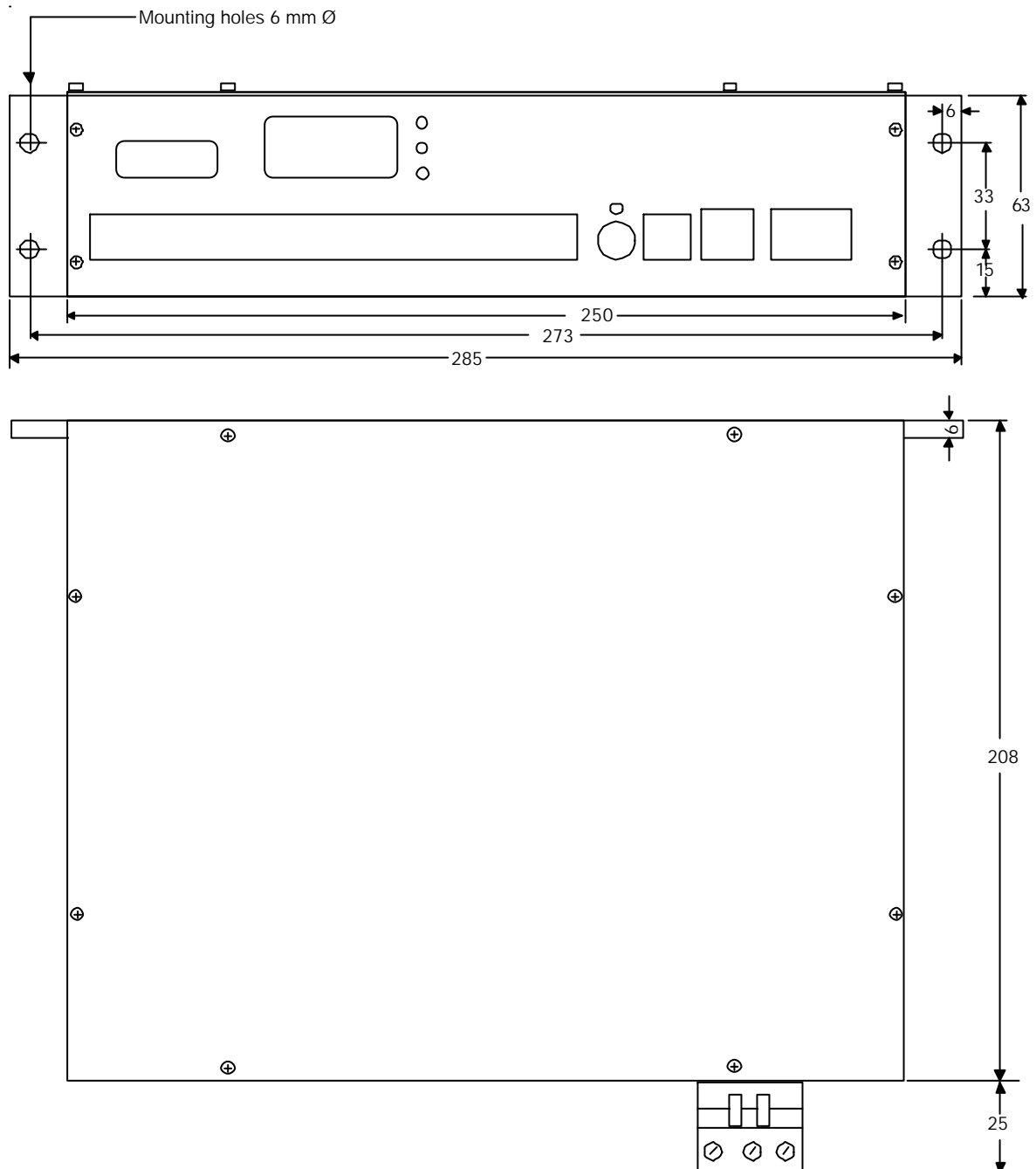


Modules



# Passenger Detection System for escalators

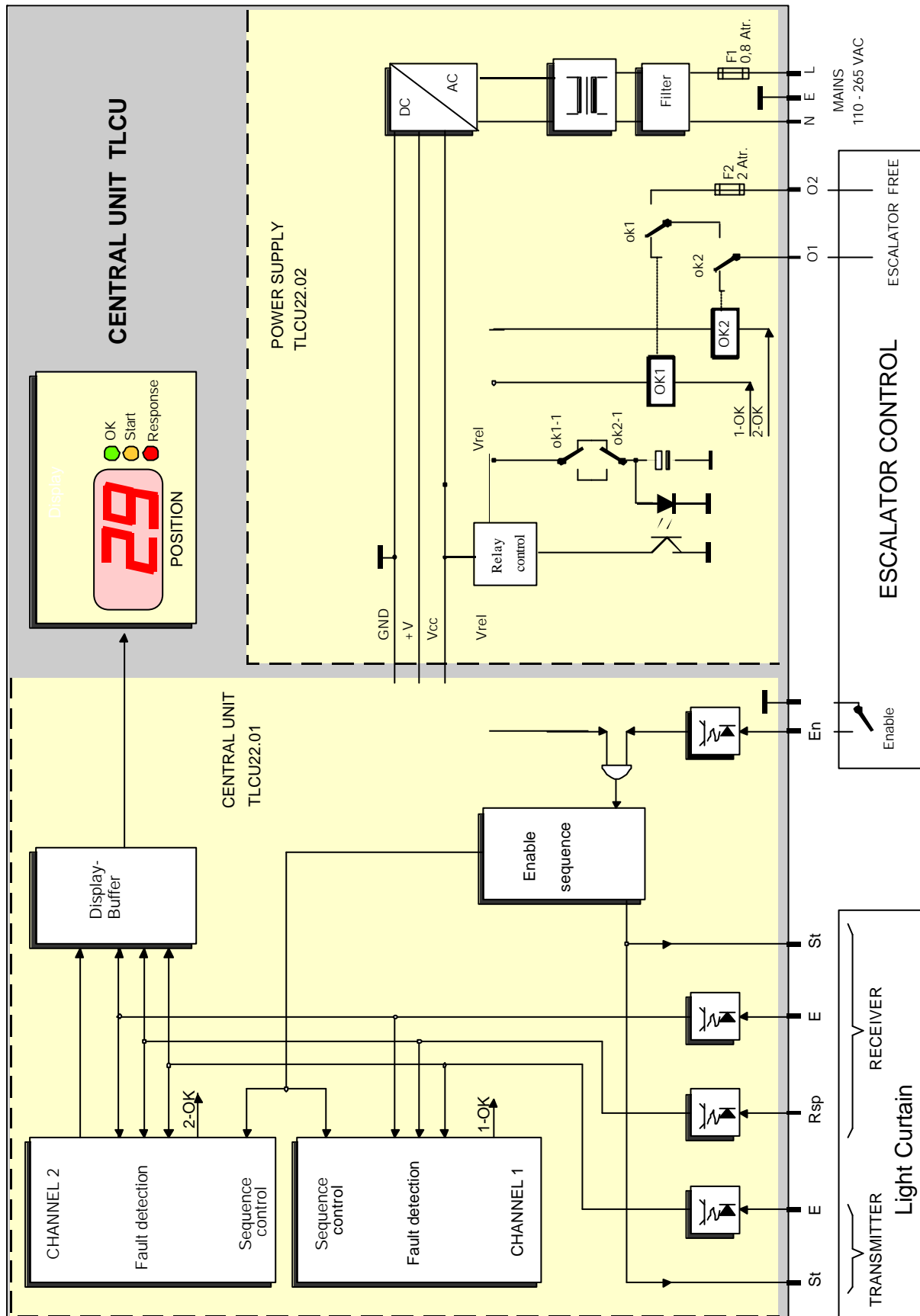
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# Passenger Detection System for escalators

TL04

Schematic diagram of central unit



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TL04

## Modular ribbon-cable system

### Assembly of ribbon-cable sections

Cable sections can be 9, 10 or 11 modules long and are delivered completely assembled. A combination of these will make up the required length of light curtain.

The sections are joined together by means of linking-modules. Linking- and end-modules have no optical function.

Each section starts with a plug-in connector and ends with either a linking-module or an end-module.

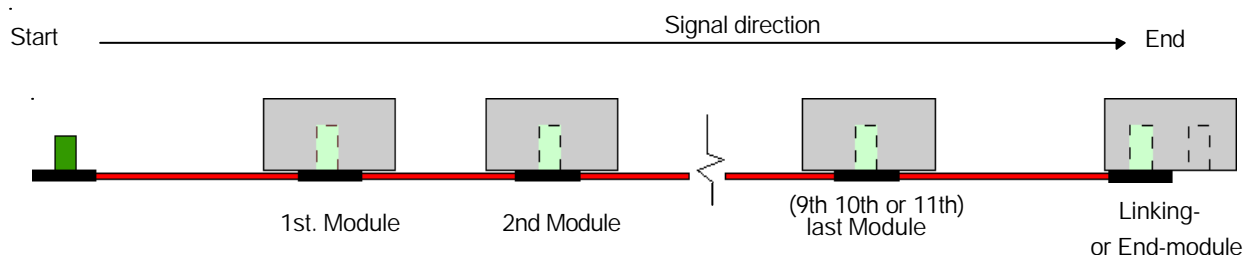
The first cable section is plugged into the adaptor-module and secured with two screws. The second and subsequent sections are plugged into and secured to the linking-module of the previous section. The light curtain is complete when the section terminated by the end-module is secured.

**THE SECURING SCREWS MUST NOT BE OVER TIGHTENED!**

Housing dimensions and mounting centres of the adaptor-, linking- and end-modules are identical to those of the modules having optical function.

When ordering, please state the required sequence of sections so that we can ensure that the last one is fitted with an end-module..

### Configuration of a cable section



# Passenger Detection System for escalators

TL04

## Modular ribbon-cable system

### Cable section

The following table shows the various combinations of cable sections to make up a light curtain from 36 to 75 modules long.

Not all possible combinations are displayed.

The combination of sections, which is optional, should be specified when ordering so that the last one can be fitted with an end-module during manufacture.

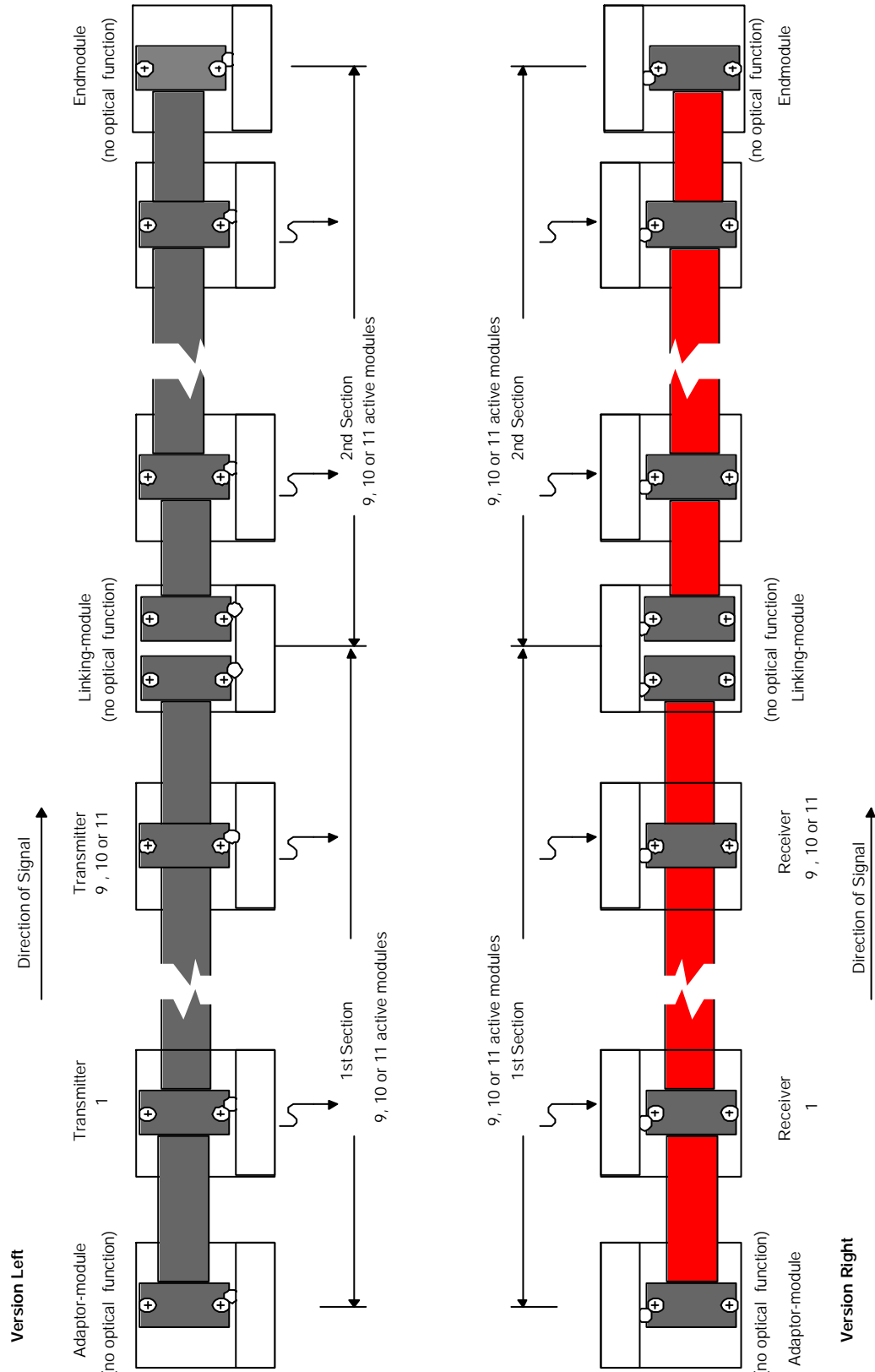
Number of modules	Number of sections	Modules per section							Non optical modules Adapt.+ linking + End
		1.	2.	3.	4.	5.	6.	7.	
36	4	9	9	9	9				A + 3 + E
37	4	9	9	9	10				A + 3 + E
38	4	9	9	10	10				A + 3 + E
39	4	9	10	10	10				A + 3 + E
40	4	10	10	10	10				A + 3 + E
41	4	10	10	10	11				A + 3 + E
42	4	10	10	11	11				A + 3 + E
43	4	10	11	11	11				A + 3 + E
44	4	11	11	11	11				A + 3 + E
45	5	9	9	9	9	9			A + 4 + E
46	5	9	9	9	9	10			A + 4 + E
47	5	9	9	9	10	10			A + 4 + E
48	5	9	9	10	10	10			A + 4 + E
49	5	9	10	10	10	10			A + 4 + E
50	5	10	10	10	10	10			A + 4 + E
51	5	10	10	10	10	11			A + 4 + E
52	5	10	10	10	11	11			A + 4 + E
53	5	10	10	11	11	11			A + 4 + E
54	5	10	11	11	11	11			A + 4 + E
55	5	11	11	11	11	11			A + 4 + E
56	6	9	9	9	9	10	10		A + 5 + E
57	6	9	9	9	10	10	10		A + 5 + E
58	6	9	9	10	10	10	10		A + 5 + E
59	6	9	10	10	10	10	10		A + 5 + E
60	6	10	10	10	10	10	10		A + 5 + E
61	6	10	10	10	10	10	11		A + 5 + E
62	6	10	10	10	10	11	11		A + 5 + E
63	6	10	10	10	11	11	11		A + 5 + E
64	6	10	10	11	11	11	11		A + 5 + E
65	6	10	11	11	11	11	11		A + 5 + E
66	6	11	11	11	11	11	11		A + 5 + E
67	7	9	9	9	10	10	10	10	A + 6 + E
68	7	9	9	10	10	10	10	10	A + 6 + E
69	7	9	10	10	10	10	10	10	A + 6 + E
70	7	10	10	10	10	10	10	10	A + 6 + E
71	7	10	10	10	10	10	10	11	A + 6 + E
72	7	10	10	10	10	10	11	11	A + 6 + E
73	7	10	10	10	10	11	11	11	A + 6 + E
74	7	10	10	10	11	11	11	11	A + 6 + E
75	7	10	10	11	11	11	11	11	A + 6 + E



# Passenger Detection System for escalators

TL04

## Modular ribbon-cable system



# Passenger Detection System for escalators

TL04

## Technical Description

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### Introduction

The Passenger Detection System is comprised of the following:

**Central unit TLCU**

**Cable (black) comprising transmitter modules TLX22**

**Cable (red) comprising receiver modules TLX22**

An adaptor- module serves as interface between the ribbon-cable of the light curtain and the round-cable coming from the central unit. The individual sections of the light curtain are delivered pre-assembled.

The plug-in connectors are secured to the modules with 2 crosshead (M3) screws after the provided rubber 'o' ring has been fitted. **THESE SCREWS AND 'O' RING MUST BE FITTED TO ENSURE A WATER TIGHT CONNECTION!**

**Disconnected connectors and modules must, at all costs, be protected from dirt and moisture!**

Before plugging in, care should be taken to ensure that the area is free of dirt and water contamination and that there are no bent pins in the module.

The 'O' Ring must be correctly fitted into the groove around the socket. We recommend to grease the 'O' Ring.

**The modules are not water tight without this ring!**

**Deformed or damaged 'O' Rings (NBR 16 x 2 mm) must be replaced!**

The module may then be plugged in and secured with 1,4 Nm max. **Avoid over tightening!**

The optic-window on the module should be kept free of dirt, grease and the like. Scratching should be avoided.

### ATTENTION

**If 1 module is disconnected, the entire PDS will not function!**

Each module with optic function must be fitted parallel to the escalator profile and mounted with two securing screws to the main structure or module housing brackets. An exact adjustment is not necessary but the straighter they are, the better.

The length of the M4 mounting screws is dependant upon the thickness of the mounting bracket or main structure.

**The mounting screws must not go deeper than 4mm into the mounting threads of the module.  
Tighten with 1.4Nm max. Do not use force!**

# Passenger Detection System for escalators

TL04

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## Central unit

The central unit contains the power supply for the light curtain and evaluates information feedback from the modules.

Connection to the central unit is through removable plugs. Connection to the light curtain is through two 7 core screened cables.

The central unit accommodates a built in self monitoring and fault diagnosis system which locates the first interrupted light barrier or faulty module in the curtain.

The location number is displayed on a 2 digit / 7 segment LED display in the front panel of the central unit.

The fault evaluation circuit has two parallel channels for reliability. The output to the escalator control is switched through two in line horizontal relay contacts with positive contact action (OK1/OK2).

The output relays OK1, OK2 are energized under no-fault conditions and when the detection field is uninterrupted. The contacts are then closed.. The contacts are protected by a 2 A slow blow fuse (F3).

A failsafe circuit de-energizes the output relays in the event of a divergence between the two channels. This can only occur in the unlikely event of an internal fault. In this case the red "FAIL" LED will light and remain on.

Activation of the PDS through the escalator control can be achieved by a simple, potential free relay contact (rating max. 30mA) across the "Enable" connection socket on front panel. For permanent operation, this input should be bridged with a wire link.

## Light Curtain

A detection field is generated between a line of transmitters and receivers. The light curtain is made up of pre-assembled cable sections 9, 10 or 11 modules in length. Each section starts with a plug-in connector and ends with either a linking-module or an end-module. After mounting the section, the connector only needs to be fitted into the preceeding linking-module and secured.

Each first section is connected to an adaptor-module. The adaptor-module is fitted with a screened, 7 core cable (YHCY 7 \* 0,75 mm<sup>2</sup>). This cable (typically 4 metres long) is moulded at one end into the adaptor-module. The end should be screw-clamped into the appropriate terminal connector in the terminal box or central unit.

Transmitter and receiver cables are individually colour coded i.e. Black = Tx; red = Rx.

Only cables and modules with the same colour code should be connected together.

The inter-changing of Tx and Rx modules will simply cause a systems failure but no permanent damage.

# Passenger Detection System for escalators

TL04

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## Installation

Installation is made extremely easy by virtue of the pre-assembled cable sections.

The ribbon cable must always be on the underside of the modules with the optic window facing towards the middle of the steps. Both adaptor-modules must be at the same end of the escalator.

The terminal box for connecting the light curtain to the central unit should be mounted here.

The terminal box (not supplied with the system), should conform to IP66.

On top of each module are two M4 threaded mounting holes. The modules are fitted to the mounting bracket one after the other, tight up to the face of the bracket, with two M4 screws.

### Attention!

**The lenght of the M4 mounting screws is dependant upon the thickness  
of the mounting bracket or main structure.**

**Damage will occur if the mounting screws go deeper than 4mm into the module.  
Tighten lightly.Do not use force!**

# Passenger Detection System for escalators

TL04

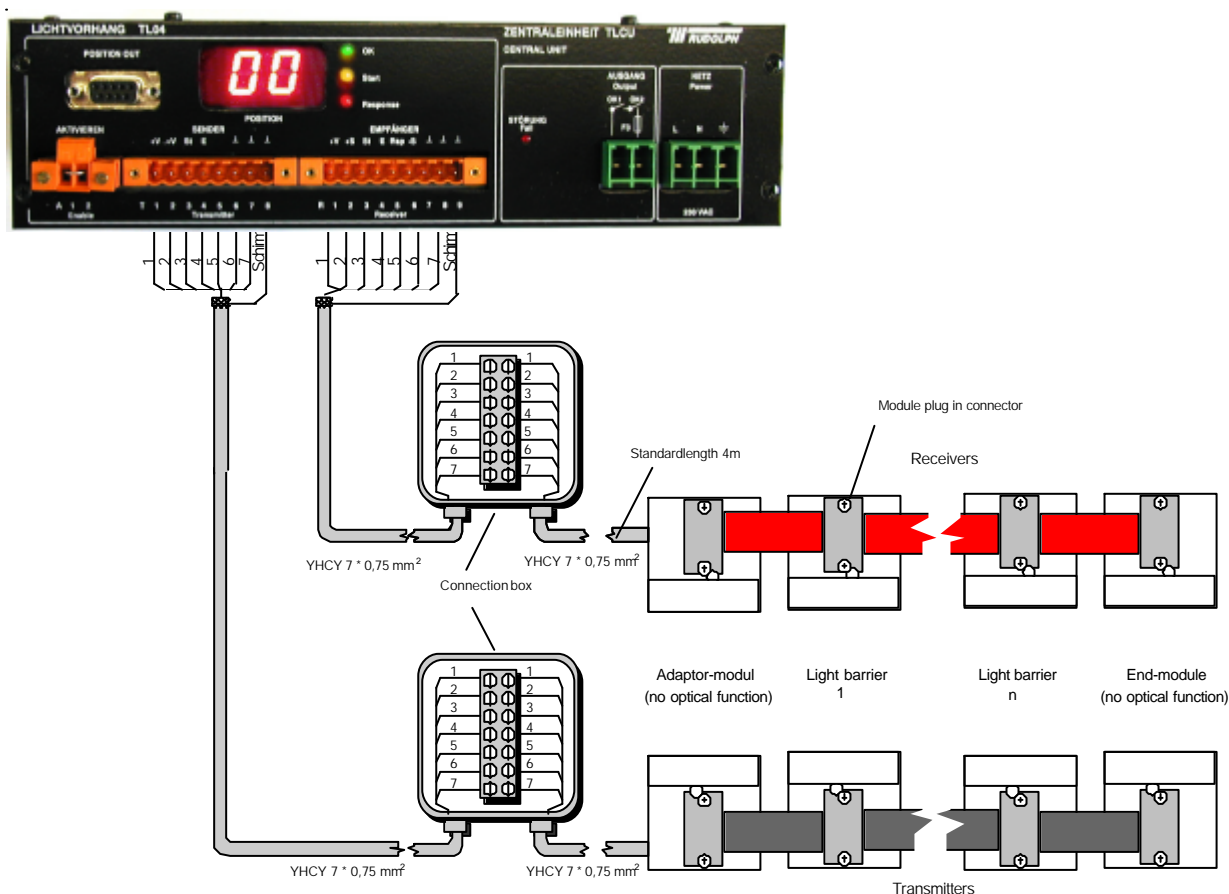
## Wiring

The screened, halogen free, 7 core cable s (YHCY 7 \* 0,75 mm<sup>2</sup>) between the central unit and the adaptor-modules are fed through the cable entry grommet of the terminal box at the end of the escalator. These connection cables are connected by means of screw terminal connectors inside the terminal box. The cable screen may not be connected in the terminal box. Only the 7 cores may..

The wiring of the terminal box must be carried out according to IP 66.

The power supply compensates voltage drops of up to 2 volts along the line from the central unit to the receiver terminal box. Conductors of 0.75 mm<sup>2</sup> cross sectional area (csa) are sufficient for leads up to 30 metres.

**The length of leads having a csa of 0.75 mm<sup>2</sup> and feeding a light curtain of 99 optic modules should not exceed 30 metres.**  
**The use of unscreened cables is not permitted!**



# Passenger Detection System for escalators

TL04

For longer lengths of cable, the following formula should be used::

$$n * l / 2800 = < 1$$

n = number of modules in the curtain, l = length of connecting lead in metres.

If the result is greater than 1, then csa must be doubled!

Both 7-core connecting leads are connected into the screw-clamp connectors in the central-unit. The 8 pole connector is for the transmitter and the 9 pole one for the receiver. The screens of both leads **must** be connected here.

**The screen of the leads must be connected to the central unit.**

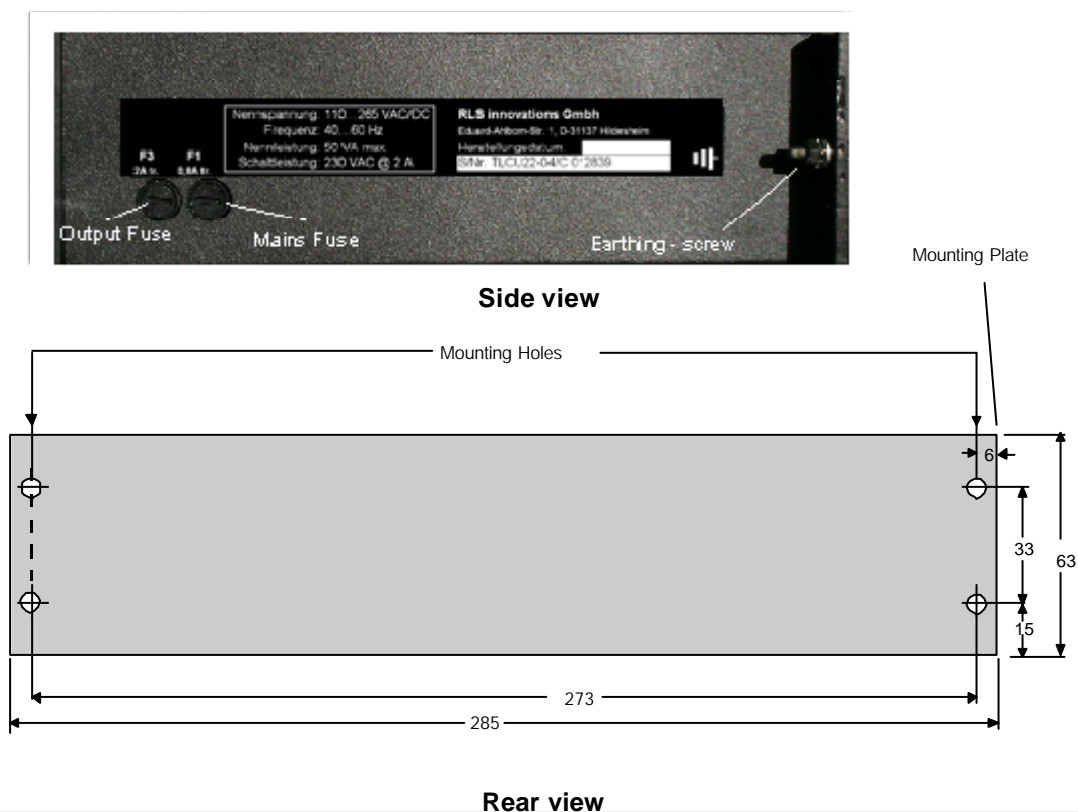
**Do not connect the screens in the terminal box.**

The input "Enable" only carries low-tension (nom.12v/30mA) and can be connected to the escalator control by a 2-core cable. For permanent operation, this input should be bridged with a wire link.

The mains-in circuits are set up for an operating voltage from 110 to 265 VAC @ 40 to 60 Hz.

The mounting position of the central unit is optional.

**Before connecting to the mains and the escalator control (OK1/OK2) the casing must be earthed to the central earthing using the earthing screw on the right hand side of the central unit!**



# Passenger Detection System for escalators

TL04

## Connecting the Central unit

### The 2-pole connector "ENABLE" (AKTIVIEREN)

Pin-Nr.	Signal-Name	Signal	Bemerkung
A1	EN	Activate input	The PDS is inactive when these terminals are not connected!
A2	GND	Ground	
<b>Activation from the escalator control :</b> A1 with A2 controlled by means of potential free relay contact. <b>Long term use:</b> A1 and A2 bridged.			

### The 8-pole connector "Transmitter" (SENDER).

Pin	Signal-Name	Signal	Conductor number
T1	+V	Supply voltage	1
T2	+V	Supply voltage	2
T3	START	Start signal	3
T4	S-END	End signal	4
T5		not used	5
T6	GND	Ground	6
T7	GND	Ground	7
T8	GND	Ground	Cable screen

### The 9-pole connector "Receiver" (EMPFÄNGER) .

Pin	Signal-Name	Signal	Conductor number
R1	+V	Supply voltage	1
R2	+S	+ Sense	2
R3	START	Start signal	3
R4	R-END	End signal	4
R5	RESP	Response-Signal	5
R6	-S	- Sense	6
R7	GND	Ground	7
R8	GND	Ground	not used
R9	GND	Ground	Cable screen

### Green, 2-pole connector "Output" (Ausgang) .

The "escalator free" signal to the escalator control is achieved through relay contacts OK1/OK2. These contacts are protected from overload by a 2A, slow blow fuse.

### Green, 3 pole connector "Power" (NETZ).

The unit is set up for a mains supply of between 110 and 265 VAC @ 40 to 60 Hz . The maximum power consumption should not exceed 50 VA . The mains fuse (F1) is an 800mA slow blow fuse. The casing must be earthed, through the screw provided, to the central earth.

### The 2-pole connector "FAIL OUT".

Potential free optocoupler output, normally closed. Opens in event of internal failure.  
Connections: - = Emitter, + = Collector  
Max. permitted voltage: +70VDC  
Max. permitted current: 25mA@ 24VDC

# Passenger Detection System for escalators

TL04

## Connecting to the central unit

### The 9-pole D-Connector „POSITION OUT“

Pin	Signal	
1	$2^0$	1. Decade
2	$2^1$	1. Decade
3	$2^2$	1. Decade
4	$2^3$	1. Decade
5	GND	
6	$2^0$	2. Decade
7	$2^1$	2. Decade
8	$2^2$	2. Decade
9	$2^3$	2. Decade

The counter o/p of the 2 digit, 7 segment display is available from the 9-way socket "POSITION OUT".

The o/p driver IC is an Octal-CMOS-Latch 74C374 with 12V supply voltage.

#### Ausgangsinformation:

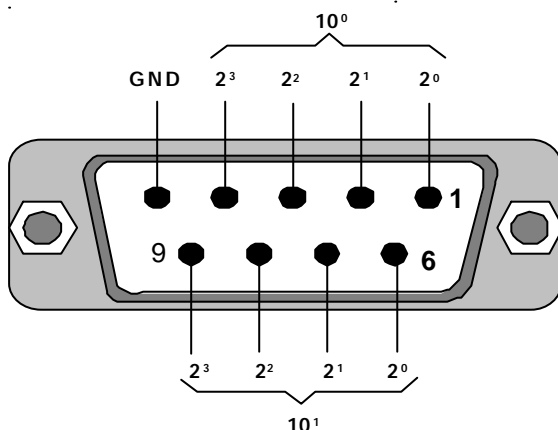
2 Decades in BCD-Format. (0=LLLL, 9=HLLH)

#### Logic level:

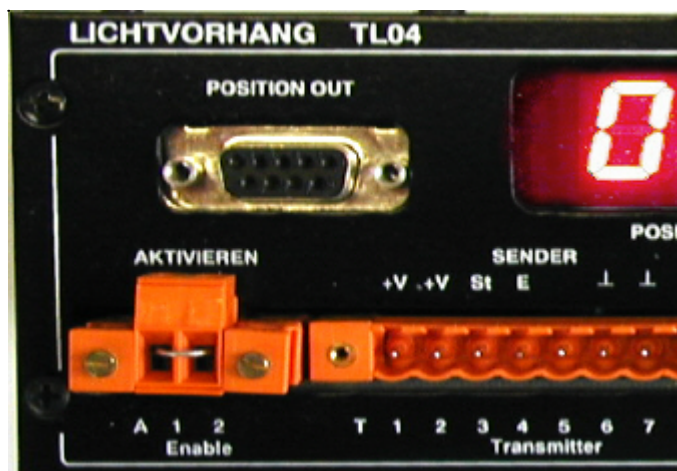
L= 0V (<1V)

H=12 V(>11 V)

max. o/p current: 8 mA (sink / source)



9-pol. D-connector in the Central unit





# Passenger Detection System for escalators

TL04

## Function of the Operating and Indicating Elements

### 1) Red LED „Fail“

After mains failure or in the event of an internal failure of the central unit, the OK output relays de-energize. This is indicated by the lighting of the red LED „Fail“.

If the LED does not extinguish itself after the mains have been re-applied there is a serious defect in the central unit.

### 2) Green LED „OK“

The green LED „OK“ indicates that the escalator is free. The output relay contacts OK1/OK2 are closed and the escalator control receives the „escalator free“ signal.

### 3) Yellow LED „Start“

This LED indicates that the central unit is sending a start pulse to the modules.

For this, the central unit must be activated (A1/A2 connected).

### 4) Red LED „Response“

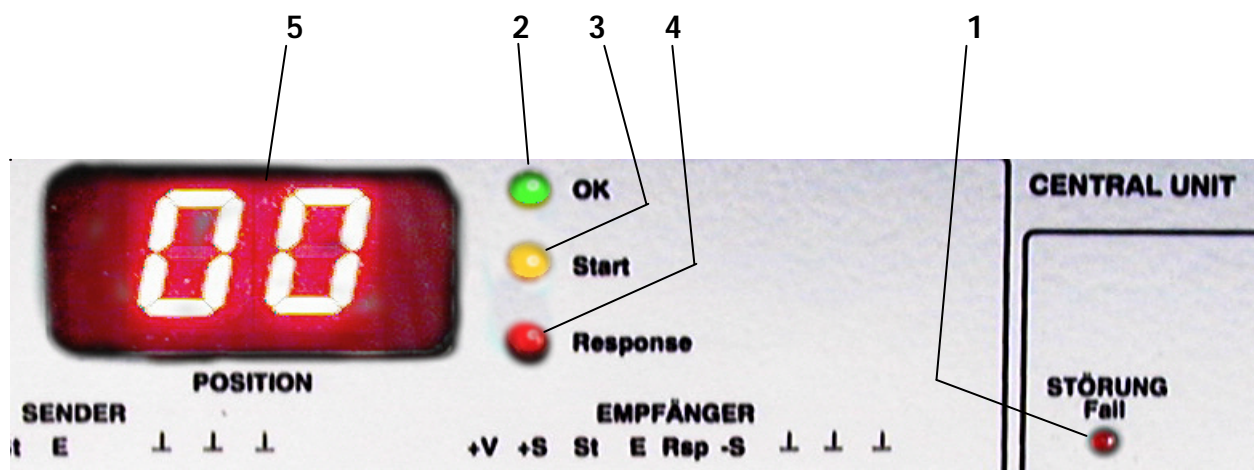
This LED indicates that the returning start pulses (response) have been received. If the the LED fails to light after the start LED, then there is a fault in light curtain and the „escalator free“ signal will not be activated.

### 5) 7-Segment-Display

The 2-digit display indicates the location of the first interrupted light barrier or the first defect module. If all is clear, the display will show 00.

If the central unit is not activated, the display will show just the 2 decimal points.

These decimal points are also used to indicate on which side an error is to be found. The left dot indicates a fault on the transmitter side and the left, a fault on the receiver side.



# Passenger Detection System for escalators

TL04

## Initial Set-up

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After mounting the modules of the light curtain in the mounting brackets and connecting all cables, the PDS can be brought into operation by plugging in the mains supply. Installational adjustments are not necessary.

### Start-up sequence

The central unit goes through a reset procedure when the mains are applied. During the time out delay of approximately 2 seconds, the unit runs through an internal function test. The same delay of 2 seconds can occur through contact bounce of the **activate** relay.

During this period, the status of all indicators is irrelevant.

### Switch-on procedure

If A1 and A2 are connected and the escalator is free of passengers when the power is applied, the display will show **00** and the LEDs **OK**, **Start** and **Response** will light.

The red LED **Fail** lights during the reset sequence and then goes out.

### Reset and restart

The central unit can be reset or restarted by removing the mains for about 5 seconds during which time the **Fail** LED will light briefly, then slowly fade out. When the LED and the segments of the display are completely out, the mains can be re-applied.

### Activating the System

If the central unit is on but not activated (A1 /A2 not connected), the two decimal points of the 7-segment display will show.

When activated, the display digits will light and the decimal points will go out.

The yellow **Start** and the red **Response** LEDs light simultaneously.

When the unit has completed its test of all modules, the green **OK** LED will light up and the **OK** relays will pull in, thereby achieving the "escalator free" signal to the escalator control.

The display shows **00**.

The condition remains until the detection field is interrupted or until the activate signal is removed.

The cycle time for the test can be calculated as follows:

$$t [\text{ms}] = n \times 2,05 \text{ ms} \quad (n = \text{length of curtain}).$$

The OK relays drop out immediately if the central unit detects an interruption in the detection field, a defect module or if the activate contact is opened.

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## Interruption of the Detection Field

When the monitoring sequence reaches an interrupted light barrier, the **OK** LED goes out, the OK Relais de-energize and the digital display shows the position number. The "escalator free" signal is immediately removed.

If more than one barrier is interrupted, only the position of the first will be shown.

If only one light barrier is interrupted, the effect of the missing response pulse will not be noticeable in the reaction of the red **Response** LED. If all barriers are interrupted, the **Response** LED will not light at all.

## Care and Maintenance

The PDS should be subjected to a thorough functions test during maintenance work on the escalator.

For a PDS in constant use, the interval between function tests should not exceed 3 months.

During the functions test, the maintenance personnel must carry out a visual inspection of the entire detection system.

Re-focusing work is not necessary.

### Please note:

Dirt and scratched perspex covers reduce the light energy and lead to increased likelihood of failure due to wear and tear.

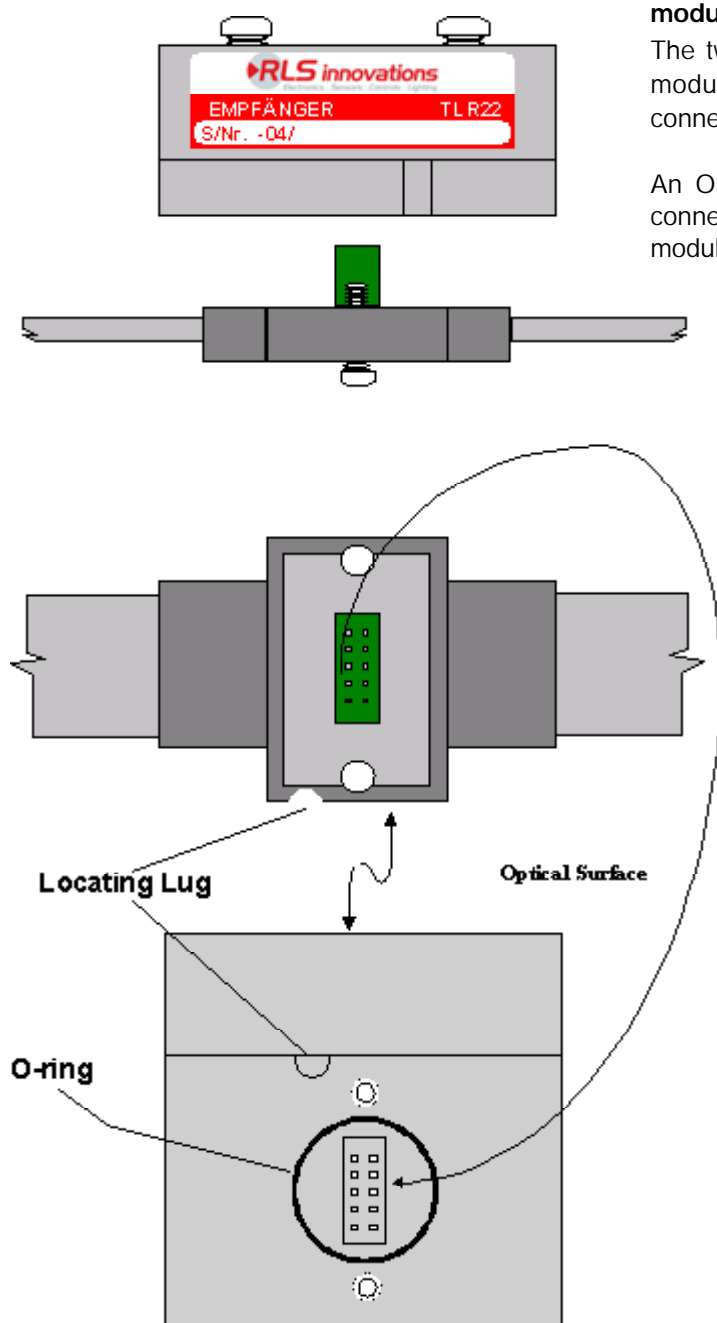
In order to maintain full operational capability, the perspex covers should be cleaned regularly and badly scratched covers should be replaced.

**Only perspex covers authorized by RLS innovations GmbH should be used!**

# Passenger Detection System for escalators

TL04

## Exchanging Modules



**Disconnect equipment from mains. Remove module from the profile.**

The two M3 x 8 screws securing the cable to the module should be loosened **alternately** until the connector can be carefully removed.

An O-ring, type NBR 16x2 mm, ensures that the connection remains water-tight. When removing the module, keep the ring safe for re-use.

**When connecting a linking-module or when exchanging a module, it is essential to ensure that the O-ring and the connection zone are free from dirt and foreign bodies!**

**Deformed or defective O-rings must always be replaced!**

**Modules without an O-ring are not water tight!**

Check the type label on the new module.

The label on the transmitter is black whereas the label on the receiver is red.

Connect transmitter modules only to the black cable and receiver modules only to the the red cable.

Tighten fixing screws securely.  
**DO NOT USE FORCE!**

**Please ensure that the optical surface is not scratched and is free of dirt, grease and any other obstructions.**

Remount the module in the profile.

Reconnect the equipment and test.

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# Passenger Detection System

## Documentation

**TL04**



Version C1.C  
THL01.05