

the sensor people

## ROTOSCAN RS4/AS-i




## About the Connecting and Operating Instructions





The Connecting and Operating Instructions for the ROTOSCAN RS4/AS-i laser scanner contains information that supplements the Connecting and Operating Instructions for the ROTOSCAN RS4-4 laser scanner. This information describes the correct manner of use, project configuration, assembly, electrical installation and putting into operation of scanners with an AS-interface connection. Additional information will be found in the Connecting and Operating Instructions for the RS4-4 and in the RS4soft User Manual. These three documents, as well as the RS4soft software, are intended for the use of planners, operators and maintenance personnel of systems which are protected with the ROTOSCAN RS4/AS-i laser scanner.

It is essential that all the instructions given in the Connecting and Operating Instructions and in the User Manual be observed, especially those relating to safety.

The Connecting and Operating Instructions and the User Manual should be carefully looked after. They must be available at all times throughout the period when the scanner is in use.

Safety instructions and warnings are indicated with the symbol .

Instructions relating to the safety of laser equipment are indicated with the symbol .

Pointers to important items of information are indicated by the  symbol.

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# 1 General remarks\_Test

The safety laser scanner RS4 is an active opto-electronic protective device or AOPD of type 3 as defined by DIN EN/IEC 61496-1 and (pr) EN/IEC 61496-3. The AS-i adapter is an accessory to the RS4 which serves for the safe connection of the device to AS-Interface.

## 1.1 Manufacturer's certification



The manufacturer of the ROTOSCAN RS4/AS-i, Leuze electronic GmbH + Co. KG, based in D-82256 Fürstentfeldbruck, Germany, has a quality assurance system that is certified in keeping with ISO 9001.

## 1.2 Approval and Declaration of EC Conformity

The ROTOSCAN RS4/AS-i laser scanner remote-acting sensor was developed and manufactured with regard to the applicable European guidelines and standards.

An EC prototype test certificate (valid for Europe) as specified in DIN EN/IEC 61496-1 and (pr) EN/IEC 61496-3 has been conferred by:

TÜV Süddeutschland Group<sup>1</sup>  
 Zertifizierstelle  
 Ridlerstr. 65,  
 D-80339 Munich  
 GERMANY



## 1.3 Definition of terms (on AS-Interface)

### Output switching element (safety output) of the AS-i safety monitor

An element that is activated by the monitor's program logic, which is in a position safely to switch off the control components subordinated to it. Only when all components function as indicated in the specifications should the output switching element be put into or allowed to remain in the On state.

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1. Technischer Überwachungsverein:  
 authority responsible for maintaining industrial standards.

**OSSD**

The one channel of the AS-i safety monitor to which safety-related AS-i components and functional components are assigned which are responsible for releasing the machine elements which create the unsafe movement.

**Integrated AS-i slave**

Component in which sensor and/or actuator functions are incorporated with the slave in a single unit.

**AS-i Master**

Component for data transmission, which controls the logical and temporal behaviour of the system on the AS-i line.

**Safety output**

See output switching element.

**Safety-related input slave**

Slave which reads the safety-related states On and Off of the sensor or command unit to which it is connected and transmits it to the master or safety monitor.

**Safety-related AS-i slave**

Slave for connecting safety-related sensors, actuators and other devices.

**Safety monitor**

Component which monitors the safety-related slaves and the correct functioning of the network.

**Slave**

Components for data transmission; the master cyclically addresses these components by their addresses. Only then do they generate an answer.

**Standard slave**

Slave for connecting non-safety-related sensors, actuators and other devices.

## 1.4 Abbreviations

<b>AS-i</b>	Actuator sensor interface (AS-Interface)
<b>AOPD</b>	Active optoelectronic protective device
<b>EMC</b>	Electromagnetic compatibility
<b>FE</b>	Functional earth
<b>PELV</b>	Protective extra-low voltage
<b>PLC</b>	Programmable logic controls

## 2 System overview

The RS4 area scanner is an active optoelectronic protective device (AOPD) of type 3. It polls the protective field that has been selected by the setting of parameters on a continuous basis, and when the protective field is violated switches off its OSSD safety switching outputs (OSSD = output signal switching device), so checking the hazardous movement. While the system is in operation, it is possible to switch between up to four parameterised protective fields and warning fields by means of local sensor signals. Depending on the parameter settings, the scanner may emit a non-safety-related warning signal if the front pane becomes too dirty and/or in the case of a warning field (that has likewise been parameterised) being violated.

In view of its integrated AS-i Interface, the RS4/AS-i can be connected to the AS-Interface bus system. If a person or obstacle is situated within the protective fields that have been defined earlier, a safety-related switching function will be triggered and the machine that is protected by means of the AS-Interface and the AS-i safety monitor will be brought into a safe state. This switching function will only be reset when the protective field is clear, irrespective of the operating mode, which may be automatic or may involve acknowledgement by way of the AS-i safety monitor.

### 2.1 Short description of the RS4/AS-i

The RS4/AS-i area scanner sends out extremely short laser pulses, and measures the time between the impacting of a pulse on an object and its being reflected back to the receiver of the RS4/AS-i. The length of time enables the device to calculate the distance between the object and the RS4/AS-i.

The polling unit in the scanner rotates, and sends out / receives a laser pulse at intervals of 0.36°. In this way a sector of a circle of up to 190° can be polled, the RS4/AS-i being located at the midpoint. The protective field that is to be monitored is limited by a user-defined curve around the scanner, the maximum distance from this to the midpoint of the scanner being 4 metres. If an object is detected between this boundary line and the scanner, thus violating the protective field, the scanner will switch off its safety-related OSSD output, and the status of the OSSDs will be transmitted to the AS-i safety monitor by way of the AS-i system in the form of a cyclic data sequence; having been notified of the violation of the protective field, the monitor will bring the hazardous movement to a halt.

In addition to the safety-related protective field, a non-safety-related warning field can be parameterised; when this is violated the system will not be switched off, but a warning signal will be given. This will likewise be included in the data telegram that is exchanged cyclically with the AS-i bus master and can be called up at will.



#### **Achtung!**

*Although the data transfer is safety-related, the warning signal should not be used in a safety-related manner, as it is not delivered by the scanner as a safe signal.*

The protective field and the warning field together constitute a pair of protective fields. They are always activated jointly, and a maximum of four protective fields may be selected at any time. All pairs of protective fields, as well as the permissible modes of switching between them, will be adapted to the given application when the system is first put into operation. When the system is operational, switching between protective field pairs is managed by local sensor signals.

## 2.2 Short description of the AS-Interface

The actuator-sensor interface (AS-interface, in short: AS-i) has established itself as a system for net-working primarily binary sensors and actuators at the lowest level of the automation hierarchy. The high number of installed systems, the ease of use and the reliable operating behaviour also make the AS-interface interesting in the area of machine safety.

The safe AS-Interface system is intended for safety applications up to category 4 in accordance with EN 954-1. A mixed manner of operation, using both AS-i standard components and AS-i safety-related components, is possible.

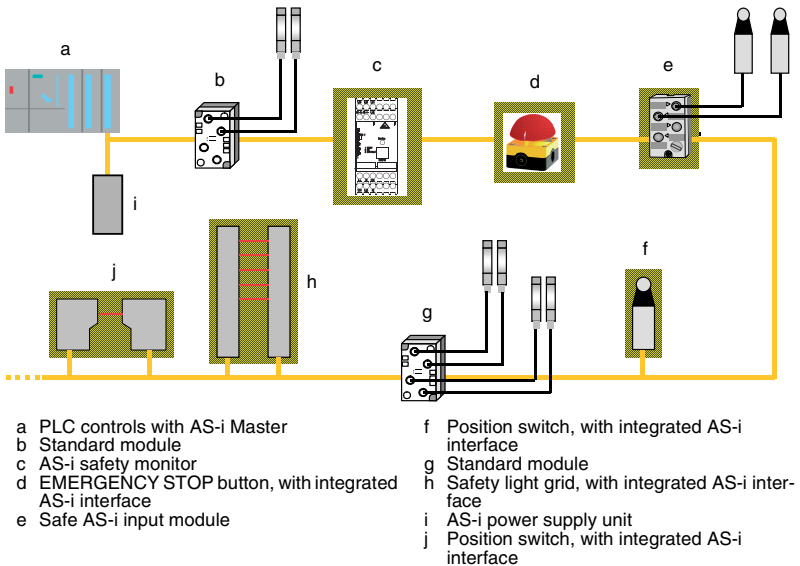


**Note:**

*A comprehensive description of safe AS-i transmission will be found in the Connecting and Operating Instructions for the AS-i safety monitor, chapter 11.*

### 2.2.1 The AS-i safety monitor

Within an AS-i system, corresponding to the configuration that the user has specified by means of the configuration software, the AS-i safety monitor keeps a check on the safety-related AS-i slaves that are allocated to it. Depending on the device model, up to two dependent or independent OSSDs with contactor monitoring are available. In case of a Stop request or of a fault occurring, the AS-i safety monitor in protective mode will safely switch the system off, with a maximum response time of 40 ms when the system is fully extended. It is possible in this connection to link as many as 31 safety-related AS-i slaves into a system.



**Fig. 2.2-1:** Safe and standard components in an AS-i network



Multiple AS-i safety monitors can be used within an AS-i system. In this way, a safety-related AS-i slave can be monitored by multiple AS-i safety monitors.

### 2.2.2 The safety-related AS-i slave

The safety-related information of the AS-i slave is transmitted by way of the non-safety-related transmission channel used by Standard AS-i. The same transmission mechanism applies to a safety-related transmission as it does to the Standard AS-Interface, that is to say, the 4-bit information that is delivered to the AS-i slave-IC will be transmitted. From a transmission perspective, information is transmitted from master to slave and back again, but the safe data information is sent from the slave to the AS-i safety monitor only, which “listens in” to the entire exchange of information and monitors what is transmitted. Here the safety-related user data are defined as follows:

- Only 1 bit of user information is transmitted. The two possible states are interpreted as meaning **free** (=1) and **not free** (=0).

Example:

Emergency stop not activated = **free** ("hazardous movement approved")

Emergency stop activated = **not free** ("hazardous movement not approved")

- In the **not free** state the values 0,0,0,0 are statically registered in the 4 input bits of the AS-i slave-IC.
- In the **free** state, with every cycle a different value is registered in the 4 input bits. The values amount to a sequence of 8 4-bit values which vary in pairs, in such a way that each slave in the system has its own unique sequence. After the eighth sequence has been successfully transmitted, the system switches to the first sequence again (endless loop). The sequence is registered in a code table of the AS-i slave and can be generated in keeping with defined rules. It is assigned by the manufacturer of the AS-i slave as part of the manufacturing process.

Data bit	Light path clear	Light path interrupted
D0	Code sequence	0
D1	Code sequence	0
D2	Code sequence	0
D3	Code sequence	0

**Table 2.2-1:** Allocation of the data bits of the safety-related AS-i slave

## 3 Safety instructions

### 3.1 General safety instructions



**Achtung!**

*The RS4/AS-i with an integrated AS-i Interface is designed exclusively for connection to the AS-Interface Safety at Work, and is not to be used in connection with other applications. The RS4/AS-i can only be connected to the machine controls by way of the AS-Interface and the AS-i safety monitor.*



**Achtung!**

*A condition of appropriate use of the RS4/AS-i is that personnel should be familiar with the Connecting and Operating Instructions for the RS4-4 and the RS4/AS-i.*

For putting the RS4/AS-i into operation with the AS-Interface, familiarity with the Connecting and Operating Instructions for the AS-i safety monitor and the User Manual for the configuration and diagnosis software of the AS-i safety monitor is also required (asimon – Configuration and Diagnostics Software).



**Note:**

*Please have regard to the safety instructions and instructions for appropriate use of the equipment in chapter 3 of the Connecting and Operating Instructions for the RS4-4.*



**Warning: laser beam!**

*The RS4 laser scanner is a laser device of laser class 1. Please have regard to the applicable statutory and local regulations for the operation of laser systems. Avoid positioning the scanner at eye level.*

### 3.2 Appropriate use



**Achtung!**

*It cannot be guaranteed that operating personnel and equipment will be protected if the device is not used in accordance with the defined mode of operation.*



**Achtung!**

*Any tampering with or modification of equipment (except in ways that are expressly described in the present Manual) is forbidden.*

### 3.3 Areas of application (AS-Interface)

The AS-i safety monitor, when used in accordance with the specifications, allows for the operation of the sensor-controlled personnel protection facilities and other safety components up to and including category 4 in accordance to EN 954-1. If sensors of a lower category should be used, the maximum category to be attained for the related safety path is defined in terms of these sensors. For example, laser scanners in accordance to EN 61496-3 can only be classified as type 3 at best. If laser scanners are incorporated in the AS-i safety network, a safety category of 3 is the maximum that may be attained for the related safety path. If there is a safety light curtain of type 4 connected to the same AS-i safety monitor, it remains unaffected by this, and may still be classified as category 4. The AS-i safety monitor also takes responsibility for the EMERGENCY STOP function, obligatory for all machines not operated by hand (stop category 0 or 1), for the dynamic monitoring of the restart function and for the external device monitoring function (EDM). In what follows we will give a few examples of the use of the AS-i safety monitor.

AS-i Safety at Work can be economically used in all cases where the standard AS-i bus recommends itself in view of its advantages as a local bus that requires little cabling. In this way, when the AS-i safety monitor is used, AS-i bus configurations that already exist as bus user devices can easily be added to, and safety components with the appropriate AS-i Safety at Work interface (e.g. COMPACT/AS-i) can easily be incorporated in the loop. If the safety component does not have an AS-i Safety at Work interface, what are known as coupling modules (e.g. the AS-i coupling module ASKM1) can effect the connection. Existing AS-i Masters and AS-i power supplies can as a rule be reused. In terms of industrial sector there are no limitations. Let us mention here a few of the more important areas of use:

- Expanded machining machines with multiple control elements and safety sensors for wood and metal applications
- Printing and paper processing machines, cutting machines
- Packaging machines, single and as part of a system
- Food processing equipment
- Piece and bulk material transport systems
- Machinery in the rubber and plastics industry
- Assembly machines and manipulators

### 3.4 Organisational measures

#### Documentation

It is an absolute requirement that regard should be had to all the statements made in this Connecting and Operating Manual, in particular in the chapters "Safety Notices" and "AS-i System Integration". Please look after this Connecting and Operating Manual and treat it with care. It should be available at all times.

#### Safety prescriptions

You should have regard to the statutory stipulations that apply locally and to the prescriptions of the relevant professional associations.

#### Qualified personnel

The assembly, startup and maintenance of the equipment should be carried out only by qualified professional personnel. Electrical work may be carried out only by a professional electrician.

**Repairs**

Repairs, in particular if they involve the opening of the housing, may only be carried out by the manufacturer or by a person whom the manufacturer has authorised. An exception to this rule is the disassembly of the end cap of the device on the connection side (on either the transmitter or the receiver) for an adjustment of the DIP switches if this should prove necessary (see chapter 3, Assignment of the DIP switches).

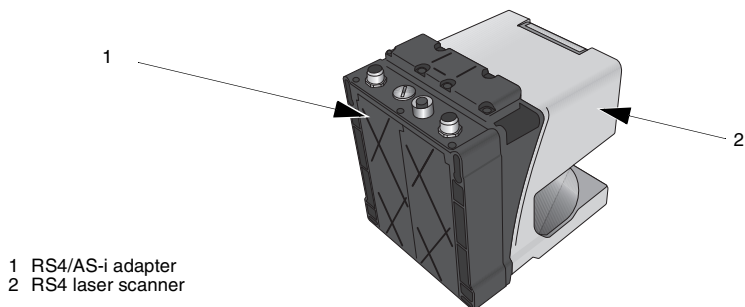
**Disposal****Note:**

*Electronic scrap is special category waste, and you should have regard to the regulations that apply locally to the disposing of such materials. COMPACT/AS-i safety light curtains and light grids do not contain any batteries that would need to be removed before the equipment is disposed of.*

## 4 Construction, assembly and connection to power supply (AS-i)

### 4.1 Construction

The RS4/AS-i consists of the RS4 laser scanner and the RS4/AS-i adapter. These have already been connected to one another at the factory. The RS4/AS-i adapter manages the processing of the standard RS4 data on the AS-Interface bus system.



1 RS4/AS-i adapter  
2 RS4 laser scanner

**Fig. 4.1-1:** Construction of the RS4/AS-i

The safety-relevant OSSD signals and the diagnosis data of the RS4 are transmitted by way of plug X1 (PIN1, PIN3) via AS-Interface to the AS-i safety monitor and AS-i Master.

In view of the high quantity of power it consumes, the RS4/AS-i requires a separate 24 VDC auxiliary power source, which is connected through plug X1 (PIN2, PIN4).

Socket X3 is responsible for the external switching of the four protective field and warning field pairs.



**Note:**

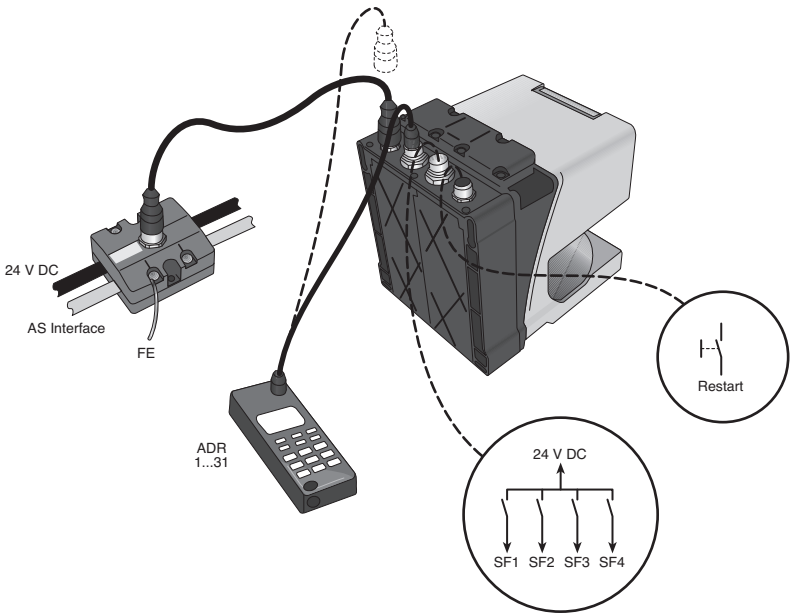
*For the wiring of the X3 socket, please observe the notes on the switching of protective fields and warning fields in chapter 6 of the ROTOSCAN RS4-4 Connecting and Operating Instructions.*

If only one protective field is required, an M12 AC-M12-15M bridge plug (bridging PIN 1 and PIN 5) can be used for the wiring of protective field and warning field 1. See in this connection chapter 8.4, Notes on ordering, RS4/AS-i accessories.

Plug X4 of the RS4/AS-i is intended for the connection of a restart button. This button serves, on the one hand, for the unblocking of the scanner-internal start/restart interlock, if this has been enabled; the button is also responsible for the acknowledgement of error messages. This becomes necessary if the scanner has suffered a malfunction.

During the activation of the restart button, the safety outputs OSSD 1 and OSSD 2 of the RS4 are switched off, and the display on the scanner lights up red. The length of the resetting signal has to be between 2 and 3 seconds. The length of the restart cable should not exceed 25 m.

As a further option, in addition to the possibility of bus addressing by means of the M12 connector socket X1, a bus address may be allocated to the RS4/AS-i by means of this addressing socket. To do this, a standard AS-Interface programming device for the definition of bus addresses should be used, in conjunction with a special addressing socket programming cable (see chapter 8, "Advice on selection and ordering, AS-i safety accessories").



**Fig. 4.1-2:** Connecting the RS4/AS-i adapter

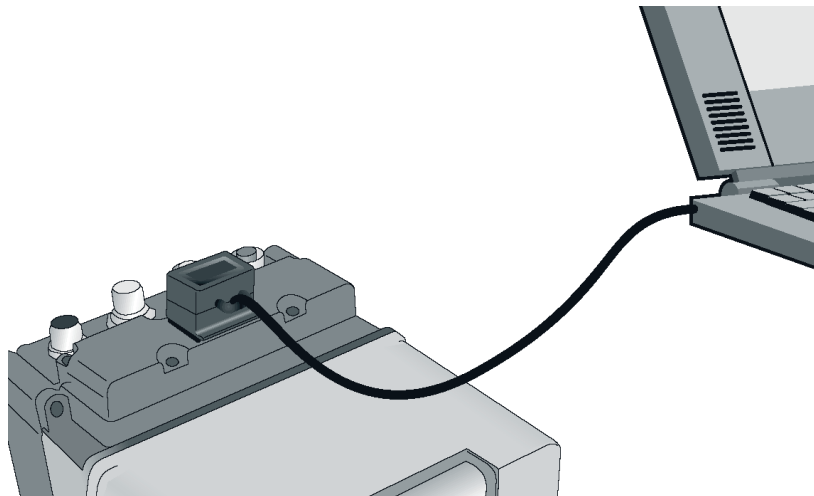
For parameterisation purposes, and for local diagnosis of the RS4, a PC with the RS4soft software is connected to the top side of the RS4/AS-i adapter via optical PC-adapter. The cable exit of the PC adapter on the RS4/AS-i thus points in the direction of the protective field. A powerful magnet in the PC adapter not only brings about a mechanical halt but at the same time informs a reed contact in the device that the PC adapter is connected.

As the power supply for the PC adapter comes through the PC's COM port, the latter must be "RS232 compliant", that is, with a load of 3 kOhm it must still be able to supply a voltage of 5 V. The claim to be "RS232-compliant" that is occasionally found with Notebook PCs is not sufficient here. The RS4/AS-i adapter registers the flow of data in passing, but not does not act on it in any way. This interface therefore corresponds, in functional terms, to the RS232 interface connected to the RS4 by means of SUB-D plugs.



**Note:**

*A comprehensive description of the software may be found in the RS4soft User Manual.*



**Fig. 4.1-3:** Connecting PC and RS4/AS-i with optical PC adapter

## 4.2 Assembly



**Note:**

*See in this connection chapter 5, "Planning and assembly instructions", of the RS4-4 Connecting and Operating Instructions.*



**Note:**

*To assemble the RS4/AS-i you should use rather long fastening screws, with a length of at least 50 mm and a diameter of 5 mm; in other respects the assembly instructions for the ROTOSCAN RS4 laser scanner will apply here as well. The borehole measurements may be seen from the scale drawings in chapter 7.*

#### 4.2.1 Calculating the safety distance / total reaction time (total response time) for AS-i applications

In general terms, the calculation that applies is in accordance with the following formula, in keeping with EN 999, where S is the safety distance between the danger zone and the protective field:

$$S = (K \times T) + C$$

$$C = 1200 \text{ mm} - 0,4 H$$

$$C_{\text{MIN}} = 850 \text{ mm}$$

$$H_{\text{MIN}} = 15(d - 15 \text{ mm})$$

$$H_{\text{MAX}} = 1000 \text{ mm}$$

Here

- S is the minimum safety distance between protective field and danger zone, in mm
- K is the speed of approach of the person or part of the body, in mm/ms
- T is the overtravel time of the machine + the reaction time of the optoelectronic protective device (AOPD) + the reaction time of the AS-i bus system in ms
- C is a safety-related constant, to take into account penetration of the danger zone before the protective facility is triggered, unit in mm
- $C_{\text{MIN}}$  is the minimum value of the safety-related constant (850 mm), unit in mm
- H is the height of the registration of measurement data taken from the reference point, unit in mm
- d is the resolution of the scanner (70 mm, covering the entire protective field), unit in mm



#### **Achtung!**

See in this connection chapter 5.4.8 of the Connecting and Operating Instructions for the ROTOSCAN RS4 laser scanner



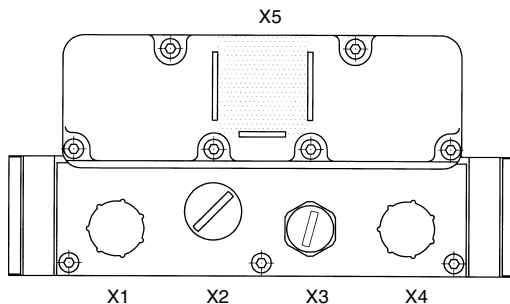
#### **Achtung!**

The additional bus system reaction time that is required by the AS-Interface and the AS-i safety monitor, coming to a maximum of 40 ms (when the full resources of the AS-Interface system are installed with 31 slaves), must be added to the response time T.



### 4.3 Electrical connection

#### 4.3.1 Connections on the RS4/AS-i



- X1 AS-i connection (data and auxiliary power supply)
- X2 Connection for the AS-i address programming device
- X3 Connection for the switching of protective fields
- X4 Restart button connection
- X5 Optical PC interface

**Fig. 4.3-1:** Connections on the RS4/AS-i

Socket/ plug	Function	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5
X1 (plug)	AS-Interface data and 24 VDC auxiliary power supply	AS-i +	0 V	AS-i -	+ 24 V DC	FE
			in		in	
X2	Bus address programming input	AS-i +	n.c.	AS-i -	n.c.	n.c.
X3 (socket)	Switching of protective fields	SF 1	SF 2	SF 3	SF 4	+ 24 V DC
		in	in	in	in	out
X4 (plug)	Restart button	n.c.	Restart	n.c.	+ 24 V DC	n.c.
			in		out	

**Table 4.3-1:** Connection pin assignment of the RS4/AS-i



**Note:**

*FE – functional earth. The device must incorporate a functional earth for the sake of enhanced EMC (electromagnetic compatibility). This should be connected to the functional earth of the machine or system.*

**Note:**

The M12 cable that connects the RS4/AS-i X1 connection to the AS-i flat cable by way of the AS-i AC-PDA1/A flat cable adapter (see chapter 8, Scope of standard delivery and Notes on ordering), should be as short as possible (no more than 2 m). The functional earth can be connected by way of PIN 5 of the X1 connection (of the RS4/AS-i) to the AS-i AC-PDA1/A flat cable adapter; there in turn the system can be provided with an earthing wire by way of two earthing springs on the modular screw plugs.

### 4.3.2 Guidelines for installation

**Achtung!**

The general safety instructions given in chapter 3 should be observed. The electrical installation is to be carried out only by qualified and properly instructed professionals.

### 4.3.3 Power supply to the RS4/AS-i

**Achtung!**

The power supply unit that provides power for the RS4/AS-i must be reliably independent of the mains as defined by IEC 60742, and must be able to bridge over short-term power cuts of up to 20 ms.

## 5 Putting the system into operation

### 5.1 Integration with the AS-Interface / functional controls



**Note:**

See also, in this connection, chapter 7 of the *Connecting and Operating Instructions for the AS-i safety monitor* (“Functionality and putting the system into operation”) and chapter 10 of the *Connecting and Operating Instructions for the ROTOSCAN RS4-4 laser scanner* (“Putting the system into operation”).

The procedure for assembling and putting the system into operation is described below:

<b>1</b>	<p><b>Address the AS-i slave</b> Addressing is carried out by way of the M12 connector socket for connection of the AS-i bus and 24 V power supply (X1), or alternatively by way of the AS-i addressing socket (X4), using standard AS-i addressing devices. Each address may be used only once in an AS-i network. Possible bus addresses range from 1 to 31.</p>
<b>2</b>	<p><b>Install the safety AS-i slave on the AS-Interface system</b> This connection is effected by way of an AS-i adapter for the connection of the AS-Interface data cable (yellow) and auxiliary power supply of 24 V DC (black), as well as with a 5-pole M12 connecting cable from the AS-i adapter to the M12 connector socket X1 of the RS4/AS-i.</p>
<b>3</b>	<p><b>Check the 24 V power supply to the sensor</b> The red LED on the RS4/AS-i will light up.</p>
<b>4</b>	<p><b>Check that the protective field of the RS4/AS-i is clear</b> The green LED will light up in about 20 seconds if the protective field is clear. The RS4/AS-i is then in operational readiness, and the code table can be programmed into the AS-i safety monitor.</p> <ul style="list-style-type: none"> <li>① For the RS4/AS-i to function properly, the M12 socket X3 that is responsible for the switching of the protective fields must first have been connected, that is to say, a protective field must have been activated. For this purpose you can use the protective field jumper plug for connection of protective field 1 (AC-M12-15M) (see chapter 8, “Scope of standard delivery and advice on ordering, RS4/AS-i accessories”).</li> <li>① For system integration purposes – that is to say, when the AS-i safety monitor is being programmed with the code table of the safety AS-i slave – the protective field of the RS4/AS-i must not be violated.</li> </ul>
<b>5</b>	<p><b>The commissioning and configuration of the safety AS-i slave will now be effected with the help of the configuration and diagnosis software of the AS-i safety monitor.</b></p>

## 5.2 Advice on malfunctioning and rectification of errors



**Note:**

See, in this connection, chapter 16 of the RS4's Connecting and Operating Instructions ("Error codes and their causes"), as well as chapter 9 of the Connecting and Operating Instructions for the AS-i safety monitor ("Status messages, malfunctions and rectification of errors").

## 5.3 Extended possibilities of diagnosis by means of AS-Interface

By bringing up the parameters by means of AS-Interface you can obtain information about the current status of the RS4 alarm output, and also about the currently active protective field (see the RS4-4 Connecting and Operating Instructions, chapter 7.3).



**Achtung!**

This information is only available for purposes of diagnosis, as querying the parameters involves a non-secure transfer of AS-i data by means of the bus. Moreover, the protective field display will only be valid for a protective field that has been set correctly.

The 4th parameter port (P3) makes it possible to start or restart the RS4/AS-i remotely. The conditions for a RESTART are in line with the directions given in the RS4 Connecting and Operating Instructions, chapter 7.1.

Parameter bit	Function	Description
P0	Alarm	Process diagnosis
P1	Protective field display*	Process diagnosis
P2	Protective field display*	Process diagnosis
P3	Restart	Process control

**Table 5.3-1:** Assignment of parameter bits (RS4/AS-i)

P2	P1	Protective field
0	0	Protective field pair 1 activated
0	1	Protective field pair 2 activated
1	0	Protective field pair 3 activated
1	1	Protective field pair 4 activated

**Table 5.3-2:** \*Assignment of parameter bits (protective field display)

## 6 Maintenance and testing

### 6.1 Replacement of a safety-related AS-i slave

If a safety-related AS-i slave becomes defective, it can be replaced even without a PC, and the AS-i safety monitor subsequently reconfigured, with the help of the SERVICE button on the AS-i safety monitor.



**Note:**

See also, in this connection, chapter 9.4 of the Connecting and Operating Instructions of the AS-i safety monitor (“Replacement of a defective safety-related AS-Interface slave”).

Here is the procedure for replacing the defective component:

<b>1</b>	<b>Disconnect the defective AS-i slave from the AS-i cable</b> The AS-i safety monitor will bring the system to a halt.
<b>2</b>	<b>Press the SERVICE button on the AS-i safety monitor</b>
<b>3</b>	<b>Install the new AS-i slave</b> ① AS-i slaves supplied by Leuze electronic are set to the bus address 0 when leaving the factory. When a slave is replaced, the AS-i master will program the replacement component automatically to the previous address of the defective component. Re-addressing of the replacement component to give the bus address of the defective component is therefore not necessary.
<b>4</b>	<b>Check the 24 V power supply to the sensor</b> The red LED on the RS4/AS-i will light up.
<b>5</b>	<b>Check that the protective field of the RS4/AS-i is clear</b> The green LED will light up in about 20 seconds if the protective field is clear. The RS4/AS-i is then in operational readiness, and the code table can be programmed into the AS-i safety monitor. ① For system integration purposes – that is to say, when the AS-i safety monitor is being programmed with the code table of the safety AS-i slave – the protective field of the RS4/AS-i must not be violated.
<b>6</b>	<b>Press the SERVICE button on the AS-i safety monitor</b>
<b>7</b>	<b>Press the AS-Interface start button to restart the AS-Interface system</b> ① The system’s restarting mode will depend on whether the AS-i configuration includes a manual restart interlock or there is an automatic restart programmed into the AS-i safety monitor (see, in this connection, the User Manual for the configuration and diagnosis software of the AS-i safety monitor).

When the SERVICE button is pressed for the first time, the system determines whether just one AS-i slave is missing. This will be noted in the error register of the AS-i safety monitor. The AS-i safety monitor then switches into configuration mode. When the SERVICE button is pressed for the second time, the code sequence of the new AS-i slave will be programmed into the system and checked for correctness. If this is found to be in order, the AS-i safety monitor will switch back into protective mode.

**Achtung!**

*After a defective safety-related AS-i slave has been replaced, it is essential to check that the new AS-i slave is functioning correctly.*

**6.2 Check the reliability of the safety switchoff mechanism**

Checks should be carried out once a year by the officer responsible for safety to ensure that the safety AS-i system is functioning correctly, that is to say, that the AS-i safety monitor will effect a safety switchoff when triggered by a safety-related sensor that has been assigned to it (e.g. RS4/AS-i).

**Achtung!**

*For this purpose the safety AS-i slave should be activated once a year, and its switching properties should be checked by observing the safety output data of the AS-i safety monitor.*

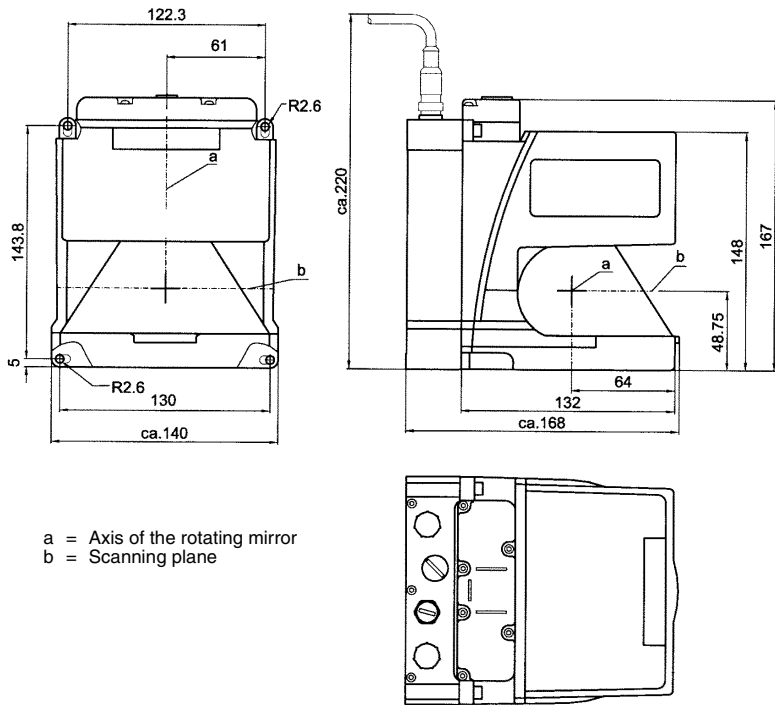
## 7 Technical specifications and dimensional drawings

Safety category	Type 3 in accordance to DIN EN/IEC 61496-1 and (pr) EN/IEC 61496-3
Us power supply	24 V DC +/- 20% ① The power supply unit of the external power supply must be reliably independent of the mains, in keeping with IEC 60742, and must be able to bridge over power cuts of 20 ms
Residual ripple of power supply	+/- 5 % within the limits of Us
Power consumption for the supply circuit	400 mA
Overload protection	Medium time lag 2 A fuse
Signal definition of the inputs	High / logical 1 : 16 .. 30V Low / logical 0: < 3 V
Type of protection	IP 65
Ambient operating temperature	0° C...+50° C
Ambient storage temperature	-20° C ...+60° C
Isolation class	Protection class 2
Relative humidity	15 ...95 %, without condensation (DIN 40040 Table 10, identifying letter E)
Weight	ca. 2.25 kg
Dimensions	167 mm x 141 mm x 168 mm
<b>AS-i specific data:</b>	
AS-i voltage	26.5...31.6V as defined by AS-i specifications
Power consumption for the AS-i circuit	50 mA
AS-i profile	Safety slave
ID-code	B
I/O code	0 (four data bits as outputs)
Slave address	Programmable AS-i address: 1...31 (factory-default: 0)
Cycle time as defined by AS-i specifications	5 ms
Sensor response time	2-fold evaluation 85 ms (corresponding to 2 scans), may be set for up to 16 scans (645 ms)
<b>AS-i system response time</b>	<b>Sensor response time + max. 40 ms</b>



### **Achtung!**

Further technical data see *Connecting and Operating Instructions ROTOSCAN Laserscanner RS4*.



**Fig. 7.0-1:** Dimensional drawing of RS4/AS-i



## 8 Standard delivery and order details

### 8.1 Standard delivery

The following form is part of the standard delivery:

- Laser scanner ROTOSCAN RS4/AS-i
- Data sheet RS4/AS-i

### 8.2 Start-up Set

RS4 start-up set is required. This can be used either with the AS-i or with the PROFIsafe version. It consists of the following components:

- optical PC adapter cable
- CD ROM containing the RS4soft software
- CD-ROM with additional components for linking to PROFIBUS
- Connecting and Operating Instruction ROTOSCAN RS4
- RS4soft User Manual
- this Connecting and Operating Instruction with additional information to RS4/AS-i
- the Connecting and Operating Instruction with additional information to RS4/PROFIsafe

### 8.3 Order details RS4/AS-i and accessories RS4/AS-i

Artikelbezeichnung	Description	Order No.
RS4-4/A1	RS4/AS-i, Laser scanner with AS-i	580014
<b>Zubehör RS4/AS-i</b>		
RS4-SWC	RS4 start-up set	970078
AC-PDA1/A	AS-i adapter for bus connection and power supply	580004
CB-M12-2000-14/23	RS4/AS-i PROFIsafe testing power supply cable	548363
AC-M12-15M	M12-bridging plug (for switching on protective field 1)	580005
CB-PCO-3000	Optional PC adapter for communication between RS4/AS-i or PROFIsafe and PC	520072
CB-M12-1000-5G/MF	M12-connecting cable 1 m, 5-pole	548361
CB-M12-2000-5G/MF	M12-connecting cable 2 m, 5-pole	548362
RS4-MS	Mounting system for setting up and adjusting the RS4/AS-i	50033346
RS4-Adap-P	Adapter plate for already existing mounting system	50035814

<b>Artikelbezeichnung</b>	<b>Description</b>	<b>Order No.</b>
RS4-Clen-Set1	150 ml Cleaning fluid for synthetic materials, 25 cleaning cloths, soft and lint-free	430400
RS4-Clean Set2	1000 ml Cleaning fluid for synthetic materials, 100 cleaning cloths, soft and lint-free	430410
Test piece TB-70-500	Cylinder, 500 mm in length, 70 mm in diameter, reflectance factor approx. 1.8%	50036433
Test piece TB-200-1000	Cylinder, 1000 mm in length, 200 mm in diameter, reflectance factor approx. 1.8%	50036434

**8.4 Order details accessories AS-i Safety and AS-i Safety Monitor**

Artikelbezeichnung	Description	Order No.
<b>Accessories AS-i Safety</b>		
APG-02	AS-i programming device for entry of addresses of A/B/standard AS-i slaves	580003
ASKM1-PK	Programming cable for AS-i programming device APG-02 (A/B/standard AS-i slaves)	580002
AM06	M12-AS-i Bus cable adapter (for yellow AS-i cable)	50024346
AKB 01	AS-i cable (1 unit per metre)	50024750
KB-095-1000-3AW	Connection cable 1 m axial/angled M12 (plug/socket)	50024748
KB-095-2000-3AW	Connection cable 2 m axial/angled M12 (plug/socket)	50024749
<b>AS-i Safety Monitor</b>		
ASM1/1	AS-i Safety monitor, 1 relay output (dual channel)	580020
ASM1/2	AS-i Safety monitor, 2 relay output (dual channel)	580021
ASM1E/1	AS-i Safety monitor, additional functionality, 1 relay output (dual channel)	580024
ASM1E/2	AS-i Safety monitor, additional functionality, 2 relay output (dual channel)	580025
ASM1-SWC	ASM1 installation set with software, Connecting and Operating Manual, asimon software users' manual, programming cable and device replacement data cable	580032
ASM1-PK	ASM1-PC-programming cable	580030
ASM1-DK	ASM1-device replacement data cable	580031
ASM1-TM	Manual: Connecting and Operating Instructions ASM1	607020
ASM1-SM	Manual: asimon – Configuration and Diagnostics Software ASM1	607030

## 9 Declaration of conformity

Leuze electronic GmbH + Co. KG  
In der Braike 1  
73277 Owen - Teck / German

The manufacturer declares that the safety components of series **RS4/AS-i** in the form in which they are marketed by us conform with the relevant, basic safety and health requirements of the EC directives\*, and that the standards\* were used in their design and construction.

Owen, 01.02.2009



Dr. Harald Grübel  
General Manager

\* You can also download this EC Declaration of Conformity from the Internet under:  
<http://www.leuze.com/rotoscan>