



SCAN

**Messender Lichtvorhang
Anschluß- und Betriebsanleitung**


**Measuring Light Curtain
Connecting and Operating Instructions**



Notes on using these connection and operating instructions



This manual contains information regarding the proper and effective use of SCAN light curtains. It is included in the scope of delivery.

Safety precautions and warnings are designated by the symbol .

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1 System Overview and Range of Applications

1.1 System Overview

SCAN light curtains consist of a transmitter and a receiver. Like a light barrier, they work with modulated infrared light and stand out due to the following features:

- Measurement field up to 6 m wide, from 900 to 3000 mm high
- 30 mm resolution at every position of the measurement field
- Can be connected directly to an PLC control (such as the Siemens S7-200)
- PNP switch output for measurement field status free/occupied
- Simple connection due to M12 connector
- Contamination and error signal output to the PLC
- Extremely small design (cross-section 17 mm x 33 mm)

1.2 Range of Applications

The scope of SCAN applications ranges from simple detection or measuring tasks, such as controlling projection or the presence of an object, to contour or shape recognition.

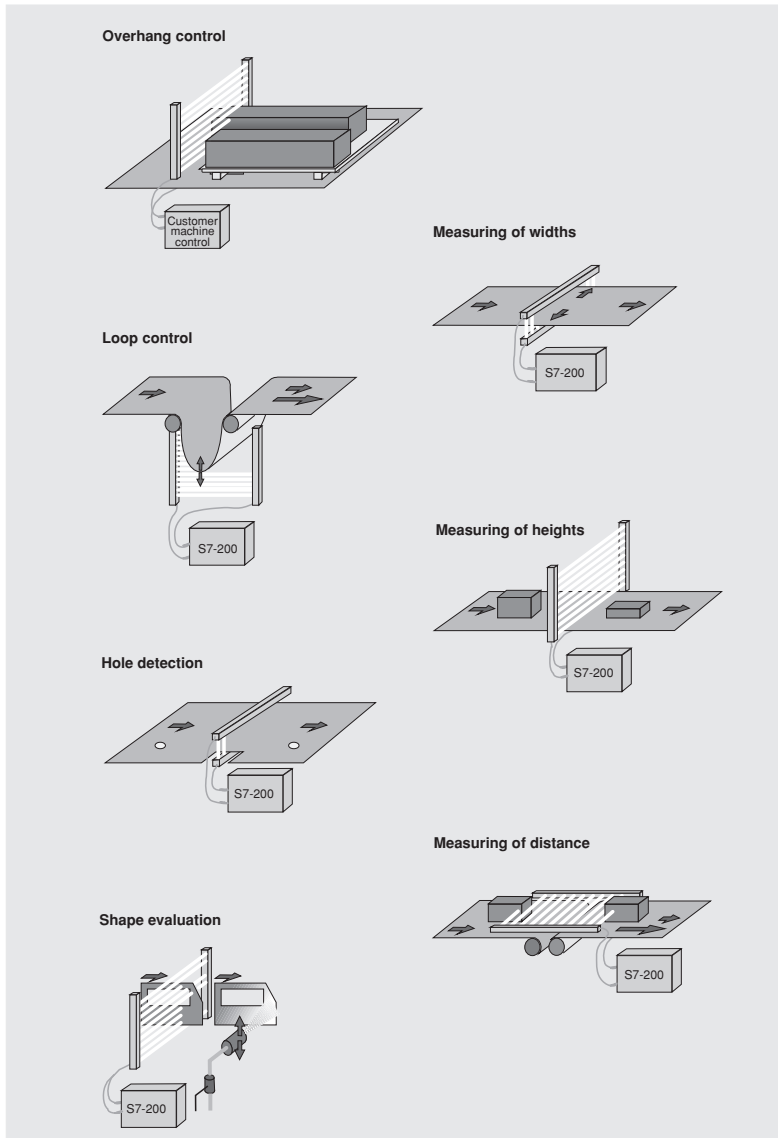


Fig. 1: Examples of Applications Using the Measuring Light Curtain SCAN

2 Safety Precautions



SCAN light curtains are **not** active optoelectronic protective devices (AOPD) in accordance with IEC 61496-1, -2 and are thus **not** suited for personnel protection.

3 Configuration and Function

3.1 System Configuration

SCAN light curtains consist of a transmitter equipped with a number of sequentially controlled IR radiation elements aligned in a row, and a receiver equipped with a number of sequentially controlled receiver elements, likewise aligned in a row. The parallel light axes projected between the transmitter and receiver create a measurement field with a resolution of 30 mm. In order to achieve linked measurement fields for different geometric planes, SCAN master and slave units can be switched in succession by means of a plug-in connector cable. The receiver has a switch output for performing simple detection tasks as well as a serial data interface for transmitting measurement values to a control system for further processing. A driver program is available that enables SCAN to be connected directly to the Siemens S7-200. Drivers for controls from other manufacturers can be produced upon request.

Figure 3 shows the system configuration of SCAN in both its standard design and its master/slave version.

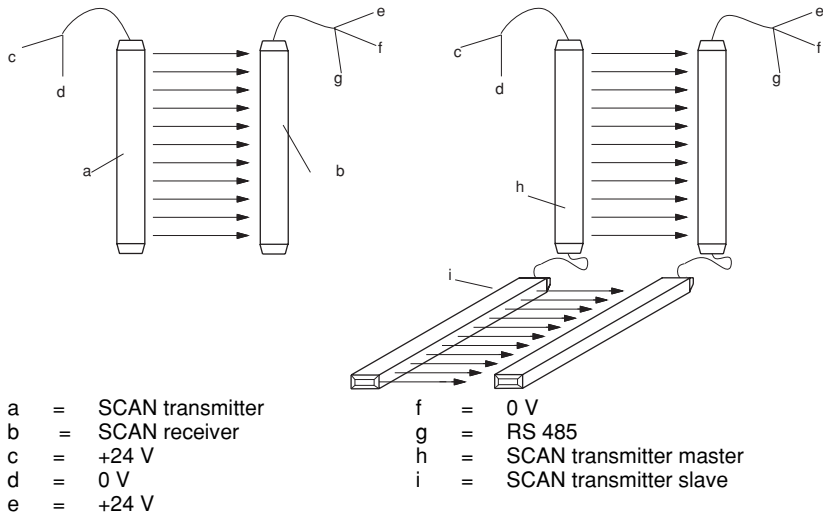
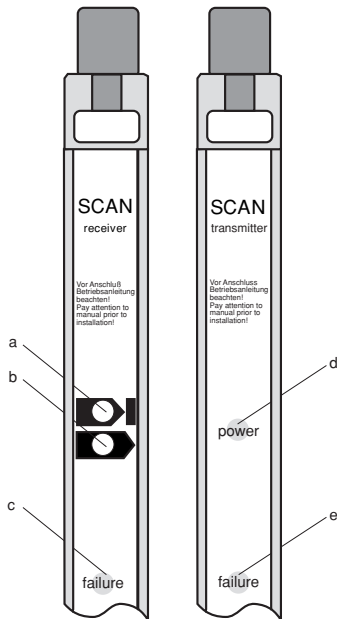


Fig. 2: SCAN Standard Configuration or Master/Slave Version

3.2 Function

After the supply voltage is applied, the infrared light axes are controlled and evaluated individually in quick succession. The measurement value of each light axis ("light path unobstructed" or "light path interrupted") is output either as an aggregate signal at the switch output or as a single measurement value within a serial data stream via the RS 485 interface of the receiver.

3.3 Display Elements



- a = Object in the measurement field or device out of alignment
- b = Measurement field unobstructed
- c = Failure in the receiver
- d = Supply voltage / Transmitter on
- e = Failure in the transmitter

Fig. 3: Display Elements

3.4 Switch Output Measurement Field Status

The short-circuit-proof 24 V pnp switch output on the receiver is able to switch earthed loads of up to 0.1 A. Contactors or relays must be wired parallel to the coil with suitable components for suppressing interference.

3.5 RS 485 Data Interface

The signal statuses of the individual light axes ("light path unobstructed" or "light path interrupted") are transmitted as a serial data stream over the RS 485 interface. The transmission takes place in half duplex mode at 19.200 baud in the Leuze lumiflex-specific protocol described below.

The data packet cyclically transmitted by the receiver is configured as follows:

Start identifier	(STK)	1 byte
Length of the entire packet	(LDP)	1 byte
Status	(STA)	1 byte
Beam number	(STZ)	1 byte
Usable data (light path unobstructed)	(NDT)	1..30 byte
CRC (8 Bit)	(CRC)	1 byte

Description:

STK: start identifier constant 0BH
LDP: dependent on the beam number (min.9 , max.35)
 LDP = 1 byte(STK) + 1 byte (LDP) + 1 byte (STA) + 1 byte (STZ)
 + x byte (NDT) + 1 byte (CRC)
 where: x [NDT] = (STZ/8) rounded up to the next full byte.

Example:

STZ = 35:
 $\rightarrow x \text{ [NDT]} = (35/8) = 4,375 \rightarrow x \text{ [NDT]} = 5 \rightarrow \text{LDP} = 5 + 5 = 10$

STZ = 162:
 $\rightarrow x \text{ [NDT]} = (162/8) = 20,25 \rightarrow x \text{ [NDT]} = 21 \rightarrow \text{LDP} = 5 + 21 = 26$

STZ = 240:
 $\rightarrow x \text{ [NDT]} = (240/8) = 30,0 \rightarrow x \text{ [NDT]} = 30 \rightarrow \text{LDP} = 5 + 30 = 35$

STA: Bit 0: 0 = no error , 1 = error/message (in normal operation Bit 0 = 0)
 Bit 1: 0 = (internal information)
 Bit 2: 1 = (internal information)
 Bit 3: 0 = strong receiver signal, 1 = weak receiver signal
 Bit 4..5: free
 Bit 6: 0 = object in the measurement field,
 1 = all light paths unobstructed
 Bit 7: 0 = (internal Information)

In case of an error/message (Bit 0 = 1):

Bit 1..5: error number

Bit 6..7: free

In case of an error/message, the error number determines the contents of the usable data:

Error numbers 0..30: Usable data (NDT) 1 byte with an indication of the error location (LOC)

Error numbers 31: Usable data (NDT) max. 250 bytebyte with copyright message

STZ: Beam number 1..240

NDT: (error/message bit = 0):

only beam data

beam 1: LSBit byte1 ... beam 240: MSBit byte30 in block

x: 0 = beam interrupted , 1 = beam unobstructed

Example:

STZ = 35: --> 5 bytes of beam data

NDT = xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx 00000xxx

CRC: 8 Bit CRC with generator polynomial 19B hex.

The CRC sum is arrived at by means of STK, LDP, STA, STZ, NDT.

Example of a complete send string:

64-beam unit,

beams 1..10 no reception,

eams 40..50 weak reception,

object in the measurement field,

no error:

0BH, 0DH, 0CH, 40H, 00H, FCH, FFH, FFH, FFH, FFH, FFH, FFH, 58H

3.6 Driver Program for the PLC Control (e.g. Siemens S7-200)

An PLC-specific software module is required in order for the control to be able to accept the measurement data. The program configuration is clearly shown by the following example of the driver for the Siemens S7-200 control. Based on the transmission protocol described above, drivers for other controls can be easily created by any programmer familiar with that particular control. Leuze lumiflex would be happy to lend support in this regard and is endeavoring to gradually offer drivers for other well-known controls.

The following example illustrates the program structure of the software module. The corresponding program listing in STEP7/Micro is available upon request.

The driver program, which functions as an interrupt module, takes over the SCAN measurement data as a serial data stream at Port 0 and deposits them in a data buffer. The individual light axis are made available to the user bit-by-bit beginning at memory position VB20 (1 = light, 0 = no light), continuing from the first light axis (at the SCAN connection) to the last light axis (at SCAN's free end).

When a data packet has been successfully received, the driver program sets the marker „M_Userbuffer_ready“. Since this marker can be deleted by the user program after the measurement values have been read in, it can be used to control the data reception.

The entire memory area of the PLC is available to the user program, with the exception of the variable memory VB0 ... VB50 and the marker bit M0.0.

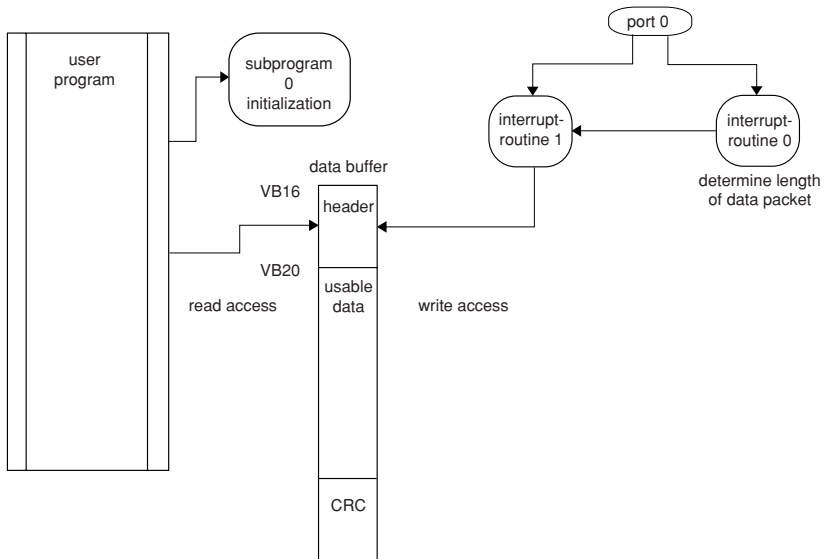


Fig. 4: Software module for data acceptance by the Siemens Simatic S7/200

3.7 Contamination and Error Signal Output

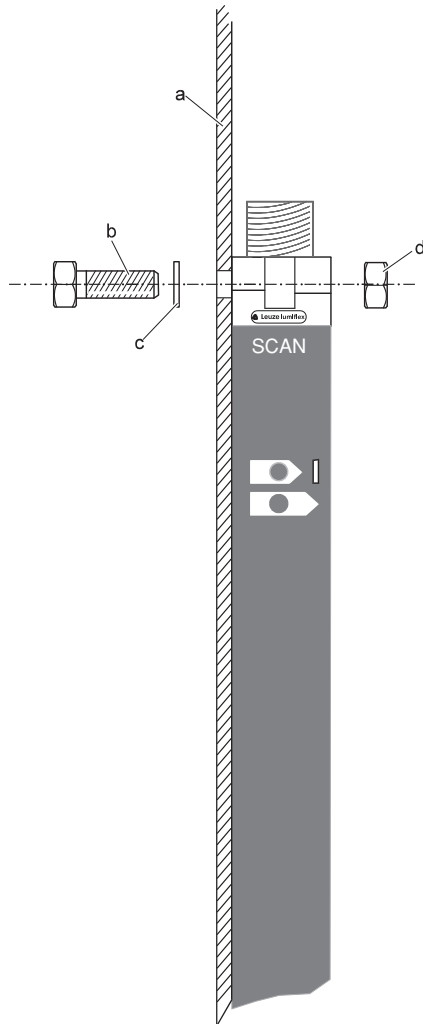
This pnp output normally carries +24 V. In case of a weak receiver signal caused by contamination or misalignment, or in case of a fault, this output is switched to high resistance. The output is short-circuit-proof and can carry up to 70 mA.

4 Mounting

4.1 Standard Mounting

SCAN units are mounted by means of through holes in the profile end pieces. (For the distance between holes, see the dimensional table on page 17 and the dimensional drawing on page 18.) The holes have a diameter of 5.3 mm.

This fixed mounting method is appropriate only when no adjustment is required (i.e. the mounting surfaces are located in one plane and the mounting positions are at the same height).



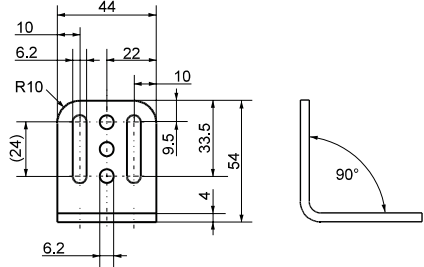
- a = Mounting surface
- b = Screw M5
- c = Washer
- d = Nut M5

Fig. 5: SCAN Standard Mounting using Through Holes in the End Pieces

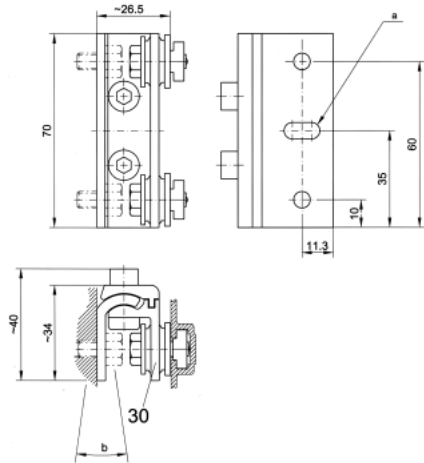
4.2 Mounting SCAN with the Protective Mounting Profile

To provide additional mechanical protection, the SCAN can be snapped into a protective mounting profile. This is recommended for larger measurement heights and when the units need to be adjustable. The protective mounting profile can be used with either a standard mounting bracket or a swivelling mounting support with vibration damping.

Standard Mounting Bracket



Swivelling Mounting Support with Vibration Damping (Swivelling range $\pm 8^\circ$)



SCAN with Protective Mounting Profile

- a = SCAN protective mounting profile
- b = Lengthwise groove for freely positionable M6 sliding brackets
- c = Slot 13 x 6
- d = swivelling angle

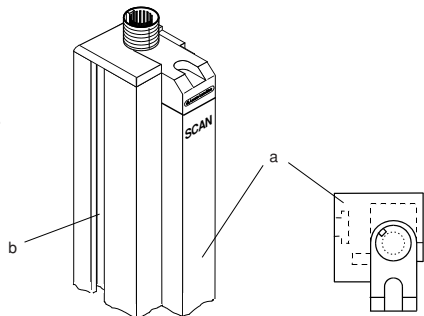


Fig. 6: Mounting using the SCAN Protective Mounting Profile

5 Electrical Installation

5.1 Supply Voltage

The transmitter and receiver must be supplied with 24 V DC +/- 20 %. The maximum power consumption is 150 mA (without load). The power supply must exhibit a safe mains separation in accordance with IEC 60742 and be able to bridge short-term mains failures of up to 20 ms.

5.2 Electrical Connections and Terminal Assignment

The connections are made using shielded connecting cables with M12 connectors (available as accessories). There are two possible types of connection. Either the transmitter and receiver can be connected to the control cabinet via separate cables (M12 plug at one end), or they can be joined via an M12 Y-distributor and then connected to the control cabinet by means of a joint connecting cable (see Accessories).

The shield must be connected to PE. The cables must be laid separately from mains power cables. The following tables show the terminal assignments of the transmitter and receiver.

SCAN Transmitter			SCAN Receiver		
M12 Connector	Wire color	Meaning	M12 Connector	Wire color	Meaning
1	white	+24 V	1	white	+24 V
2	brown	PE	2	brown	PE
3	green	0 V	3	green	0 V
4	yellow	free	4	yellow	Switch output
5	grey	free	5	grey	"Weak signal", "Failure"
6	pink	free	6	pink	RS 485+
7	blue	free	7	blue	RS 485-
8		Protective shield/PE	8		Protective shield/PE

5.2.1 SCAN as a Switching Light Curtain in Stand-alone Operation

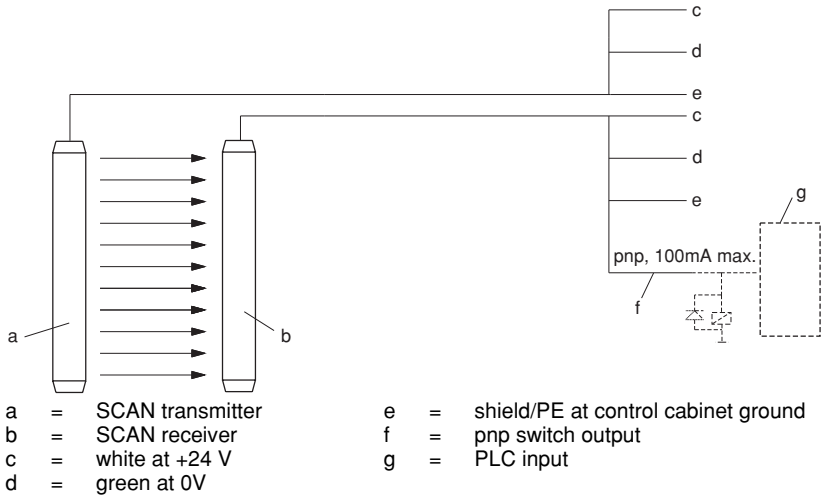


Fig. 7: SCAN as a Switching Light Curtain in Stand-alone Operation

5.2.2 SCAN as a Measuring Light Curtain with the Siemens S7-200

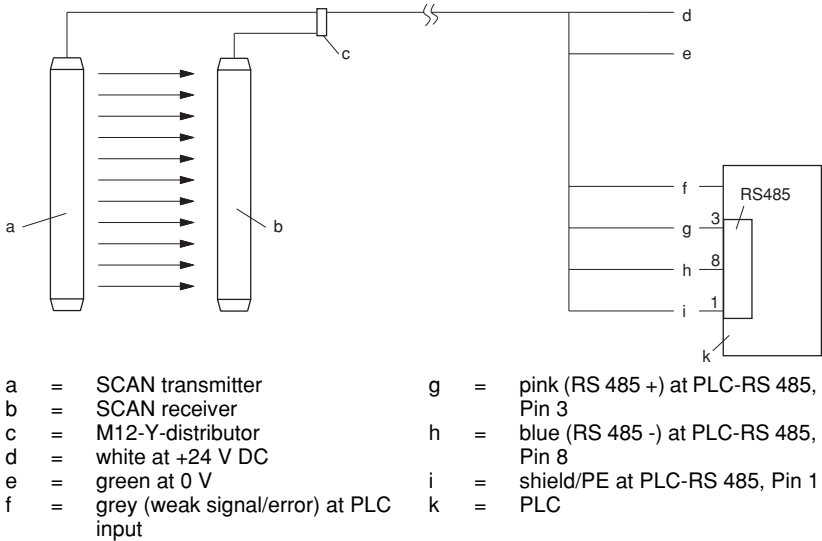


Fig. 8: SCAN as a Measuring Light Curtain in Combination with the Siemens S7-200

6 Start-up

- Before switching on the unit for the first time, check the supply voltage (24 V DC +/- 20 %).
- Turn on the supply voltage (transmitter LED "power" lights up).
- A self-test lasting approx. 2 seconds will be performed in the transmitter and receiver.
- In case of optimal alignment, only the green LED in the receiver will still be lit up.

If the green LED does not light up after 2 seconds, please check the following points:

- Make sure that there is no object in the sensing zone.
- If so, remove the object.
- Check the orientation of the units to each other. (Transmitter and receiver must be mounted at the same height, and the front screens must be exactly parallel to each other.)
- If the "failure" LED lights up in the transmitter or receiver, the corresponding component has an internal defect and must be replaced.
- For operation with Simatic S7-200:
To activate the freely programmable communication over Port 0, the operating mode switch must be set at "RUN". In the "TERM" position, the PPI protocol for communicating with the programming device is enabled. The entire memory area of the PLC, except for the variable memory VB0 ... VB50 and the marker byte M0.0, is available to the user program.

7 Cleaning

The front screens must be cleaned regularly, depending on the amount of dirt that has accumulated. The message output of the receiver indicates, at the latest, when cleaning is necessary. We recommend using a mild cleaning agent for cleaning the Plexiglas front screens. The Plexiglas front screens are highly resistant to diluted acids and alkalies, and are resistant to organic solvents to a limited extent.

8 Technical Data and Dimensional Drawings

Measurement field height	900, 1050, 1200, 1350, 1500, 1800 mm *)
Measurement field width (range)	0.3 ... 6 m
Resolution	30 mm
Number of light axes	33 - 250 (6 light axes per 150 mm measurement height)
Time required per light axis	200 µs
Enclosure rating	IP 65
Ambient operating temperature	0 ... 55 °C

Protection class	I
Supply voltage	24 V DC +/- 20 %
Current consumption	Transmitter: 75 mA, receiver: 75 mA
Switch output	pnp output, short-circuit-proof, 100 mA max
Contamination/error signal output	pnp output, short-circuit-proof, 70 mA max
Data interface/Receiver	RS-485, 19 200 baud, half duplex mode
Electrical connection	8-pin round M12 plug-in connector
Connecting cable	7-pin, 0.25 mm ² , shielded, with injection molded connector, length 5 m or 15 m (see Accessories)
Dimensions	Cross-section 17 mm x 33 mm, Length (with connector and connecting area) = measurement height + 96 mm
Humidity	15 ... 95 % (non-condensing)
Storage temperature	-25 ... +75 °C

*) other measurement heights up to 3000 mm upon request

Dimensions, Weights and Scanning Times of the SCAN light curtains

Device Type	Protecting height = Dim.A [mm] *)	Dim. B [mm]	Mounting Dim. a [mm]	Weight [kg]	Time/Scan [ms]
S30-150	170.5	248.5	238.5	0.156	7.2
S30-225	245.5	323.5	313.5	0.198	10.8
S30-300	320.5	398.5	388.5	0.24	14.6
S30-450	470.5	548.5	538.5	0.324	10.8
S30-600	620.5	698.5	688.5	0.408	14.4
S30-750	770.5	848.5	838.5	0.492	18
S30-900	920.5	998.5	988.5	0.576	14.4
S30-1050	1070.5	1148.5	1138.5	0.66	16.8
S30-1200	1220.5	1298.5	1288.5	0.745	19.2
S30-1350	1370.5	1448.5	1438.5	0.83	21.6
S30-1500	1520.5	1598.5	1588.5	0.913	24
S30-1650	1670.5	1748.5	1738.5	0.997	26.4
S30-1800	1820.5	1898.5	1888.5	1.08	28.8
S30-2100	2120.5	2198.5	2188.5	1.2	32.4
S30-2400	2420.5	2498.5	2488.5	1.36	38.4
S30-2700	2720.5	2798.5	2788.5	1.52	43.2
S30-3000	3020.5	3098.5	3088.5	1.68	48

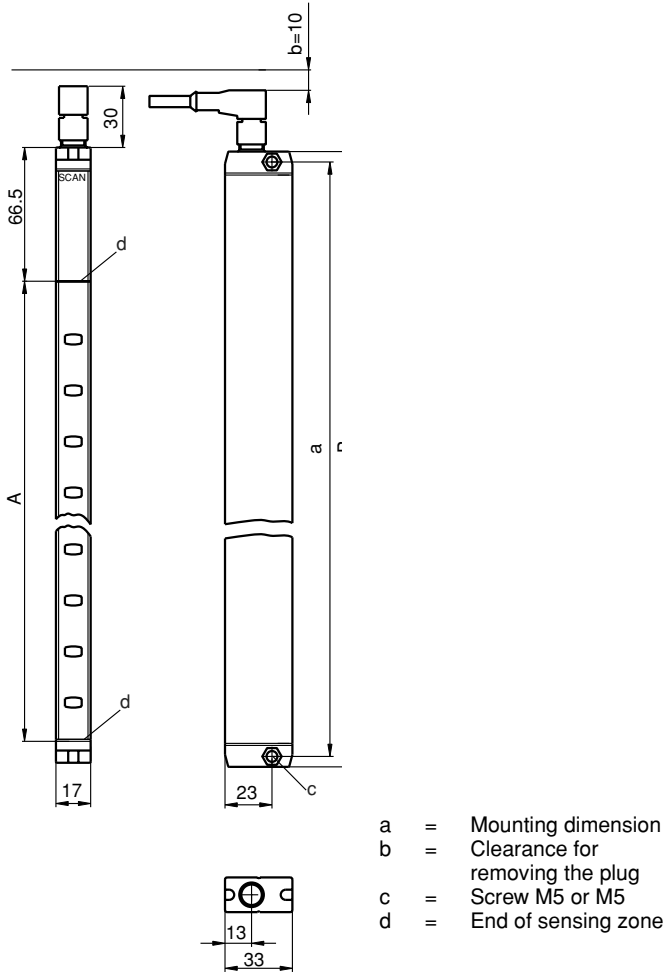


Fig. 9: Dimensional Drawing of SCAN Series S30

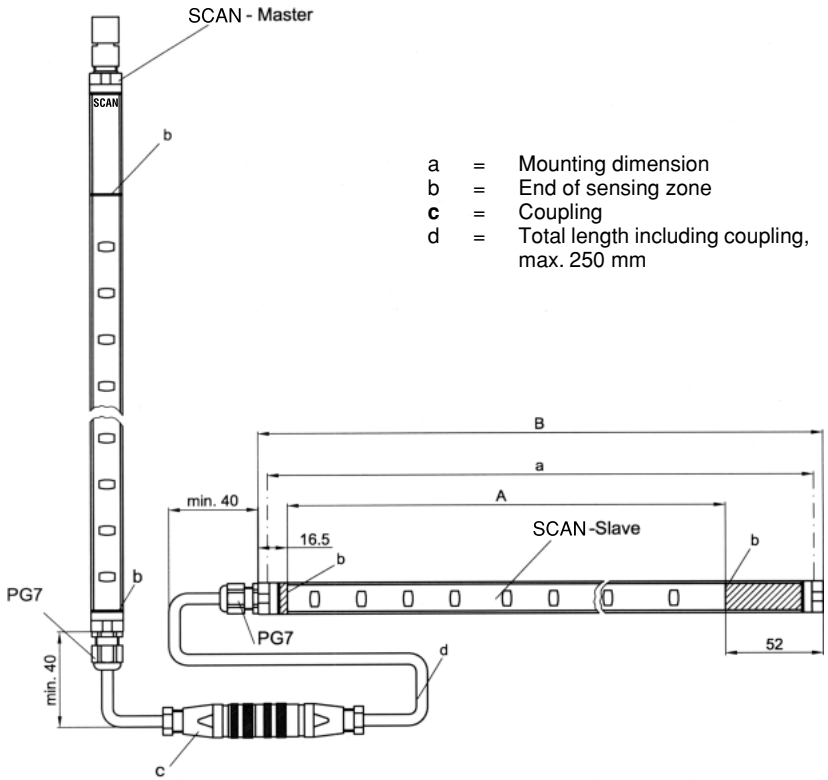


Fig. 10: Dimensional Drawing of SCAN "Cascaded Design"

Dimensional Table

Device Type	Slave Maß A	Slave Maß B
S30-150	180	248.5
S30-225	225	323.5
S30-300	330	398.5
S30-450	480	548.5
S30-600	630	698.5
S30-750	780	848.5
S30-900	930	998.5
S30-1050	1080	1148.5
S30-1200	1230	1298.5
S30-1350	1380	1448.5
S30-1500	1530	1598.5
S30-1650	1680	1748.5
S30-1800	1830	1898.5

The total measurement times for master and slave units are made up of the sum of the partial scan times.

9 Selection and Ordering Information

9.1 Device Designation

Example SR30-900 M
Ea bb-dddd e

S SCAN

a T = transmitter
R = receiver

bb Resolution [mm]

dddd Measurement height [mm]

e Only for cascadable units
M = master unit
S = slave unit

9.2 Order Numbers and Accessories

The scope of supply of a SCAN consists of:

- 1 SCAN transmitter ST...

- 1 SCAN receiver SR ...
- 1 set of Connection and Operating Instructions

Order numbers

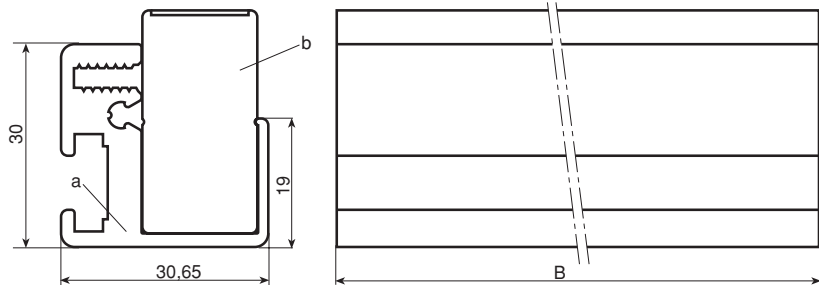
Type *)	Standard	Master	Slave
ST30-900 SR30-900	641309 644309	642309 645309	643309 646309
ST30-1050 SR30-1050	641310 644310	642310 645310	643310 646310
ST30-1200 SR30-1200	641312 644312	642312 645312	643312 646312
ST30-1350 SR30-1350	641313 644313	642313 645313	643313 646313
ST30-1500 SR30-1500	641315 644315	642315 645315	643315 646315
ST30-1650 SR30-1650	641316 644316	642316 645316	643316 646316
ST30-1800 SR30-1800	641318 644318	642318 645318	643318 646318

*) other measurement heights up to 3000 mm upon request

Accessories:

SCAN Protective Mounting Profile

The snap-open profile offers additional protection and variable possibilities for mounting using either a standard mounting bracket or a swivelling mounting support.



- a = SCAN protective mounting profile
b = SCAN

Fig. 11: Dimensional Drawing of "SCAN Protective Mounting Profile"

For the dimensions of B, see dimensional table on page 17/18.

Order numbers

Type	Order No.
Driver program for the S7-200 control on 3.5 " diskette	601120
Connecting cable (M12 plug/socket at each end), length 0.5 m ¹⁾	548501
Connecting cable (M12 plug/socket at each end), length 2 m ¹⁾	548502
Connecting cable (M12 plug/socket at each end), length 5 m ¹⁾	548505
Connecting cable (M12 plug/socket at each end), length 10 m ¹⁾	548510
M12 Y-distributor (for joining the transmitter and receiver cables into one common cable to the control) ¹⁾	548500
Connecting cable (M12 socket at one end), length 5 m ²⁾	548405
Connecting cable (M12 socket at one end), length 15 m ²⁾	548415
Protective mounting profile SCAN-900	426809
Protective mounting profile SCAN-1050	426810
Protective mounting profile SCAN-1200	426812
Protective mounting profile SCAN-1350	426813
Protective mounting profile SCAN-1500	426815
Protective mounting profile SCAN-1650	426816
Protective mounting profile SCAN-1800 ³⁾	426818
Mounting bracket with accessories (sold in sets of two) ^{4), 5)}	560120
Swivelling mounting with vibration damping ^{4), 5)}	560300

- 1) For wiring with a joint cable to the control cabinet are required:
 1 cable from the transmitter to the distributor,
 1 cable from the receiver to the distributor,
 1 cable from the distributor to the control cabinet and
 1 M12-Y-distributor
- 2) For wiring with two separate cables to the control cabinet are required:
 1 cable from the transmitter to the control cabinet and
 1 cable from the receiver to the control cabinet
- 3) Other heights upon request
- 4) Only for use with the SCAN protective mounting profile
- 5) 2 pieces each required for the transmitter and the receiver

10 Declaration of Conformity

ENGLISCH



Leuze lumiflex

EC Declaration of Conformity

according to EC Machine Directive 98/37/EC, Annex II C

We herewith declare, Leuze lumiflex GmbH + Co. KG
Liebigstrasse 4
82256 Fürstenfeldbruck

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

Description of the Component: Measuring Light Curtain

Safety Component Type: **SCAN**

Serial Number: see type plate

Applicable EC Directives: EC Low Voltage Directive (73/23/EEC)
EC Directive of Electromagnetic Compatibility (89/336/EEC)
As amended by 91/263/EWG, 92/31/EWG and 93/68/EWG

CE-marking: The compliance with the directives 73/23/EWG and 89/336/EWG is certified by the CE.mrk.

Fürstenfeldbruck, 20. August 2002

ppa: Dr. Holger Lehmitz
Manager product unit
Safety at work

ppa: Werner Lehner
Manager product management



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