

## AMS 301i

### Optical laser measurement system – RS 485

Original operating instructions



© 2021

Leuze electronic GmbH + Co. KG

In der Braike 1

D-73277 Owen / Germany

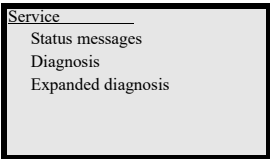
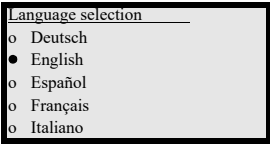
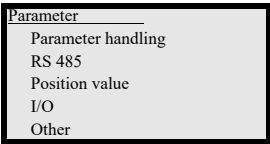
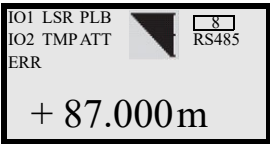
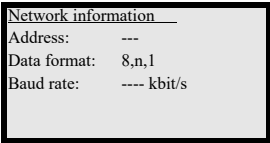
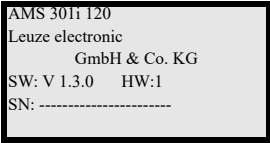
Phone: +49 7021 573-0

Fax: +49 7021 573-199

<http://www.leuze.com>

[info@leuze.de](mailto:info@leuze.de)

The main menus



**Device information - main menu**  
This menu item contains detailed information on

- Device type
- Manufacturer
- Software and hardware version
- Serial number

No entries can be made via the display.

**Network information - main menu**  
Explanations of address, data format, baud rate.  
No entries can be made via the display.

**Status and measurement data - main menu**

- Display of status, warning and error messages.
- Status overview of the switching inputs/outputs
- Bar graph for the received signal level.
- Activated interface.
- Measurement value

No entries can be made via the display.  
See "Indicators in the display" on page 39.

**Parameter - main menu**

- Configuration of the AMS.

See "Parameter menu" on page 44.

**Language selection - main menu**

- Selection of the display language.

See "Language selection menu" on page 48.

**Service - main menu**

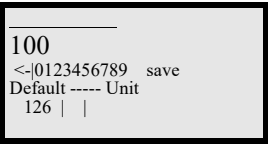
- Display of status messages.
- Display of diagnostic data.

No entries can be made via the display.  
See "Service menu" on page 48.

Device buttons:

- Navigate upward/sideways
- Navigate downward/sideways
- ESCAPE leave
- ENTER confirm

Input of values



- + Delete character
- + Enter digit
- save + Save input

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>General information</b>  | <b>4</b>  |
| 1.1      | Explanation of symbols  | 4         |
| 1.2      | Declaration of Conformity   | 4         |
| 1.3      | Description of functions AMS 301/                                       | 5         |
| <b>2</b> | <b>Safety</b>   | <b>6</b>  |
| 2.1      | Intended use  | 6         |
| 2.2      | Foreseeable misuse  | 6         |
| 2.3      | Competent persons   | 7         |
| 2.4      | Exemption of liability  | 7         |
| 2.5      | Laser safety notices  | 8         |
| <b>3</b> | <b>Fast commissioning / operating principle</b>                         | <b>11</b> |
| 3.1      | Mounting the AMS 301/   | 11        |
| 3.1.1    | Mounting the device   | 11        |
| 3.1.2    | Mounting the reflector  | 11        |
| 3.2      | Connecting the voltage supply   | 12        |
| 3.3      | Display   | 12        |
| 3.4      | AMS 301/ on the RS 485  | 12        |
| <b>4</b> | <b>Technical data</b>   | <b>13</b> |
| 4.1      | Technical data of laser measurement system                              | 13        |
| 4.1.1    | General specifications AMS 301/   | 13        |
| 4.1.2    | AMS 301/ dimensioned drawing  | 15        |
| 4.1.3    | Overview of AMS 301/ types  | 16        |
| <b>5</b> | <b>Installation and mounting</b>  | <b>17</b> |
| 5.1      | Storage, transportation   | 17        |
| 5.2      | Mounting the AMS 301/   | 18        |
| 5.2.1    | Optional mounting bracket   | 20        |
| 5.2.2    | Parallel mounting of the AMS 301/                                       | 21        |
| 5.2.3    | Parallel mounting of AMS 301/ and DDLS optical data transmission        | 22        |
| 5.3      | Mounting the AMS 301/ with laser beam deflector unit                    | 23        |
| 5.3.1    | Mounting the laser beam deflector unit with integrated mounting bracket | 23        |
| 5.3.2    | Dimensioned drawing of US AMS 01 deflector unit                         | 24        |
| 5.3.3    | Mounting the US 1 OMS deflector unit without mounting bracket           | 25        |

|          |   |           |
|----------|---|-----------|
| <b>6</b> | <b>Reflectors</b> . . . . .                                       | <b>26</b> |
| 6.1      | General information . . . . .                                     | 26        |
| 6.2      | Description of the reflective tape . . . . .                      | 26        |
| 6.2.1    | Technical data of self-adhesive tape . . . . .                    | 27        |
| 6.2.2    | Technical data of reflective tape on support plate . . . . .      | 27        |
| 6.2.3    | Dimensioned drawing of reflective tape on carrier plate . . . . . | 28        |
| 6.2.4    | Technical data of heated reflectors . . . . .                     | 29        |
| 6.2.5    | Dimensioned drawing of heated reflectors. . . . .                 | 30        |
| 6.3      | Selecting reflector size . . . . .                                | 31        |
| 6.4      | Mounting the reflector . . . . .                                  | 32        |
| 6.4.1    | General information . . . . .                                     | 32        |
| 6.4.2    | Mounting the reflector . . . . .                                  | 32        |
| 6.4.3    | Table of reflector pitches . . . . .                              | 35        |
| <b>7</b> | <b>Electrical connection</b> . . . . .                            | <b>36</b> |
| 7.1      | Safety notices for the electrical connection . . . . .            | 36        |
| 7.2      | PWR – voltage supply / switching input/output . . . . .           | 37        |
| 7.3      | RS 485 BUS IN . . . . .   | 37        |
| 7.4      | RS 485 BUS OUT . . . . .  | 38        |
| 7.5      | Service . . . . .   | 38        |
| <b>8</b> | <b>Display and control panel AMS 301/.</b> . . . .                | <b>39</b> |
| 8.1      | Structure of the control panel. . . . .                           | 39        |
| 8.2      | Status indicators and operation . . . . .                         | 39        |
| 8.2.1    | Indicators in the display . . . . .                               | 39        |
| 8.2.2    | LED status indicators . . . . .                                   | 41        |
| 8.2.3    | Control buttons. . . . .  | 42        |
| 8.3      | Menu description . . . . .  | 43        |
| 8.3.1    | The main menus . . . . .  | 43        |
| 8.3.2    | Parameter menu . . . . .  | 44        |
| 8.3.3    | Language selection menu . . . . .                                 | 48        |
| 8.3.4    | Service menu . . . . .  | 48        |
| 8.4      | Operation . . . . .   | 49        |
| <b>9</b> | <b>RS 485 interface</b> . . . . .                                 | <b>51</b> |
| 9.1      | General information on the RS 485 interface. . . . .              | 51        |
| 9.2      | RS 485 – Electrical connection . . . . .                          | 51        |

|           |  |           |
|-----------|--|-----------|
| 9.3       | RS 485 address entry . . . . .                                 | 52        |
| 9.3.1     | Entry of RS 485 address . . . . .                              | 52        |
| 9.4       | RS 485 interface data . . . . .                                | 53        |
| 9.4.1     | Default settings for the RS 485 interface . . . . .            | 53        |
| 9.4.2     | Parameter settings for AMS 301/ . . . . .                      | 53        |
| 9.4.3     | Communication protocol (binary protocol) . . . . .             | 53        |
| <b>10</b> | <b>Diagnostics and troubleshooting . . . . .</b>               | <b>56</b> |
| 10.1      | Service and diagnosis in the display of the AMS 301/ . . . . . | 56        |
| 10.1.1    | Status messages . . . . .                                      | 56        |
| 10.1.2    | Diagnosis . . . . .  | 57        |
| 10.1.3    | Expanded diagnosis . . . . .                                   | 57        |
| 10.2      | General causes of errors . . . . .                             | 58        |
| 10.2.1    | Power LED . . . . .  | 58        |
| 10.3      | Interface errors . . . . .                                     | 59        |
| 10.3.1    | BUS LED . . . . .  | 59        |
| 10.4      | Status indicators in the display of the AMS 301/ . . . . .     | 59        |
| <b>11</b> | <b>Type overview and accessories . . . . .</b>                 | <b>61</b> |
| 11.1      | Part number code . . . . .                                     | 61        |
| 11.2      | Overview of AMS 301/types (RS 485) . . . . .                   | 61        |
| 11.3      | Overview of reflector types . . . . .                          | 62        |
| 11.4      | Accessories . . . . .  | 62        |
| 11.4.1    | Accessories – Mounting bracket . . . . .                       | 62        |
| 11.4.2    | Accessories – Deflector unit . . . . .                         | 62        |
| 11.4.3    | Accessories – M12 connector . . . . .                          | 62        |
| 11.4.4    | Accessories – Terminating resistor . . . . .                   | 63        |
| 11.4.5    | Accessories – Ready-made cables for voltage supply . . . . .   | 63        |
| 11.4.6    | Accessories – Ready-made cables for RS 485 . . . . .           | 64        |
| <b>12</b> | <b>Maintenance . . . . .</b>                                   | <b>67</b> |
| 12.1      | General maintenance information . . . . .                      | 67        |
| 12.2      | Repairs, servicing . . . . .                                   | 67        |
| 12.3      | Disassembling, packing, disposing . . . . .                    | 67        |

# 1 General information

## 1.1 Explanation of symbols

The symbols used in this technical description are explained below.



**Attention!**

*This symbol precedes text messages which must strictly be observed. Failure to observe the provided instructions could lead to personal injury or damage to equipment.*



**Attention Laser!**

*This symbol warns of possible danger through hazardous laser radiation.*



**Note!**

*This symbol indicates text passages containing important information.*

## 1.2 Declaration of Conformity

The AMS 301/i absolute measuring optical laser measurement system was designed and manufactured in accordance with the applicable European directives and standards.

The AMS series is "UL LISTED" according to American and Canadian safety standards and fulfills the requirements of Underwriter Laboratories Inc. (UL).



**Note!**













*The Declaration of Conformity for these devices can be requested from the manufacturer.*

The manufacturer of the product, Leuze electronic GmbH & Co. KG in D-73277 Owen, possesses a certified quality assurance system in accordance with ISO 9001.

1.3 Description of functions AMS 301/

The AMS 301/ optical laser measurement system calculates distances to fixed as well as moving system parts. The distance to be measured is calculated according to the principle of the propagation time of radiated light. Here, the light emitted by the laser diode is reflected by a reflector onto the receiving element of the laser measurement system. The AMS 301/ uses the "propagation time" of the light to calculate the distance to the reflector. The high absolute measurement accuracy of the laser measurement system and the fast response time are designed for position control applications.

With its AMS 3xx/ product series, Leuze makes available a wide range of internationally relevant interfaces. Note that each interface version listed below corresponds to a different AMS 3xx/ model.

|   |   |               |
|---|---|---------------|
|    |    | AMS 304/      |
|    |   | AMS 348/      |
|    |   | AMS 355/      |
|    |   | AMS 358/      |
|    |   | AMS 335/      |
|   |   | AMS 338/      |
|  |   | AMS 308/      |
|  |   | AMS 384/      |
|  |   | AMS 301/      |
|  |  | =<br>AMS 300/ |



## 2 Safety

This sensor was developed, manufactured and tested in line with the applicable safety standards. It corresponds to the state of the art.

### 2.1 Intended use

The AMS is an absolute measuring optical laser measurement system which allows distance measurement of up to 300m against a reflector.

#### Areas of application

The AMS is designed for the following areas of application:

- Positioning of automated, moving plant components
- Travel and lifting axes of high-bay storage devices
- Repositioning units
- Gantry crane bridges and their trolleys
- Elevators
- Electroplating plants



CAUTION

#### Observe intended use!

⚠ *Only operate the device in accordance with its intended use. The protection of personnel and the device cannot be guaranteed if the device is operated in a manner not complying with its intended use.*

*Leuze electronic GmbH + Co. KG is not liable for damages caused by improper use.*

⚠ *Read the technical description before commissioning the device. Knowledge of this technical description is an element of proper use.*

#### NOTE

#### Comply with conditions and regulations!

⚠ *Observe the locally applicable legal regulations and the rules of the employer's liability insurance association.*



#### Attention

*For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).*

### 2.2 Foreseeable misuse


Any use other than that defined under "Intended use" or which goes beyond that use is considered improper use.

In particular, use of the device is not permitted in the following cases:

- in rooms with explosive atmospheres
- as stand-alone safety component in accordance with the machinery directive <sup>1)</sup>
- for medical purposes

#### NOTE

##### **Do not modify or otherwise interfere with the device!**

 *Do not carry out modifications or otherwise interfere with the device.*

*The device must not be tampered with and must not be changed in any way.*

*The device must not be opened. There are no user-serviceable parts inside.*

*Repairs must only be performed by Leuze electronic GmbH + Co. KG.*

## 2.3 Competent persons

Connection, mounting, commissioning and adjustment of the device must only be carried out by competent persons.

Prerequisites for competent persons:

- They have a suitable technical education.
- They are familiar with the rules and regulations for occupational safety and safety at work.
- They are familiar with the technical description of the device.
- They have been instructed by the responsible person on the mounting and operation of the device.

### **Certified electricians**

Electrical work must be carried out by a certified electrician.

Due to their technical training, knowledge and experience as well as their familiarity with relevant standards and regulations, certified electricians are able to perform work on electrical systems and independently detect possible dangers.

In Germany, certified electricians must fulfill the requirements of accident-prevention regulations DGUV (German Social Accident Insurance) provision 3 (e.g. electrician foreman). In other countries, there are respective regulations that must be observed.

## 2.4 Exemption of liability

Leuze electronic GmbH + Co. KG is not liable in the following cases:

- The device is not being used properly.
- Reasonably foreseeable misuse is not taken into account.
- Mounting and electrical connection are not properly performed.
- Changes (e.g., constructional) are made to the device.

<sup>1)</sup> Use as safety-related component within the safety function is possible, if the component combination is designed correspondingly by the machine manufacturer.

## 2.5 Laser safety notices



### ATTENTION! LASER RADIATION – CLASS 2 LASER PRODUCT

#### Do not stare into beam!

The device satisfies the requirements of IEC/EN 60825-1:2014 safety regulations for a product of **laser class 2** product and complies with 21 CFR 1040.10 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

- ⚠ *Never look directly into the laser beam or in the direction of reflected laser beams!*  
*If you look into the beam path over a longer time period, there is a risk of injury to the retina.*
- ⚠ *Do not point the laser beam of the device at persons!*
- ⚠ *Interrupt the laser beam using a non-transparent, non-reflective object if the laser beam is accidentally directed towards a person.*
- ⚠ *When mounting and aligning the device, avoid reflections of the laser beam off reflective surfaces!*
- ⚠ *CAUTION! The use of operating and adjustment devices other than those specified here or the carrying out of differing procedures may lead to dangerous exposure to radiation.*
- ⚠ *Observe the applicable statutory and local laser protection regulations.*
- ⚠ *The device must not be tampered with and must not be changed in any way.*  
*There are no user-serviceable parts inside the device.*  
*Repairs must only be performed by Leuze electronic GmbH + Co. KG.*

#### NOTE

#### Affix laser information and warning signs!

Laser information and warning signs are attached to the device (see figure 2.1). Also included with the device are self-adhesive laser warning and laser information signs (stick-on labels) in multiple languages (see figure 2.2).

- ⚠ *Affix the laser information sheet to the device in the language appropriate for the place of use.*  
*When using the device in the U.S.A., use the stick-on label with the "Complies with 21 CFR 1040.10" notice.*
- ⚠ *Affix the laser information and warning signs near the device if no signs are attached to the device (e.g. because the device is too small) or if the attached laser information and warning signs are concealed due to the installation position.*  
*Affix the laser information and warning signs so that they can be read without the reader being exposed to the laser radiation of the device or other optical radiation.*

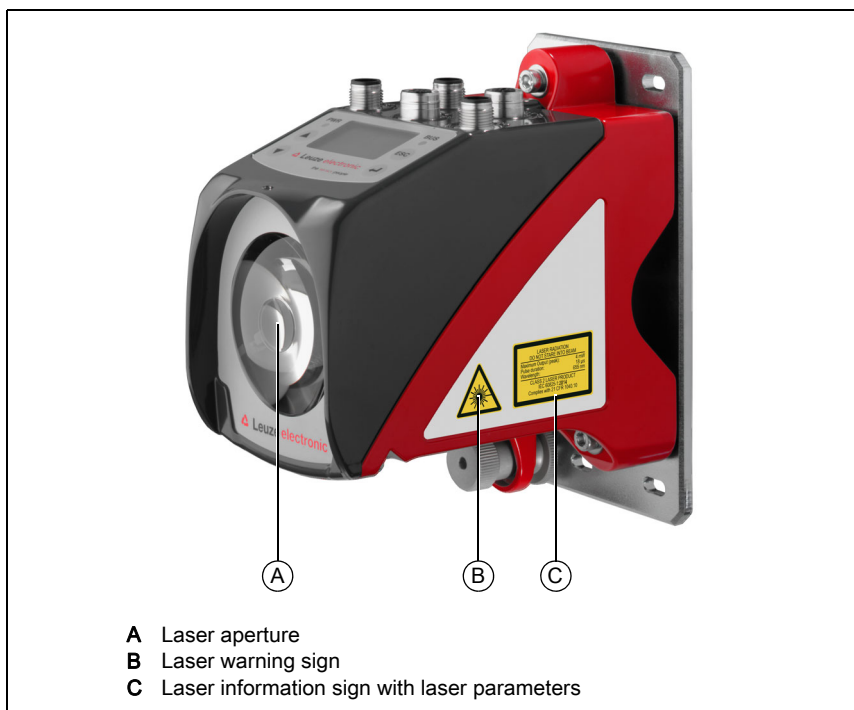


Figure 2.1: Laser apertures, laser warning signs

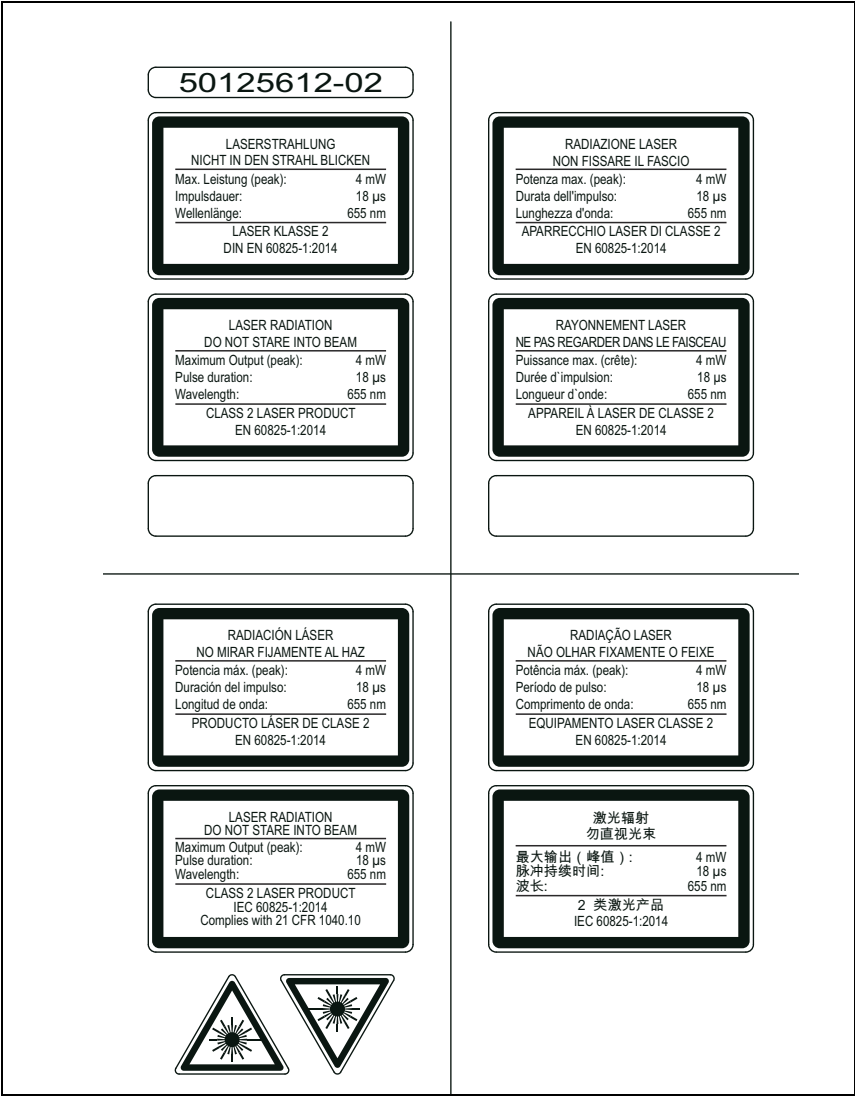


Figure 2.2: Laser warning and information signs – supplied stick-on labels

### 3 Fast commissioning / operating principle

**Note!**

Below you will find a **short description for the initial commissioning** of the AMS 301*i*. Detailed explanations for the listed points can be found throughout the handbook.

#### 3.1 Mounting the AMS 301*i*

The AMS 301*i* and the corresponding reflector are mounted on two mutually opposing, plane-parallel, flat walls.



Figure 3.1: Schematic illustration of mounting

**Attention!**

For error-free position measurement, there must be an unobstructed line-of-sight between the AMS 301*i* and the reflector.

##### 3.1.1 Mounting the device

The laser is mounted using 4 screws (M5).

Alignment is performed using 2 adjustment screws. Adjust so that the laser light spot is positioned at the center of the reflector. The alignment is secured with the knurled nut and locked with the M5 nut.

**Detailed information can be found in Chapter 5.2 and Chapter 5.3.**

##### 3.1.2 Mounting the reflector

The reflector is mounted using 4 screws (M5). The reflector is angled using the spacer sleeves included. Incline the reflector by approx. 1°.

**Detailed information can be found in Chapter 6.4.**



### 3.2 Connecting the voltage supply

The laser measurement system is connected using M12 connectors. The voltage supply is connected via the PWR M12 connection.

**Detailed information can be found in Chapter 7.**

### 3.3 Display

Once the laser measurement system is supplied with voltage, the device status as well as the measured position values can be read on the display. The display automatically switches to the display of the measurement values.

Use the up/down buttons   to the left of the display to read and change a wide range of data and parameters.

Depending on the connected interface, the network address or IP addresses must be configured via the display.

**Detailed information can be found in Chapter 8.**

### 3.4 AMS 301*i* on the RS 485

The transmission parameters are listed in the menu structure and on the foldout at the end of the technical description.

The parameters can be changed after activation of parameter enable.

**Detailed information can be found in Chapter 9.**

## 4 Technical data

### 4.1 Technical data of laser measurement system

#### 4.1.1 General specifications AMS 301/

| Measurement data                       | AMS 301/40 (H)                                    | AMS 301/120 (H) | AMS 301/200 (H)                                  | AMS 301/300 (H) |
|--|---|-----------------|--|-----------------|
| Measurement range                      | 0.2 ... 40m                                       | 0.2 ... 120m    | 0.2 ... 200m                                     | 0.2 ... 300m    |
| Accuracy                               | ± 2mm   | ± 2mm           | ± 3mm  | ± 5mm           |
| Reproducibility <sup>1)</sup>          | 0.3mm   | 0.5mm           | 0.7mm  | 1.0mm           |
| Light spot diameter                    | ≤ 40mm  | ≤ 100mm         | ≤ 150mm  | ≤ 225mm         |
| Output time                            |   |                 | 1.7 ms   |                 |
| Response time                          |   |                 | 14ms   |                 |
| Basis for contouring error calculation |   |                 | 7 ms   |                 |
| Resolution                             | Adjustable; see chapters on individual interfaces |                 |  |                 |
| Temperature drift                      |   |                 | ≤ 0.1mm/K  |                 |
| Ambient temperature sensitivity        |   |                 | 1ppm/K   |                 |
| Air pressure sensitivity               |   |                 | 0.3ppm/hPa                                       |                 |
| Traverse rate                          |   |                 | ≤ 10m/s  |                 |
| <b>Electrical data</b>                 |   |                 |  |                 |
| Supply voltage Vin <sup>2)</sup>       |   |                 | 18 ... 30VDC                                     |                 |
| Current consumption                    |   |                 | Without device heating: ≤ 250mA / 24VDC          |                 |
|  |   |                 | With device heating: ≤ 500mA / 24VDC             |                 |
| <b>Optical data</b>                    |   |                 |  |                 |
| Transmitter                            |   |                 | Laser diode, red light                           |                 |
| Laser class                            |   |                 | 2 acc. to IEC 60825-1:2014                       |                 |
| Wavelength                             |   |                 | 655nm  |                 |
| Impulse duration                       |   |                 | ≤ 18µs   |                 |
| Max. output power (peak)               |   |                 | ≤ 4mW  |                 |
| <b>Interfaces</b>                      |   |                 |  |                 |
| RS 485 / baud rate in kbit/s           |   |                 | 9.6 / 19.2 / 38.4 / 57.6 / 115.2                 |                 |
| <b>Controls and indicators</b>         |   |                 |  |                 |
| Keyboard                               |   |                 | 4 keys   |                 |
| Display                                |   |                 | Monochromatic graphical display, 128 x 64 pixels |                 |
| LED                                    |   |                 | 2 LEDs, two-colored                              |                 |
| Inputs/outputs                         |   |                 |  |                 |
| Quantity                               |   |                 | 2, programmable                                  |                 |
| Input                                  |   |                 | Protected against polarity reversal              |                 |
| Output                                 |   |                 | Max. 60 mA, short-circuit-proof                  |                 |



### Mechanical data

|                      |                                      |
|----------------------|--------------------------------------|
| Housing              | Diecast zinc/aluminum                |
| Optics               | Glass                                |
| Weight               | Approx. 2.45 kg                      |
| Degree of protection | IP 65 acc. to EN 60529 <sup>3)</sup> |

### Environmental conditions

|                        |   |
|------------------------|---|
| Operating temperature  |   |
| without device heating | -5 °C ... +50 °C                        |
| with device heating    | -30 °C ... +50 °C <sup>4)</sup>         |
| Storage temperature    | -30 °C ... +70 °C                       |
| Air humidity           | Max. 90 % rel. humidity, non-condensing |
| MTTF                   | 31 years (at 25 °C) <sup>5)</sup>       |

### Mechanical/electrical loading capacity

|           |   |
|-----------|---|
| Vibration | Acc. to EN 60068-2-6                                |
| Noise     | Acc. to EN 60060-2-64                               |
| Shock     | Acc. to EN 60068-2-27                               |
| EMC       | Acc. to EN 61000-6-2 and EN 61000-6-4 <sup>6)</sup> |

- 1) Statistical error: 1 sigma; minimum switch-on time: 2 min.
- 2) For UL applications: only for use in "Class 2" circuits according to NEC.
- 3) With screwed-on M12 plugs or mounted caps.
- 4) With devices with heating, the switch on/off area of the internal heating can be extended to prevent condensation from forming. Total prevention of condensation cannot be guaranteed due to the limited heating capacity of the AMS 301*/*.
- 5) We reserve the right to make changes. (Value is updated at regular intervals.)
- 6) This is a Class A product. In a domestic environment this product may cause radio interference, in which case the operator may be required to take adequate measures.



The AMS 301*/* is designed in accordance with protection class III for supply with PELV (protective extra-low voltage).

### 4.1.2 AMS 301 / dimensioned drawing

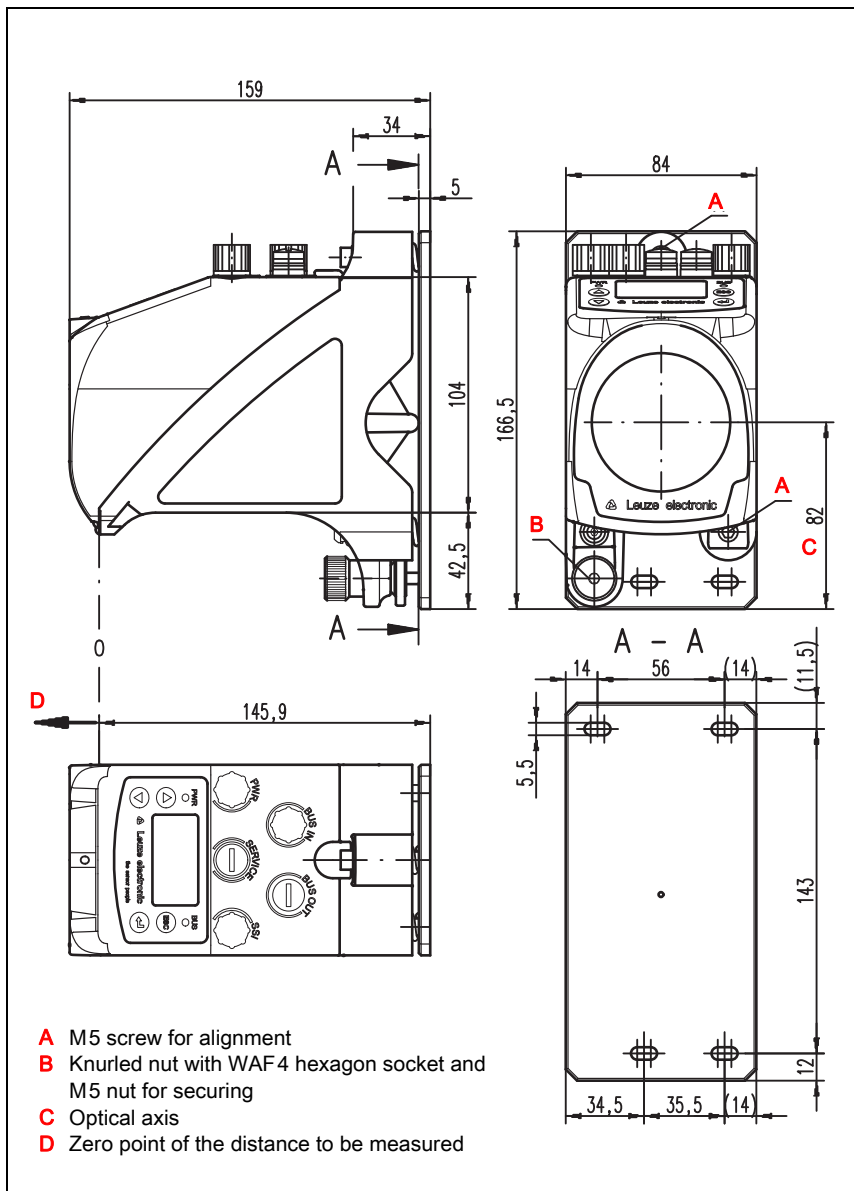


Figure 4.1: AMS 301 / dimensioned drawing

### 4.1.3 Overview of AMS 301/i types

#### AMS 301/i (RS 485)

| Type designation | Description  | Part no. |
|------------------|--|----------|
| AMS 301/i40      | 40m operating range, RS 485 interface                      | 50113669 |
| AMS 301/i120     | 120m operating range, RS 485 interface                     | 50113670 |
| AMS 301/i200     | 200m operating range, RS 485 interface                     | 50113671 |
| AMS 301/i300     | 300m operating range, RS 485 interface                     | 50113672 |
| AMS 301/i40 H    | 40m operating range, RS 485 interface, integrated heating  | 50113673 |
| AMS 301/i120 H   | 120m operating range, RS 485 interface, integrated heating | 50113674 |
| AMS 301/i200 H   | 200m operating range, RS 485 interface, integrated heating | 50113675 |
| AMS 301/i300 H   | 300m operating range, RS 485 interface, integrated heating | 50113676 |

Table 4.1: Overview of AMS 301/i types

## 5 Installation and mounting

### 5.1 Storage, transportation



#### Attention!

Package the device for transport and storage in such a way that is protected against shock and humidity. Optimum protection is achieved when using the original packaging. Ensure compliance with the approved environmental conditions listed in the specifications.

#### Unpacking

- ✎ Check the packaging content for any damage. If damage is found, notify the post office or shipping agent as well as the supplier.
- ✎ Check the delivery contents using your order and the delivery papers:
  - Delivered quantity
  - Device type and model as indicated on the name plate
  - Brief manual

The name plate provides information as to what AMS 301/i type your device is. For specific information, please refer to Chapter 11.2.

#### Name plates

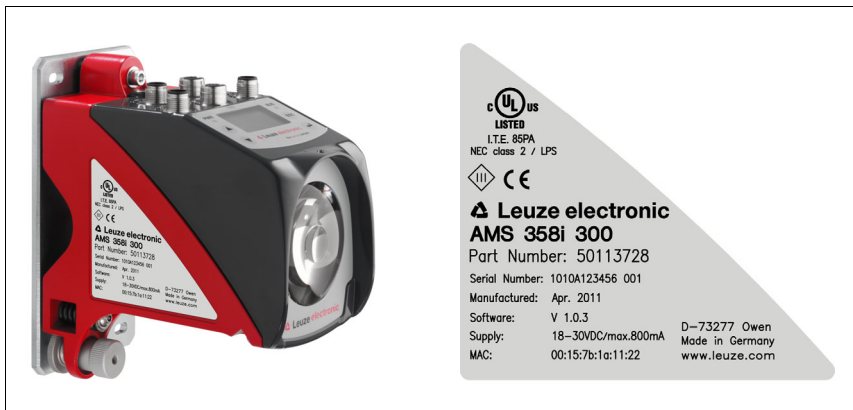


Figure 5.1: Device name plate using the AMS 358/i as an example



#### Note!

Please note that the shown name plate is for illustration purposes only; the contents do not correspond to the original.

- ✎ Save the original packaging for later storage or shipping.

If you have any questions concerning your shipment, please contact your supplier or your local Leuze sales office.

🔗 *Observe the applicable local regulations when disposing of the packaging materials.*

## 5.2 Mounting the AMS 301/

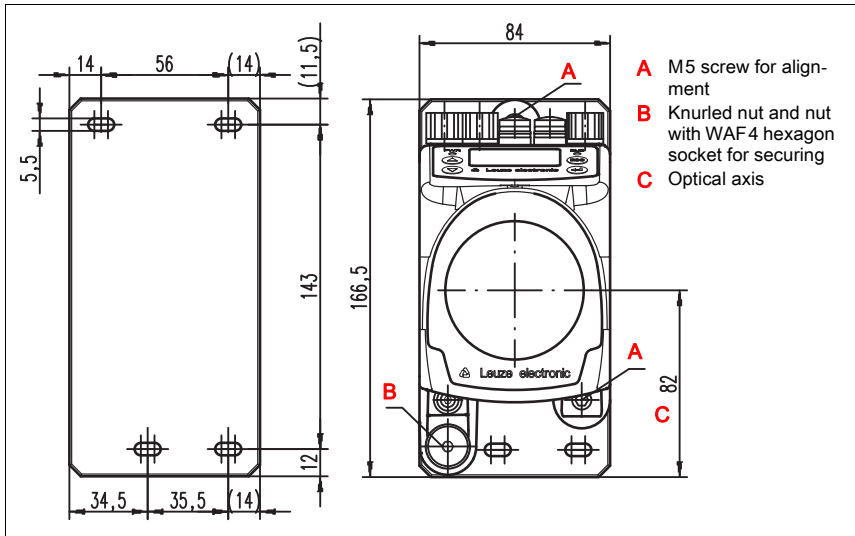


Figure 5.2: Mounting the device

The AMS 301/ and the corresponding reflector are mounted on two mutually opposing, plane-parallel, flat walls or system parts. For error-free position measurement, there must be an unobstructed line-of-sight between the AMS 301/ and the reflector.

Use M5 screws to fasten the laser measurement system. Secure the screws with a lock washer to protect against loosening caused by vibrations.

**Aligning the laser light spot with the center of the reflector**

The laser light spot has to be aligned so that it always hits the center of the opposing reflector, both at close range as well as at the maximum measurement distance. **To align, use the two M5 Allen screws ("A" in Figure 5.2).** When aligning, please ensure that the knurled nut and the lock nut ("B" in Figure 5.2) are opened wide.

**Attention!**

*To prevent the laser measurement system from moving out of alignment during continuous operation, subsequently hand-tighten the knurled nut and counterlock with the nut with WAF4 hexagon socket ("B" in Figure 5.2). Knurled nut and nut must not be tightened until alignment has been completed.*

**Attention!**

*The device must not be opened. Failure to comply will render the guarantee void. Warranted features cannot be guaranteed after the device has been opened.*

### 5.2.1 Optional mounting bracket

A mounting bracket for mounting the AMS 301/i on a flat, horizontal surface is available as an optional accessory.

Type designation: MW OMS/AMS 01

Part no.: 50107255

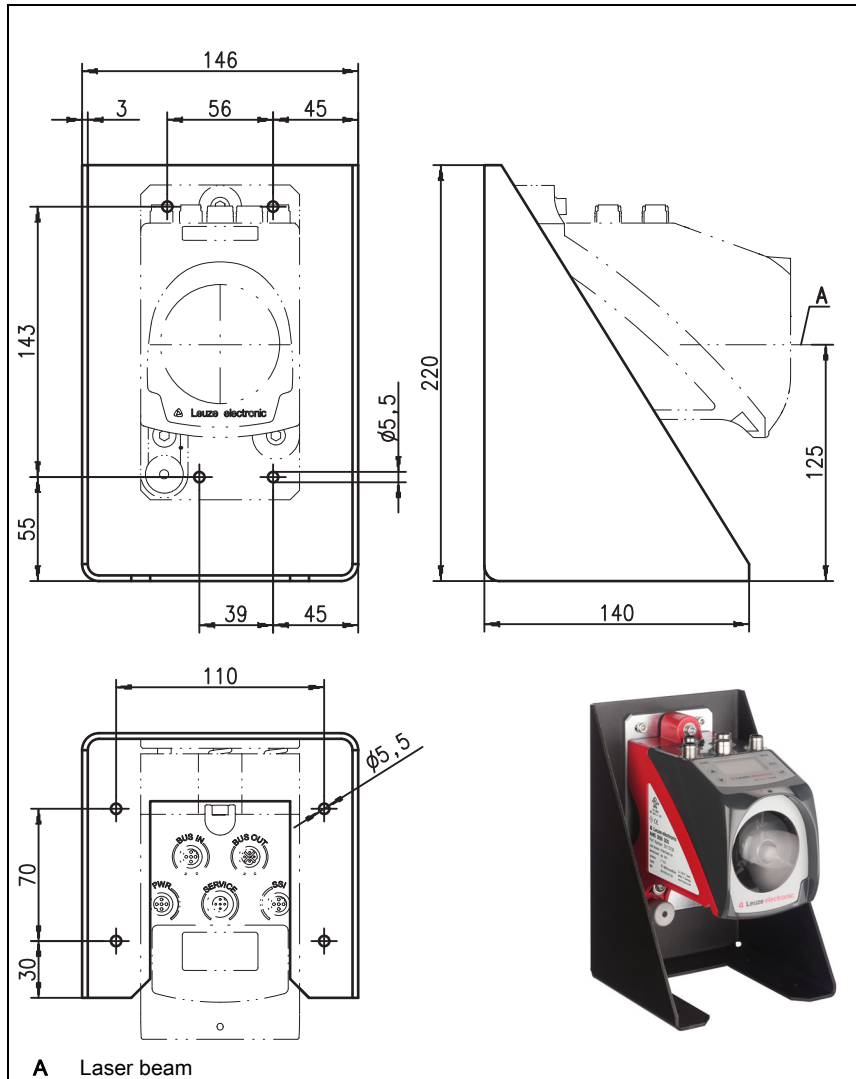


Figure 5.3: Optional mounting bracket

## 5.2.2 Parallel mounting of the AMS 301/

### Definition of the term "parallel spacing"

As shown in Figure 5.4, dimension X describes the "parallel spacing" of the inner edges of the two laser light spots on the reflector.

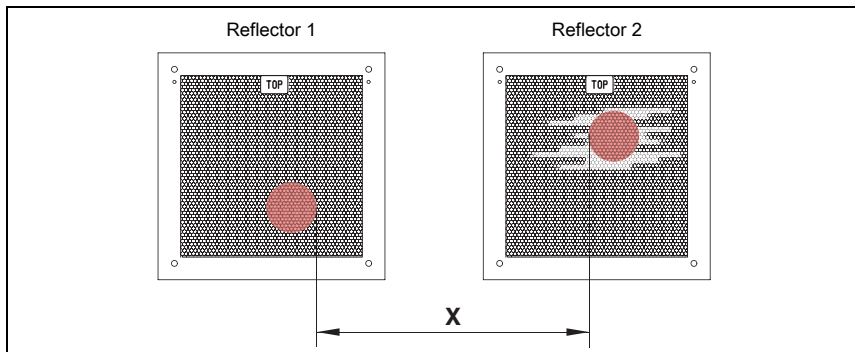


Figure 5.4: Minimum parallel spacing X between adjacent AMS 301/

The diameter of the light spot increases with distance.

|                           | AMS 301/40 (H) | AMS 301/120 (H) | AMS 301/200 (H) | AMS 301/300 (H) |
|---------------------------|----------------|-----------------|-----------------|-----------------|
| Max. measurement distance | 40m            | 120m            | 200m            | 300m            |
| Light spot diameter       | ≤ 40mm         | ≤ 100mm         | ≤ 150mm         | ≤ 225mm         |

Thus, the center-to-center spacing of the two AMS 301/ devices with respect to one another can be calculated as a function of the maximum measurement distance.

To define the minimum parallel spacing between two AMS 301/, it is necessary to distinguish between three different arrangements of AMS 301/ and reflectors.

**The AMS 301/ are mounted stationary and in parallel on one plane.  
Both reflectors move independently of one another at different distances to the AMS 301/.**

Minimum parallel spacing X of the two laser light spots:

$$X = 100\text{mm} + (\text{max. measurement distance in mm} \times 0.01)$$

**The AMS 301/ are mounted stationary and in parallel on one plane.  
Both reflectors move in parallel at the same distance to the AMS 301/.**  
 Measurement distance **up to 120m**: minimum parallel spacing  $X \geq 600\text{mm}$   
 Measurement distance **up to 200m**: minimum parallel spacing  $X \geq 750\text{mm}$   
 Measurement distance **up to 300m**: minimum parallel spacing  $X \geq 750\text{mm}$



The reflectors are mounted stationary and in parallel on one plane.

Both AMS 301*i* move independently of one another at different or the same distances to the reflectors.

Measurement distance **up to 120m**: minimum parallel spacing  $X \geq 600\text{mm}$

Measurement distance **up to 200m**: minimum parallel spacing  $X \geq 750\text{mm}$

Measurement distance **up to 300m**: minimum parallel spacing  $X \geq 750\text{mm}$



**Note!**

*Please note that when the AMS 301*i* are mounted in a mobile manner, travel tolerances could cause the two laser light spots to move towards each other.*

*Take the travel tolerances of the vehicle into account when defining the parallel spacing of adjacent AMS 301*i*.*

### 5.2.3 Parallel mounting of AMS 301*i* and DDLS optical data transmission

The optical data transceivers of the DDLS series and the AMS 301*i* do not interfere with one another. Depending on the size of the used reflector, the DDLS can be mounted with a minimum parallel spacing of 100mm to the AMS 301*i*. The parallel spacing is independent of the distance.

## 5.3 Mounting the AMS 301 /with laser beam deflector unit

### General information

The two available deflector units are used for the 90° deflection of the laser beam, see "Accessories – Deflector unit" on page 62.



### Attention!

*The deflector units are designed for a maximum range of 40m.  
Longer distances on request.*

### 5.3.1 Mounting the laser beam deflector unit with integrated mounting bracket

The AMS 301 /is screwed onto the mechanism of the US AMS 01 deflector unit. The mirror can be mounted for three deflection directions:

1. Upward beam deflection
2. Beam deflection to the left
3. Beam deflection to the right

The deflector unit is mounted on plane-parallel, flat walls or system parts. For error-free position measurement, there must be an unobstructed line-of-sight between the AMS 301 /... and the deflection mirror as well as between the mirror and the reflector.

Use the M5 screws to mount the deflector unit. Secure the screws with a lock washer to protect against loosening caused by vibrations.



Figure 5.5: Mounting variants of the US AMS 01 laser beam deflector unit

5.3.2 Dimensioned drawing of US AMS 01 deflector unit

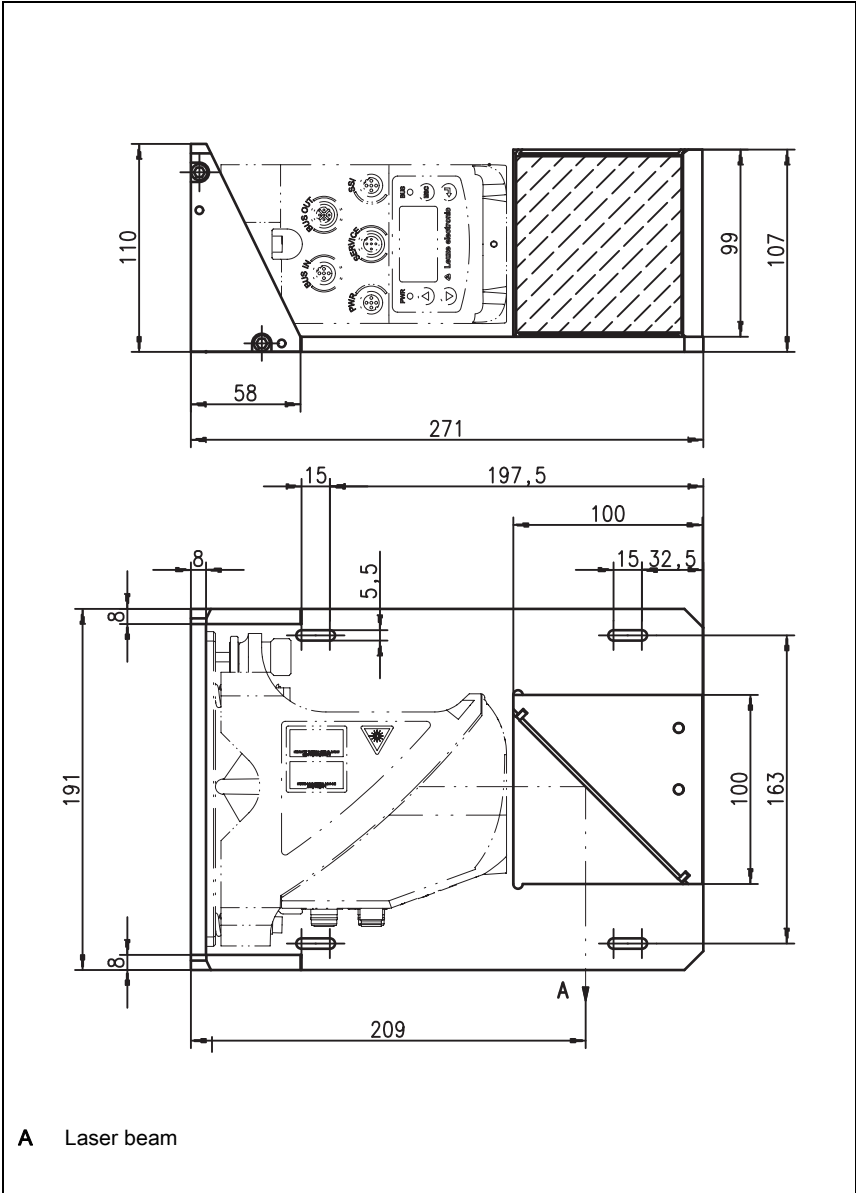


Figure 5.6: Dimensioned drawing of US AMS 01 deflector unit

### 5.3.3 Mounting the US 1 OMS deflector unit without mounting bracket

The US 1 OMS deflector unit and the AMS 301*i* are mounted separately.



**Note!**

*When mounting, make certain that the laser light spot of the AMS 301*i* is aligned with the center of the deflection mirror.*

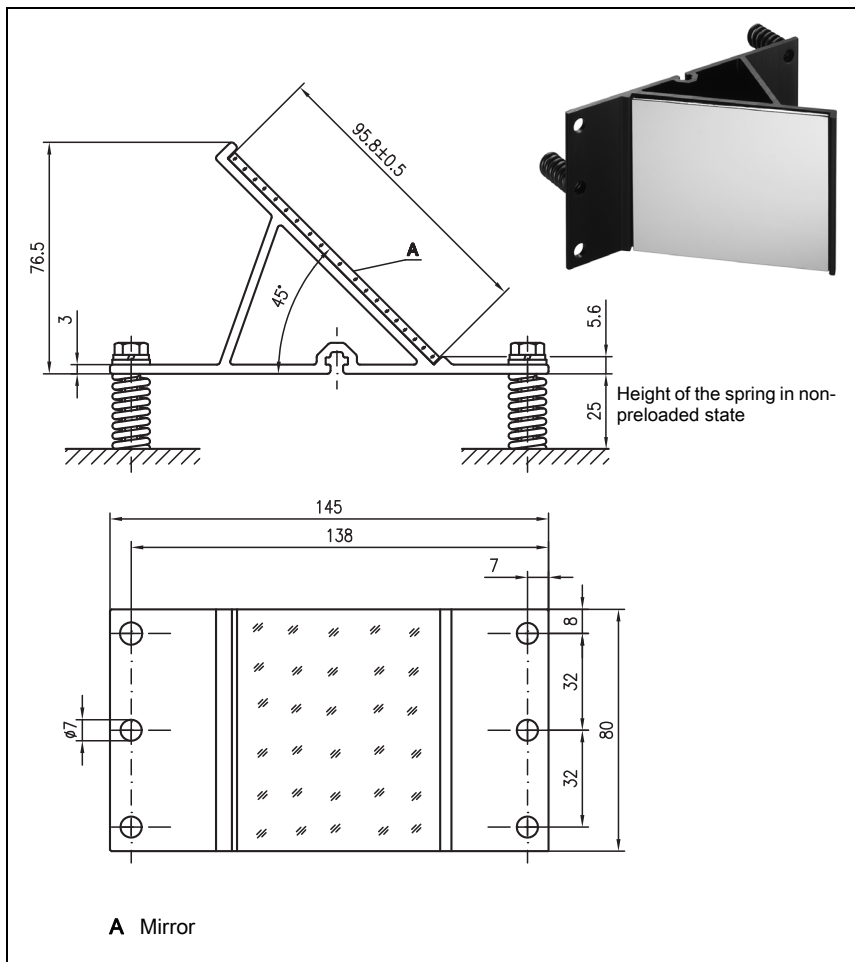


Figure 5.7: Photo and dimensioned drawing of the US 1 OMS deflector unit

The laser light spot is aligned with the reflector as described in Chapter 5.2.

## 6 Reflectors

### 6.1 General information

The AMS 301*/* measures distances against a reflective tape specified by Leuze. All technical data given for the AMS 301*/*, such as the operating range or accuracy, can only be achieved with the reflective tape specified by Leuze.

The reflective tapes are available as self-adhesive tapes or affixed to a carrier plate and with an integrated heater especially for use at low temperatures. Reflective tapes with heating have the designation "**Reflective tape ...x...-H**", where "**H**" is an abbreviation for the heating variant.

The reflective tapes/reflectors must be ordered separately. The choice of size is left to the user. In Chapter 6.3, recommendations on reflector size are given depending on the distance that is to be measured. In each case, the user must check whether the recommendation is suitable for the respective application.

### 6.2 Description of the reflective tape

The reflective tape consists of a white, microprism-based reflective material. The microprisms are protected by a hard, highly transparent protective layer.

Under certain circumstances, the protective layer can cause surface reflections. The surface reflections can be directed past the AMS 301*/* by positioning the reflective tape at a slight incline. The inclination of the reflective tape/reflectors is described in Chapter 6.4.2. The required pitch can be found in Table 6.1 "Reflector pitch resulting from spacer sleeves" on page 35.

The reflective tapes have a protective film that is easy to peel off. It must be removed from the reflector before the complete system is put into operation.

### 6.2.1 Technical data of self-adhesive tape

|   | Article   |                              |                              |                     |                     |
|---|---|------------------------------|------------------------------|---------------------|---------------------|
| Type designation                                      | Reflective tape<br>200x200-S  | Reflective tape<br>500x500-S | Reflective tape<br>914x914-S | REF 4-A-<br>150x150 | REF 4-A-<br>300x300 |
| Part no.  | 50104361  | 50104362                     | 50108988                     | 50141015            | 50141014            |
| Film size   | 200 x 200 mm  | 500 x 500 mm                 | 914x914 mm                   | 150 x<br>150 mm     | 300 x<br>300 mm     |
| Recommended application temperature for adhesive tape | +5°C ... +25°C  |                              |                              |                     |                     |
| Temperature resistance, affixed                       | -40°C ... +80°C   |                              |                              |                     |                     |
| Bonding surface                                       | The bonding surface must be clean, dry and free of grease.  |                              |                              |                     |                     |
| Cutting tape  | Cut with a sharp tool, always on the side with the prism structure.   |                              |                              |                     |                     |
| Cleaning  | Do not use any abrasive agents. A conventional household detergent can be used as a cleaning agent. Rinse with clear water and dry the surface. |                              |                              |                     |                     |
| Film storage  | Store in a cool and dry place.  |                              |                              |                     |                     |

### 6.2.2 Technical data of reflective tape on support plate

The reflective tape is affixed to a carrier plate. Included with the carrier plate are spacers for positioning at an incline in order to avoid surface reflections (see chapter 6.4.2 "Mounting the reflector").

|                                   | Article   |                              |                              |
|-----------------------------------|---|------------------------------|------------------------------|
| Type designation                  | Reflective tape<br>200x200-M  | Reflective tape<br>500x500-M | Reflective tape<br>914x914-M |
| Part no.                          | 50104364  | 50104365                     | 50104366                     |
| Film size                         | 200 x 200 mm  | 500 x 500 mm                 | 914x914 mm                   |
| Outer dimensions of carrier plate | 250 x 250 mm  | 550 x 550 mm                 | 964 x 964 mm                 |
| Weight                            | 0.8 kg  | 4 kg                         | 25 kg                        |
| Cleaning                          | Do not use any abrasive agents. A conventional household detergent can be used as a cleaning agent. Rinse with clear water and dry the surface. |                              |                              |
| Reflector storage                 | Store in a cool and dry place.  |                              |                              |

6.2.3 Dimensioned drawing of reflective tape on carrier plate

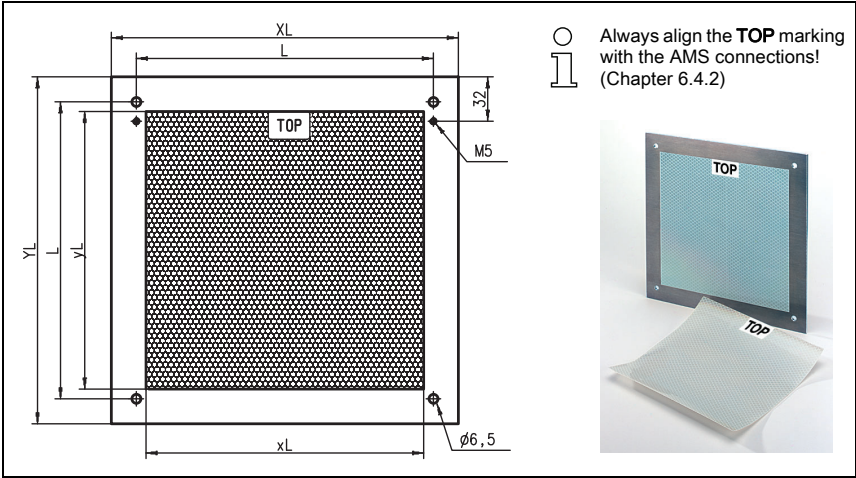


Figure 6.1: Dimensioned drawing of reflectors

| Article                   | Reflective tape (mm) |     | Reflector plate (mm) |     |     |
|---------------------------|----------------------|-----|----------------------|-----|-----|
|                           | xL                   | yL  | XL                   | YL  | L   |
| Reflective tape 200x200-M | 200                  | 200 | 250                  | 250 | 214 |
| Reflective tape 500x500-M | 500                  | 500 | 550                  | 550 | 514 |
| Reflective tape 914x914-M | 914                  | 914 | 964                  | 964 | 928 |

## 6.2.4 Technical data of heated reflectors

The reflective tape is affixed to a heated, thermally insulated carrier. The insulation results in a very high energetic efficiency.

Only the reflective tape is kept at the specified temperature by the integrated heater. The insulation on the back prevents the generated heat from being dissipated via the steel construction. Energy costs are greatly reduced in the case of continuous heating.

|                                   | Article   |                              |                              |
|-----------------------------------|---|------------------------------|------------------------------|
| Type designation                  | Reflective tape<br>200x200-H  | Reflective tape<br>500x500-H | Reflective tape<br>914x914-H |
| Part no.                          | 50115020  | 50115021                     | 50115022                     |
| Voltage supply                    | 230VAC  |                              |                              |
| Power                             | 100W  | 600W                         | 1800W                        |
| Current consumption               | ~ 0.5A  | ~ 3A                         | ~ 8A                         |
| Length of supply line             | 2 m   |                              |                              |
| Size of reflective tape           | 200 x 200mm   | 500 x 500mm                  | 914 x 914mm                  |
| Outer dimensions of base material | 250 x 250mm   | 550 x 550mm                  | 964 x 964mm                  |
| Weight                            | 0.5kg   | 2.5kg                        | 12kg                         |
| Temperature control               | Controlled heating with the following switch-on and switch-off temperatures, measured at the reflector surface.                                 |                              |                              |
| Switch-on temperature             | ~ 5°C   |                              |                              |
| Switch-off temperature            | ~ 20°C  |                              |                              |
| Operating temperature             | -30°C ... +70°C   |                              |                              |
| Storage temperature               | -40°C ... +80°C   |                              |                              |
| Air humidity                      | Max. 90 %, non-condensing   |                              |                              |
| Cleaning                          | Do not use any abrasive agents. A conventional household detergent can be used as a cleaning agent. Rinse with clear water and dry the surface. |                              |                              |
| Reflector storage                 | Store in a cool and dry place.  |                              |                              |



6.2.5 Dimensioned drawing of heated reflectors

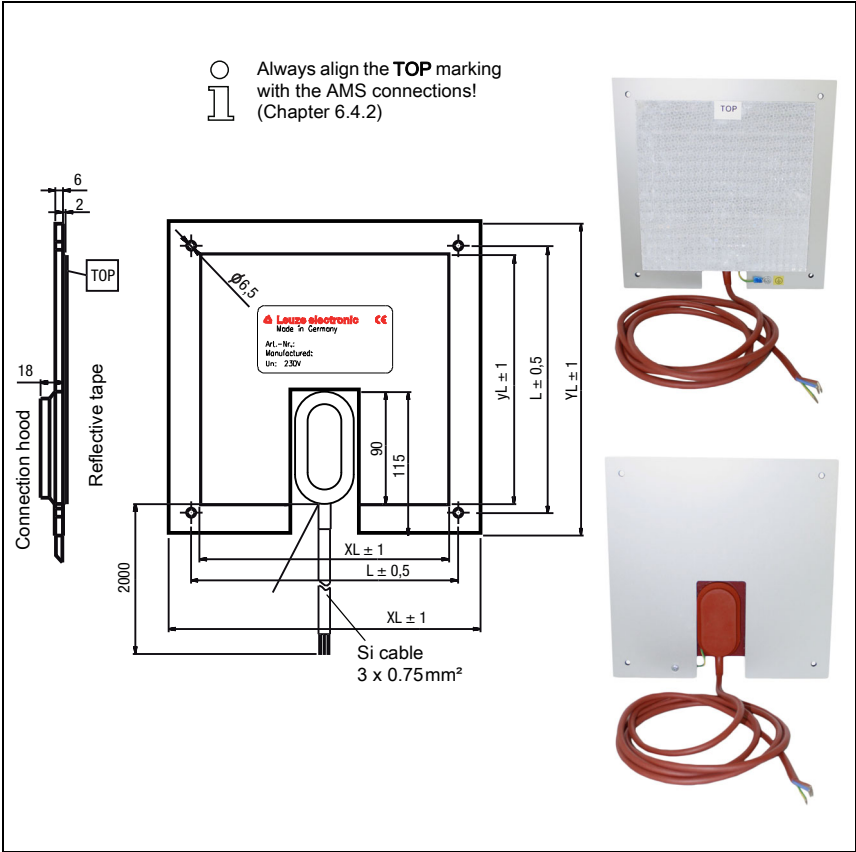


Figure 6.2: Dimensioned drawing of heated reflectors

| Article                   | Reflective tape (mm) |     | Insulated carrier plate (mm) |     |     |
|---------------------------|----------------------|-----|------------------------------|-----|-----|
|                           | xL                   | yL  | XL                           | YL  | L   |
| Reflective tape 200x200-H | 200                  | 200 | 250                          | 250 | 214 |
| Reflective tape 500x500-H | 500                  | 500 | 550                          | 550 | 514 |
| Reflective tape 914x914-H | 914                  | 914 | 964                          | 964 | 928 |

### 6.3 Selecting reflector size

Depending on the system design, the reflector can be mounted so that it moves with the vehicle or it can be mounted at a fixed location.



#### Attention!

*The reflector sizes shown below are a recommendation from Leuze for on-vehicle mounting of the AMS 301*i*. For stationary mounting of the AMS 301*i*, a smaller reflector is generally sufficient for all measurement distances. For this reason, two smaller reflector sizes are available in the self-adhesive variant "-S".*

*During system planning and design, always check whether mechanical travel tolerances require the use of a reflector larger than that which is recommended. This applies, in particular, when the laser measurement system is mounted on a vehicle. During travel, the laser beam must reach the reflector unobstructed. For on-vehicle mounting of the AMS 301*i*, the reflector size must accommodate any travel tolerances that may arise and the associated "wandering" of the light spot on the reflector.*

#### Overview of reflector types

| Recommended reflector size                          |  |   |  |
|---|--|---|--|
| Selected AMS 301 <i>i</i><br>(operating range in m) | Recommended<br>reflector size<br>(H x W) | Type designation<br>...-S = self-adhesive<br>...-M = carrier plate<br>...-H = heating   | Part no.   |
| AMS 301 <i>i</i> /40 (max. 40m)                     | 200 x 200mm                              | REF 4-A-150x150 <sup>1)</sup><br>Reflective tape 200x200-S<br>Reflective tape 200x200-M<br>Reflective tape 200x200-H<br>REF 4-A-300x300 <sup>1)</sup> | 50141015<br>50104361<br>50104364<br>50115020<br>50141014 |
| AMS 301 <i>i</i> /120 (max. 120m)                   | 500x500mm                                | Reflective tape 500x500-S<br>Reflective tape 500x500-M<br>Reflective tape 500x500-H   | 50104362<br>50104365<br>50115021                         |
| AMS 301 <i>i</i> /200 (max. 200m)                   | 749x914mm<br>914x914mm                   | Reflective tape 749x914-S<br>Reflective tape 914x914-M<br>Reflective tape 914x914-S<br>Reflective tape 914x914-H                                      | 50104363<br>50104366<br>50108988<br>50115022             |
| AMS 301 <i>i</i> /300 (max. 300m)                   | 749x914mm<br>914x914mm                   | Reflective tape 749x914-S<br>Reflective tape 914x914-M<br>Reflective tape 914x914-S<br>Reflective tape 914x914-H                                      | 50104363<br>50104366<br>50108988<br>50115022             |

1) For landside mounting

## 6.4 Mounting the reflector

### 6.4.1 General information

#### ***Self-adhesive reflective tapes***

The reflective tapes of the "Reflective tape ...x...-S" series (self-adhesive) must be affixed to a flat, clean and grease-free surface. We recommend using a separate carrier plate, which is to be provided on-site.

As described in Table 6.1, the reflective tape must be at an angle.

#### ***Reflective tapes on carrier plate***

The reflective tapes of the "Reflective tape ...x...-M" series have corresponding mounting holes. Spacer sleeves are provided to enable mounting at the necessary pitch angle. For further information, see Table 6.1.

#### ***Heated reflectors***

The reflective tapes of the "Reflective tape ...x...-H" series have corresponding mounting holes. Due to the voltage supply affixed on the rear, the reflector cannot be mounted flat. Four spacer sleeves in two different lengths are supplied. Use the spacer sleeves to ensure separation from the wall as well as to provide the necessary pitch for avoiding surface reflection. For further information, see Table 6.1.

The reflector has a 2m-long connection cable for supplying with 230VAC. Connect the cable to the nearest power distribution point. Observe the current consumptions listed in the technical data.



#### ***Attention!***

*Connection work must be carried out by a certified electrician.*

### 6.4.2 Mounting the reflector

The combination of laser measurement system and reflective tape/reflector is mounted so that the laser light spot hits the film as centered as possible and without obstruction.

For this purpose, use the alignment elements provided on the AMS 301*i*... (see chapter 5.2 "Mounting the AMS 301i"). If necessary, remove the protective film from the reflector.



#### ***Attention!***

The "TOP" label on the reflectors should be aligned the same as the connections of the AMS 301*i*.

#### ***Example:***

*If the AMS 301i is mounted so that the M 12 connections are on the top, the "TOP" label of the reflector is also on the top. If the AMS 301i is mounted so that the M 12 connections are on the side, the "TOP" label of the reflector is also on the side.*

**Note!**

The reflector must be positioned at an angle. Use the spacer sleeves for this purpose. Angle the reflector so that the **surface reflections of the foil seal are deflected to the left, right or upwards**. Chapter 6.4.3 gives the correct pitch with respect to the reflector size and, thus, the length of the spacers.

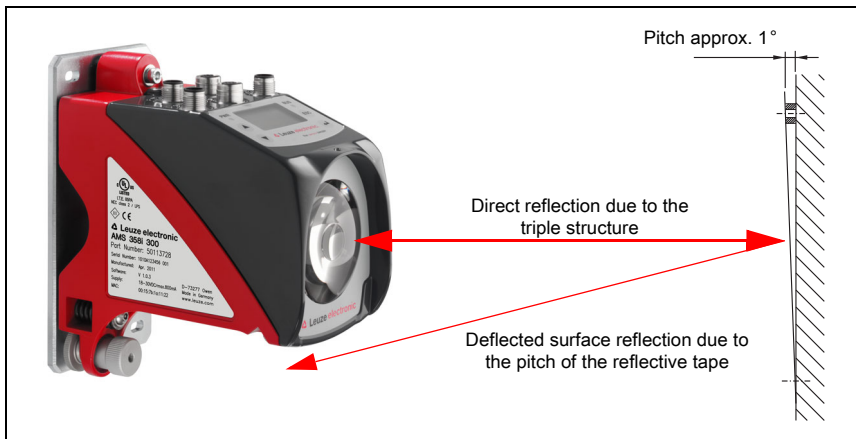
**Reflective tapes ...-S and ...-M**

Figure 6.3: Mounting the reflector

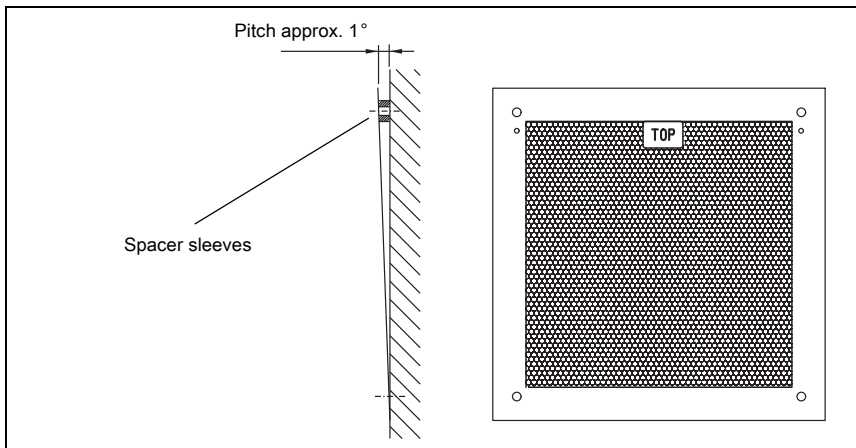


Figure 6.4: Pitch of the reflector

Reflective tapes ...-H

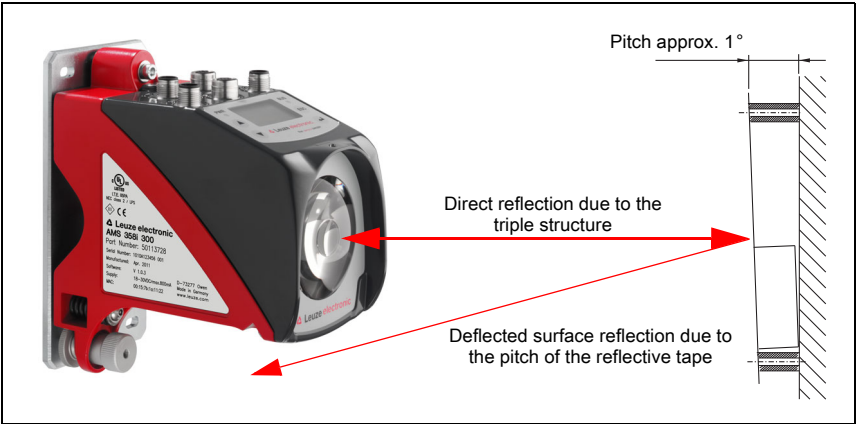


Figure 6.5: Mounting of heated reflectors

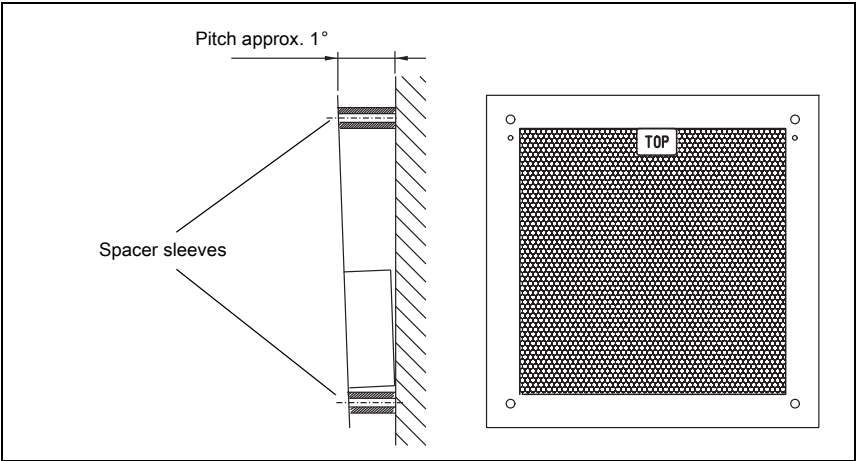


Figure 6.6: Pitch of the heated reflector

### 6.4.3 Table of reflector pitches

| Reflector type   | Pitch resulting from spacer sleeves <sup>1)</sup> |          |
|--|---|----------|
| Reflective tape 200x200-S<br>Reflective tape 200x200-M | 2 x 5mm   |          |
| Reflective tape 200x200-H                              | 2 x 15mm  | 2 x 20mm |
| Reflective tape 500x500-S<br>Reflective tape 500x500-M | 2 x 10mm  |          |
| Reflective tape 500x500-H                              | 2 x 15mm  | 2 x 25mm |
| Reflective tape 749x914-S                              | 2 x 20mm  |          |
| Reflective tape 914x914-S<br>Reflective tape 914x914-M | 2 x 20mm  |          |
| Reflective tape 914x914-H                              | 2 x 15mm  | 2 x 35mm |

1) Spacer sleeves are included with reflective tape ...-M and ...-H

Table 6.1: Reflector pitch resulting from spacer sleeves



#### **Note!**

*Reliable operation of the AMS 301*i* and, thus, max. operating range and accuracy can only be achieved with the reflective tape specified by Leuze. Correct operation cannot be guaranteed if other reflectors are used!*

## 7 Electrical connection

The AMS 301*i* laser measurement systems are connected using variously coded M12 connectors. This ensures unique connection assignments.



### **Note!**

*The corresponding mating connectors and ready-made cables are available as accessories for all connections. For further information, see chapter 11 "Type overview and accessories".*



Figure 7.1: Connections of the AMS 301*i*

### 7.1 Safety notices for the electrical connection



#### **Attention!**

*Before connecting the device, be sure that the supply voltage agrees with the value printed on the name plate.*

*The device may only be connected by a qualified electrician.*

*Ensure that the functional earth (FE) is connected correctly. Unimpaired operation is only guaranteed when the functional earth is connected properly.*

*If faults cannot be cleared, the device should be switched off and protected against accidental use.*



#### **Attention!**

*For UL applications, use is only permitted in Class 2 circuits in accordance with the NEC (National Electric Code).*



*The laser measurement systems are designed in accordance with protection class III for supply by PELV (protective extra-low voltage with reliable disconnection).*



### **Note!**

*Degree of protection IP65 is achieved only if the connectors and caps are screwed into place!*

Described in detail in the following are the individual connections and pin assignments.

7.2 PWR – voltage supply / switching input/output

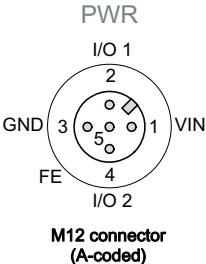
| PWR (5-pin plug, A-coded)   |        |       |  |
|---|--------|-------|--|
|  | Pin    | Name  | Comment                                |
|   | 1      | VIN   | Positive supply voltage +18 ... +30VDC |
|   | 2      | I/O 1 | Switching input/output 1               |
|   | 3      | GNDIN | Negative supply voltage 0VDC           |
|   | 4      | I/O 2 | Switching input/output 2               |
|   | 5      | FE    | Functional earth                       |
|   | Thread | FE    | Functional earth (housing)             |

Table 7.1: Pin assignments - PWR

Further information on configuring the input/output can be found in Chapter 8 and Chapter 9.

7.3 RS 485 BUS IN

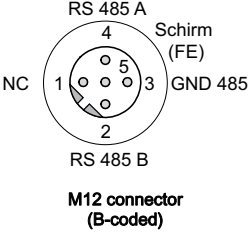
| RS 485 BUS IN (5-pin plug, B-coded)  |        |          |                          |
|--|--------|----------|--------------------------|
|  | Pin    | Name     | Comment                  |
|  | 1      | NC       | Not assigned             |
|  | 2      | RS 485 B | Data RS 485 B (-)        |
|  | 3      | GND ISO  | Data reference potential |
|  | 4      | RS 485 A | Data RS 485 A (+)        |
|  | 5      | FE       | Functional earth         |
|  | Thread | Shield   | Shield                   |

Table 7.2: RS 485 BUS IN pin assignment



7.4 RS 485 BUS OUT

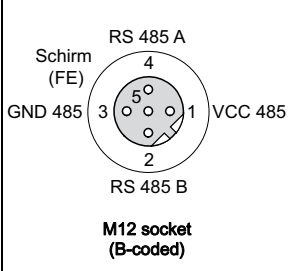
| RS 485 BUS OUT (5-pin socket, B-coded)  |     |          |                                  |
|---|-----|----------|----------------------------------|
|  | Pin | Name     | Comment                          |
|   | 1   | VCC 485  | Supply voltage +5V (Termination) |
|   | 2   | RS 485 B | Data RS 485 B (-)                |
|   | 3   | GND ISO  | Data reference potential         |
|   | 4   | RS 485 A | Data RS 485 A (+)                |
|   | 5   | FE       | Functional earth                 |
| Thread  |     | Shield   | Shield                           |

Table 7.3: RS 485 BUS OUT pin assignment

7.5 Service

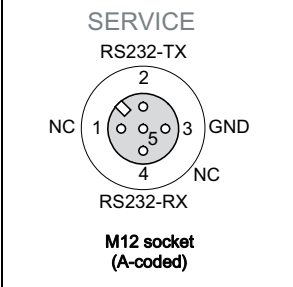
| Service (5-pin socket, A-coded)  |     |          |                                       |
|--|-----|----------|---------------------------------------|
|  | Pin | Name     | Comment                               |
|  | 1   | NC       | Not assigned                          |
|  | 2   | RS232-TX | Transmission line RS 232/service data |
|  | 3   | GND      | Voltage supply 0VDC                   |
|  | 4   | RS232-RX | Receiving line RS 232/service data    |
|  | 5   | NC       | Not used                              |
| Thread   |     | FE       | Functional earth (housing)            |

Table 7.4: Pin assignment - Service



**Note!**

The service interface is designed only for use by Leuze!

## 8 Display and control panel AMS 301i

### 8.1 Structure of the control panel

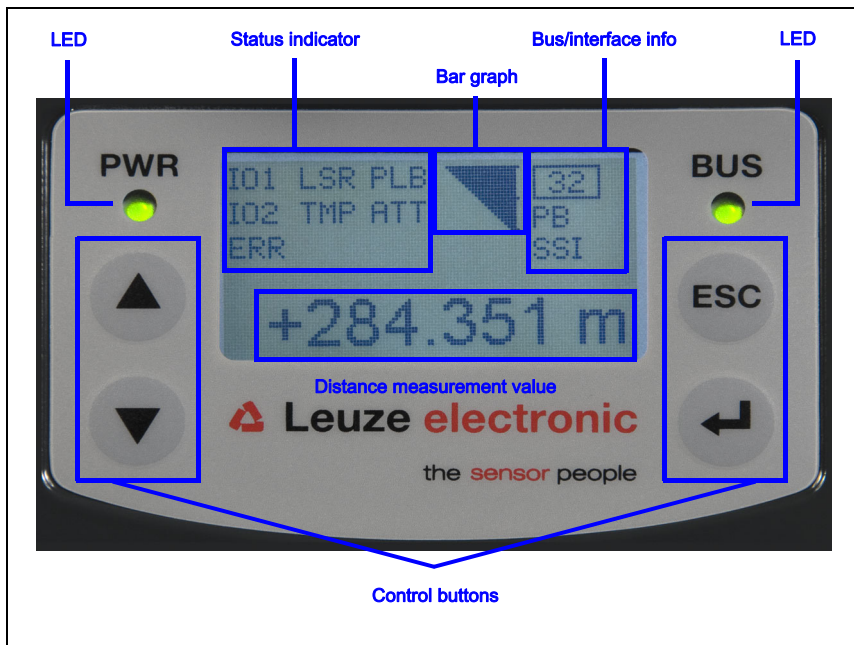


Figure 8.1: Structure of the control panel using the AMS 304i/PROFIBUS device variant as an example



**Note!**

*The figure is for illustration purposes only and does not correspond to the AMS 301i with respect to specified bus/interface info.*

### 8.2 Status indicators and operation

#### 8.2.1 Indicators in the display

**Status and warning messages in the display**

- IO1 **Input 1 or output 1 active:**  
Function depending on configuration.
- IO2 **Input 2 or output 2 active:**  
Function depending on configuration.

- LSR    Warning - laser prefailure message:**  
Laser diode old, device still functional, exchange or have repaired.
- TMP    Warning - temperature monitoring:**  
Internal device temperature above/below permissible range.
- PLB    Plausibility error:**  
Implausible measurement value. Possible causes: light beam interruption, outside of measurement range, permissible internal device temperature considerably exceeded or traverse rate >10m/s.  
Depending on the configuration, either zero or the last valid measurement value is output at the interfaces.
- ATT    Warning - received signal:**  
Laser exit window or reflector soiled or fogged by rain, water vapor or fog. Clean or dry surfaces.
- ERR    Internal hardware error:**  
The device must be sent in for inspection.

### Bar graph



Indicates the **strength of the received laser light**.

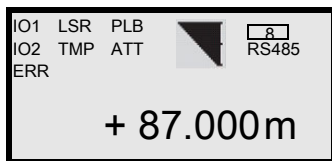
The center bar represents the **ATT** warning threshold. The distance value remains valid and is output at the interfaces.

If no bar graph is available, the **PLB** status information appears at the same time.

The measurement value is assessed as implausible. Depending on the configuration, either zero or the last valid measurement value is output at the interfaces.

### Interface info

The number "8" in the display indicates the set address, and the designation "RS 485" indicates the activated interface.



← Address  
Activated interface

← Position value

### Position value

The measured position value is displayed in the configured unit of measurement.

- +87.000m    With the **metric** setting, the measurement value is always displayed in meters to **three decimal places**.
- +87.0in    With the **inch** setting, the measurement value is always displayed in inches to **one decimal place**.

## 8.2.2 LED status indicators

### PWR LED

PWR


**off**

#### Device OFF

- No supply voltage

PWR


**Flashing green**

#### Power LED flashes green

- No measurement value output
- Voltage connected
- Self test running
- Initialization running
- Boot process running

PWR


**Green continuous light**

#### Power LED green

- AMS 301/OK
- Measurement value output
- Self test successfully finished
- Device monitoring active

PWR


**Red flashing**

#### Power LED flashes red

- Device OK but warning message (ATT, TMP, LSR) set in display
- Light beam interruption
- Plausibility error (PLB)

PWR


**Red continuous light**

#### Power LED red

- No measurement value output; for details, see display

### BUS LED

BUS


**Flashing green**

#### BUS LED flashes green

- Initialization of the host interface





BUS


**Green continuous light**

#### BUS LED green

- Host interface active


### 8.2.3 Control buttons

|   |              |  |
|---|--------------|--|
|  | <b>Up</b>    | Navigate upward/sideways.                |
|  | <b>Down</b>  | Navigate downward/sideways.              |
|  | <b>ESC</b>   | Exit menu item.                          |
|  | <b>ENTER</b> | Confirm/enter value, change menu levels. |

#### Navigating within the menus

The menus within a level are selected with the up/down buttons  .

The selected menu item is activated with the enter button .

Press the ESC button  to move up one menu level.

When one of the buttons is actuated, the display illumination is activated for 10 min.

#### Setting values

If input of a value is possible, the display looks like this:





```




100
  <-|0123456789 save
    Default ----- Unit
126      |  |
        
```

 +  Delete character

 ...  +  Enter digit

**save** +  Save

Use the   and  buttons to set the desired value. An accidental, incorrect entry can be corrected by selecting <-| and then pressing .




Then use the  =buttons to select save and save the set value by pressing .

#### Selecting options

If options can be selected, the display looks like this:

```

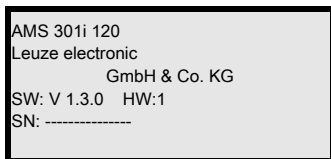
o OFF
  ON
    Default ----- Unit
  OFF      |  |
        
```

Select the desired option with the   buttons. Activate the option by pressing .

## 8.3 Menu description

### 8.3.1 The main menus

After voltage has been applied to the laser, device information is displayed for several seconds. The display then shows the measurement window with all status information.

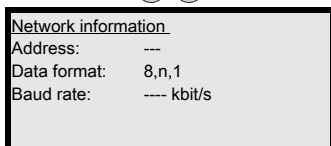


#### Device information - main menu

This menu item contains detailed information on

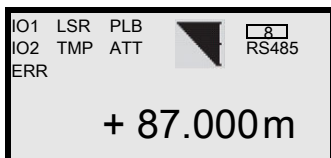
- Device type
- Manufacturer
- Software and hardware version
- Serial number

No entries can be made via the display.



#### Network information - main menu

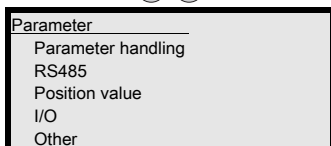
- Explanations of address, data format, baud rate.
- No entries can be made via the display.



#### Status and measurement data - main menu

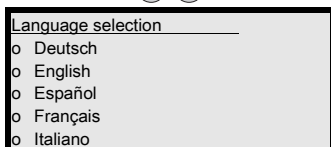
- Display of status, warning and error messages.
- Status overview of the switching inputs/outputs
- Bar graph for the received signal level.
- Link
- Measurement value

No entries can be made via the display.  
See "Indicators in the display" on page 39.



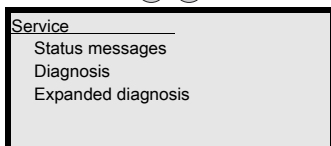
#### Parameter - main menu

- Configuration of the AMS.
- See "Parameter menu" on page 44.



#### Language selection - main menu

- Selection of the display language.
- See "Language selection menu" on page 48.



#### Service - main menu

- Display of status messages.
- Display of diagnostic data.

No entries can be made via the display.  
See "Service menu" on page 48.



**Note!**  
**The rear cover of this manual includes a *fold-out page* with the complete *menu structure*. It describes the menu items in brief.**


8.3.2 Parameter menu

Parameter handling submenu

The following functions can be called up in the Parameter handling submenu:

- Lock and enable parameter entry
- Set up a password
- Reset the AMS 301*i* to the default settings

Table 8.1: Parameter handling submenu

| Level 3               | Level 4           | Level 5 | Selection/configuration option<br>Description   | Standard |
|-----------------------|-------------------|---------|---|----------|
| Parameter enable      |                   |         | ON/OFF<br>The standard setting (OFF) prevents unintended parameter changes.<br>With parameter enable activated (ON), the display is inverted. In this state, it is possible to change parameters manually.  | OFF      |
| Password              | Activate password |         | ON/OFF<br>To enter a password, parameter enable must be activated. If a password is assigned, changes to the AMS 301 <i>i</i> can only be made after the password is entered.<br>The master password 2301 overrides the individually set password.  | OFF      |
|                       | Password entry    |         | For setting a four-digit numerical password.  |          |
| Parameters to default |                   |         | By pressing the enter button  after selecting Parameters to default, all parameters are reset to their standard settings without any further security prompts.<br>In this case, English is selected as the display language. |          |

Additional important information on parameter handling can be found at the end of the chapter.

RS 485 submenu

Table 8.2: RS 485 submenu

| Level 3    | Level 4 | Level 5 | Selection/configuration option<br>Description   | Standard    |
|------------|---------|---------|---|-------------|
| Activation |         |         | Activates or deactivates the AMS 301 <i>i</i> as an RS 485 participant.   | ON          |
| Address    |         |         | Setting of the address used for host communication. The address range spans from 0 to 15.   | 0           |
| Baud rate  |         |         | 9.6 kbit/s / 19.2 kbit/s / 38.4 kbit/s / 57.6 kbit/s / 115.2 kbit/s<br>Selection of the serial communication baud rate. It must be identical on transmitter and receiver side in order to enable communication. | 38.4 kbit/s |

Table 8.2: RS 485 submenu

| Level 3             | Level 4 | Level 5 | Selection/configuration option<br>Description   | Standard |
|---------------------|---------|---------|---|----------|
| Format              |         |         | ... 8,n,1 / ... 8,e,1 / ... 8,o,1<br>Selection of the serial communication data mode. This is specified with the number of data bits, parity (N=none, E=even, O=odd) and number of stop bits. For example, '8N1' thus means 8 data bits, no parity, 1 stop bit. | 8,n,1    |
| Position resolution |         |         | 0.01 mm / 0.1 mm / 1 mm / 10 mm / free resolution<br>The measurement value can be displayed in these resolutions.<br>The value of the free resolution is determined in the "Position value" submenu in the "Free resolution value" parameter.                   | 0.1 mm   |
| Velocity resolution |         |         | 1 mm/s / 10 mm/s / 100 mm/s   | 1 mm/s   |

### Position value submenu

Table 8.3: Position value submenu

| Level 3                               | Level 4 | Level 5 | Selection/configuration option<br>Description   | Standard  |
|---------------------------------------|---------|---------|---|-----------|
| Unit                                  |         |         | Metric/Inch<br>Specifies the units of the measured distances  | Metric    |
| Counting direction                    |         |         | Positive/Negative<br>Positive: The measurement value begins at 0 and increases with increasing distance.<br>Negative: The measurement value begins at 0 and decreases with increasing distance. Negative distance values may need to be compensated with an offset or preset.   | Positive  |
| Offset                                |         |         | Output value = measurement value + offset<br>The resolution of the offset value is independent of the selected "Position resolution" and is entered in mm or inch/100. The offset value is effective immediately after entry. If the preset value is activated, this has priority over the offset. Preset and offset are not offset against each other. | 0 mm      |
| Preset                                |         |         | The preset value is accepted by means of teach pulse. The teach pulse can be applied to a hardware input of the M12 PWR connector. The hardware input must be appropriately configured. See also configuration of the I/Os.   | 0 mm      |
| Free resolution value                 |         |         | The measurement value can be resolved in increments of 1/1000 within the 5 ... 50000 value range. If e.g. a resolution of 0.875 mm per digit is required, the parameter is set to 875. In the activated interface, the measurement value display must also be set to "free resolution" ("Position resolution" parameter).                               | 1000      |
| Error delay                           |         |         | ON/OFF<br>Specifies whether, in the event of an error, the position value immediately outputs the value of the "Position value in the case of failure" parameter or the last valid position value for the configured error delay time.  | ON/100 ms |
| Position value in the case of failure |         |         | Last valid value / zero<br>Specifies which position value is output after the error delay time elapses.   | Zero      |



## I/O submenu

Table 8.4: I/O submenu

| Level 3      | Level 4            | Level 5           | Selection/configuration option<br>Description   | Standard                                  |
|--------------|--------------------|-------------------|---|---|
| I/O 1        | Port configuration |                   | Input/Output<br>Defines whether I/O 1 functions as an output or input.  | Output                                    |
|              | Switching input    | Function          | No function/teach preset/laser ON/OFF   | No function                               |
|              |                    | Activation        | Low active/High active  | Low active                                |
|              | Switching output   | Function          | Pos. limit value 1 / Pos. limit value 2 / Velocity / Intensity (ATT) / Temp. (TMP) / Laser (LSR) / Plausibility (PLB) / Hardware (ERR)<br>The individual functions are "ORed" on the selected switching output. | Plausibility (PLB), hardware (ERR)        |
|              |                    | Activation        | Low active/High active  | Low active                                |
| I/O 2        | Port configuration |                   | Input/Output<br>Defines whether I/O 2 functions as an output or input.  | Output                                    |
|              | Switching input    | Function          | No function/teach preset/laser ON/OFF   | No function                               |
|              |                    | Activation        | Low active/High active  | Low active                                |
|              | Switching output   | Function          | Pos. limit value 1 / Pos. limit value 2 / Velocity / Intensity (ATT) / Temp. (TMP) / Laser (LSR) / Plausibility (PLB) / Hardware (ERR)<br>The individual functions are "ORed" on the selected switching output. | Intensity (ATT), Temp. (TMP), Laser (LSR) |
|              |                    | Activation        | Low active/High active  | Low active                                |
| Limit values | Upper pos. limit 1 | Activation        | ON/OFF  | OFF                                       |
|              |                    | Limit value input | Value input in mm or inch/100   | 0   |
|              | Lower pos. limit 1 | Activation        | ON/OFF  | OFF                                       |
|              |                    | Limit value input | Value input in mm or inch/100   | 0   |
|              | Upper pos. limit 2 | Activation        | ON/OFF  | OFF                                       |
|              |                    | Limit value input | Value input in mm or inch/100   | 0   |
|              | Lower pos. limit 2 | Activation        | ON/OFF  | OFF                                       |

Table 8.4: I/O submenu

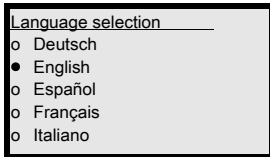
| Level 3 | Level 4       | Level 5           | Selection/configuration option<br>Description | Standard |
|---------|---------------|-------------------|---|----------|
|         |               | Limit value input | Value input in mm or inch/100                 | 0        |
|         | Max. velocity | Activation        | ON/OFF  | OFF      |
|         |               | Max. velocity     | Value input in mm/s or inch/100s              | 0        |

## Other submenu

Table 8.5: Other submenu

| Level 3              | Level 4   | Level 5 | Selection/configuration option<br>Description  | Standard    |
|----------------------|-----------|---------|--|-------------|
| Heating control      |           |         | Standard (10°C ... 15°C)/Extended (30°C ... 35°)<br>Defines a switch-on/switch-off range for the heating control. The extended switch-on/switch-off range for heating may provide a remedy in the event of condensation problems. Due to the limited heating capacity, it cannot be guaranteed that no condensation will form on the optics in the extended switch-on/switch-off range.<br>This parameter is available as standard, but functions only for devices with integrated heating (AMS 301 <i>i</i> ... H). | Standard    |
| Display illumination |           |         | 10 minutes/ON<br>Display illumination is switched off after 10 minutes or, if the parameter is set to "ON", illumination is always on.   | 10min       |
| Display contrast     |           |         | Weak/Medium/Strong<br>The display contrast may change at extreme temperature values. The contrast can subsequently be adapted using the three levels.  | Medium      |
| Service RS232        | Baud rate |         | 57.6kbit/s / 115.2kbit/s<br>The service interface is only available to Leuze personnel.  | 115.2kbit/s |
|                      | Format    |         | 8,e,1 / 8,n,1<br>The service interface is only available to Leuze personnel.   | 8,n,1       |

### 8.3.3 Language selection menu



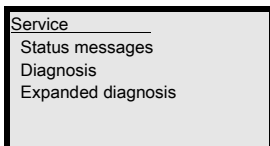
5 display languages are available:

- German
- English
- Spanish
- French
- Italian

The AMS 301*i* is delivered from the factory with the display preset to English.

To change the language, no password needs to be entered nor must parameter enable be active. The display language is a passive operational control and is therefore not a function parameter per se.

### 8.3.4 Service menu



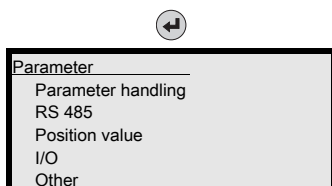
A detailed description of the individual functions can be found in Chapter 10.

## 8.4 Operation

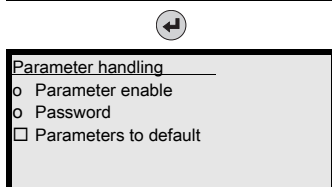
An operating process is described here using parameter enable as an example.

### Parameter enable

During normal operation parameters can be viewed only. If parameters are to be changed, the ON menu item in the Parameter -> Parameter handling -> Parameter enable menu must be activated. To do this, proceed as follows.

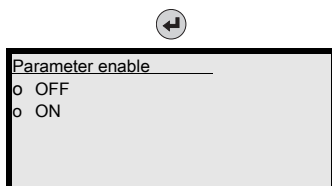


In the main menu, press the enter button to enter the Parameter menu.



Use the buttons to select the Parameter handling menu item.

Press the enter button to enter the Parameter handling menu.



In the Parameter handling menu, use the buttons to select the Parameter enable menu item.

Press the enter button to enter the Parameter enable menu.



In the Parameter enable menu, use the buttons to select the ON menu item.

Press the enter button to activate parameter enable.

The PWR LED lights up orange; the display is inverted. You can now set the individual parameters on the display.

Press the ESC button twice to return to the Parameter menu.



### Viewing and editing parameters

As long as parameter enable is active, the entire AMS 301i display is inverted.

Communication between the control and the AMS 301i via the RS 485 interface is also active when parameter enable is active.

**Note!**

*Changes to parameters via display entry have immediate effect.*

*If a password was stored, parameter enable is not possible until this password is entered; see "Password for parameter enable" below.*

**Password for parameter enable**

Parameter entry on the AMS 301*i* can be protected with a four-digit numerical password. On the AMS 301*i*, the password is entered via the display. If parameter enable has been activated after successfully entering the password, parameters can be changed via the display.

**Note!**

*The **master password 2301** can enable the AMS 301*i* at any time.*

9 RS 485 interface

9.1 General information on the RS 485 interface

The AMS 301*i* has an integrated RS 485 interface. On delivery, the RS 485 interface is active.



**Note!**  
*To activate / deactivate the interface, parameter enable must be activated (see Chapter 8.3.2).*

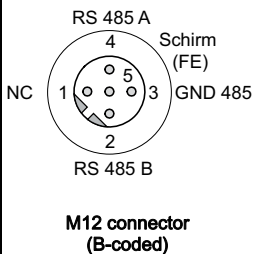
The currently active interface is indicated in the display.



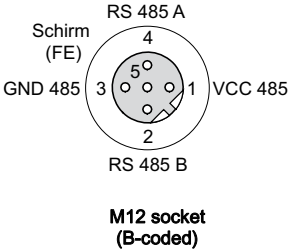
Figure 9.1: Interfaces of the AMS 301*i*

9.2 RS 485 – Electrical connection

RS 485 BUS IN / M12 pin assignment

| RS 485 BUS IN (5-pin plug, B-coded)   |        |          |                            |
|---|--------|----------|----------------------------|
|  | Pin    | Name     | Comment                    |
|   | 1      | NC       | Not assigned               |
|   | 2      | RS 485 B | Data RS 485 B (-)          |
|   | 3      | GND 485  | Data reference potential   |
|   | 4      | RS 485 A | Data RS 485 A (+)          |
|   | 5      | FE       | Functional earth           |
|   | Thread | Shield   | Functional earth (housing) |

RS 485 BUS OUT / M12 pin assignment

| RS 232 BUS IN (5-pin socket, B-coded)   |        |          |                            |
|---|--------|----------|----------------------------|
|  <p>M12 socket<br/>(B-coded)</p> | Pin    | Name     | Comment                    |
|   | 1      | VCC 485  | VCC for termination        |
|   | 2      | RS 485 B | Data RS 485 B (-)          |
|   | 3      | GND 485  | Data reference potential   |
|   | 4      | RS 485 A | Data RS 485 A (+)          |
|   | 5      | FE       | Functional earth           |
|   | Thread | Shield   | Functional earth (housing) |

9.3 RS 485 address entry



**Note!**

Basic operation of the control panel/display is described in Chapter 8.4.  
To set the address, parameter enable must be activated. The display is inverted when parameter enable is active.



**Attention!**

When parameter enable is active, all changes made via the control panel/display become effective immediately.

9.3.1 Entry of RS 485 address

To do this proceed as follows:

- ⚙️ *Activate Parameter enable.*
- ⚙️ *Select the RS485 submenu.*
- ⚙️ *Select the Address menu item.*
- ⚙️ *Select the RS 485 address of the AMS 301*i* between 0 and 15.*
- ⚙️ *Deactivate parameter enable.*

## 9.4 RS 485 interface data

### 9.4.1 Default settings for the RS 485 interface

The RS 485 is active in the delivered condition.

| Designation         | Value range                      | Default      |
|---------------------|----------------------------------|--------------|
| Activation          | ON/OFF                           | <b>ON</b>    |
| Baud rate in kbit/s | 9.6 / 19.2 / 38.4 / 57.6 / 115.2 | <b>38.4</b>  |
| Data format         | 8,n,1 / 8,e,1 / 8,o, 1           | <b>8,n,1</b> |

### 9.4.2 Parameter settings for AMS 301*i*

An overview of all parameters to be set is given in the foldout at the end of the manual.

All parameters are set via the panel/display

Basic operation of the display is described in Chapter 8.4.

To change parameters, parameter enable must be activated.



**Note!**

*Changed parameters take effect on the interface immediately.*

### 9.4.3 Communication protocol (binary protocol)

#### 9.4.3.1 Request for AMS 301*i* data

Transfer of the measured distances or the velocity is requested and actuation of the laser diode (ON/OFF) controlled via a 3-byte-long protocol.

#### Request to the AMS 301*i*

| Byte     | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>0</b> | 1     | 1     | 0     | 0     | ADR   | ADR   | ADR   | ADR   |
| <b>1</b> | CMD   | CMD   | CMD   | CMD   | CMD   | CMD   | CMD   | CMD   |
| <b>2</b> | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   |

**Byte 0:**

Bit 7 and bit 6: static 1

Bit 5 and bit 4: static 0

Bit 3 to bit 0: addressing of the AMS 301*i*

Possible address entry from 0 to 15.

The used address must be set on the AMS 301*i* via the display.

Bit 0 = LSB, Bit 3 = MSB

**Byte 1:**

CMD

Command = Data request to the AMS 301*i*.



| Binary coding | Hex coding | Function                                       |
|---------------|------------|--|
| 1111 0001     | F1         | Request of a single distance value             |
| 1111 0100     | F4         | Laser diode ON                                 |
| 1111 0101     | F5         | Laser diode OFF                                |
| 1111 0110     | F6         | Request of a single velocity value             |
| 1111 1000     | F8         | Single request for position and velocity value |

**Byte 2:** XOR link of byte 0 and byte 1  
An even number of binary 1 (calculated column by column from top to bottom) sets the XOR bit to 1.

Example

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0    | 1     | 0     | 1     | 1     | 1     | 1     | 0     | 0     |
| 1    | 1     | 1     | 1     | 1     | 0     | 1     | 1     | 0     |
| XOR  | 0     | 1     | 0     | 0     | 1     | 0     | 1     | 0     |

The XOR checksum is entered by the sender (control) in the request protocol and checked by the receiver (AMS 301/). A protocol is correctly transferred if the XOR checksum of the transmitter and the XOR checksum of the receiver are the same. If the XOR comparison is negative (different checksums), the protocol is not accepted by the AMS 301/. The AMS 301/ does not send acknowledgment for an unequal checksum.

**Response of the AMS 301/ data to the CMD request for F1<sub>n</sub>, F4 -F6<sub>n</sub>, F8<sub>n</sub>**

The output of the AMS 301/ data (response) is contained in 6 bytes.

**Response of the AMS 301/**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0    | 0     | Laser | I/O2  | I/O1  | ADR   | ADR   | ADR   | ADR   |
| 1    | Ready | LSR   | TMP   | ERR   | ATT   | PLB   | OVFL  | SIGN  |
| 2    | D23   | D22   | D21   | D20   | D19   | D18   | D17   | D16   |
| 3    | D15   | D14   | D13   | D12   | D11   | D10   | D09   | D08   |
| 4    | D07   | D06   | D05   | D04   | D03   | D02   | D01   | D00   |
| 5    | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   |

**Response of the AMS 301/data to the request for F8<sub>n</sub>**

The output of the AMS 301/data (Response) is contained in 8 bytes.

**Response of the AMS 301/**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0    | 0     | LASER | IO2   | IO1   | ADR   | ADR   | ADR   | ADR   |
| 1    | READY | LSR   | TMP   | ERR   | ATT   | PLB   | OVFL  | SIGN  |
| 2    | D23   | D22   | D21   | D20   | D19   | D18   | D17   | D16   |
| 3    | D15   | D14   | D13   | D12   | D11   | D10   | D9    | D8    |
| 4    | D7    | D6    | D5    | D4    | D3    | D2    | D1    | D0    |
| 5    | V15   | V14   | V13   | V12   | V11   | V10   | V9    | V8    |
| 6    | V7    | V6    | V5    | V4    | V3    | V2    | V1    | V0    |
| 7    | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   | XOR   |

Laser: Laser status; laser ON = 0; laser OFF = 1

I/O1 / I/O2: I/O status: signal level inactive = 0; signal level active = 1

Ready: AMS 300/status: not ready = 0, ready = 1

LSR: Prefailure message for laser diode: OK = 0, warning = 1

TMP: Temperature warning: OK = 0, warning = 1

ERR: Device error: OK = 0, error = 1

ATT: Weakening reception signal: OK = 0, warning = 1

PLB: Implausible measurement value: OK = 0, warning = 1

OVFL: Measurement value cannot be represented in 24 bits: OK = 0, warning = 1

Sign: Sign of measurement value: 0 = positive, 1 = negative

D23 - D00: Distance value or velocity value D23 = MSB, D00 = LSB

V15 - V00: Velocity value V15 = MSB, V00 = LSB

XOR: XOR link of byte 0 to byte 4

An odd number of binary 1 (calculated column by column from top to bottom) sets the XOR bit to 1.

**Example**

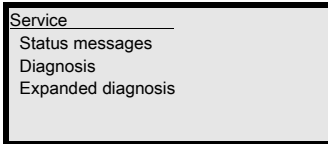
| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0    | 1     | 0     | 1     | 1     | 1     | 1     | 0     | 0     |
| 1    | 1     | 1     | 1     | 1     | 0     | 1     | 1     | 0     |
| XOR  | 0     | 1     | 0     | 0     | 1     | 0     | 1     | 0     |

The XOR checksum is entered by the AMS 301/ in the response protocol and checked by the receiver (control). A protocol is correctly transferred if the XOR checksum of the transmitter and the XOR checksum of the receiver are the same. If the XOR comparison is negative (different checksum), the protocol is rejected by the control or the control outputs an error message.

## 10 Diagnostics and troubleshooting

### 10.1 Service and diagnosis in the display of the AMS 301*i*

In the main menu of the AMS 301*i*, expanded "Diagnostics" can be called up under the Service heading.

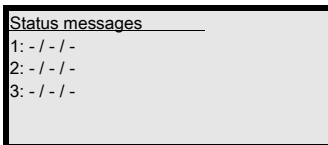


From the Service main menu, press the enter button (↵) to access the underlying menu level. Use the up/down buttons (▲ ▼) to select the corresponding menu item in the selected level; use the enter button (↵) to activate the selection.

Return from any sub-level to the next-higher menu item by pressing the ESC button (ESC).

#### 10.1.1 Status messages

The status messages are written in a ring memory with 25 positions. The ring memory is organized according to the FIFO principle. No separate activation is necessary for storing the status messages. Power OFF clears the ring memory.



#### Basic representation of the status messages

**n: Type / No. / 1**

Meaning:

**n:** memory position in the ring memory

**Type:** type of message:

**I** = info, **W** = warning, **E** = error, **F** = severe system error.

**No:** internal error detection

**1:** frequency of the event (always "1" because no summation occurs)

The status messages within the ring memory are selected with the up/down buttons (▲ ▼). Use the enter button (↵) to call up **detailed information** about the respective status message:


### Detailed information about a status message

**Type:** type of message + internal counter

**UID:** Leuze-internal coding of the message


**ID:** description of the message

**Info:** not currently used

Within the detailed information, press the enter button  again to activate an **action menu** with the following functions:



- Acknowledge message
- Delete message
- Acknowledge all
- Delete all


## 10.1.2 Diagnosis

The diagnostics function is activated by selecting the Diagnostics menu item. The ESC button  deactivates the diagnostics function and clears the contents of the recordings.

The recorded diagnostic data is displayed in 2 fields. In the upper half of the display, status messages of the AMS and the bar graph are displayed. The lower half contains information used for Leuze-internal evaluation.

|            |       |     |  |
|------------|-------|-----|--|
| IO1        | LSR   | PLB |  |
| IO2        | TMP   | ATT |  |
| ERR        |       |     |  |
| <hr/>      |       |     |  |
| Pos. act.: | ----- |     |  |
| Pos. min.: | ----- |     |  |
| Pos. max.: | ----- |     |  |

Use the up/down buttons   to scroll in the bottom half between various displays. The contents of the scrollable pages are intended solely for Leuze for internal evaluation.

The diagnostics have no influence on communication with the host interface and can be activated during operation of the AMS 301 .

## 10.1.3 Expanded diagnosis

The Expanded diagnosis menu item is used for Leuze-internal evaluation.

10.2 General causes of errors

10.2.1 Power LED

See also Chapter 8.2.2.

| Error                 | Possible error cause        | Measure   |
|-----------------------|-----------------------------|---|
| PWR LED "OFF"         | No supply voltage connected | Check supply voltage.   |
|                       | Hardware error              | Send in device.   |
| PWR LED "flashes red" | Light beam interruption     | Check alignment.  |
|                       | Plausibility error          | Traverse rate >10m/s.   |
| PWR LED "static red"  | Hardware error              | For error description, see display,<br>It may be necessary to send in the device. |

Table 10.1: General causes of errors

## 10.3 Interface errors

### 10.3.1 BUS LED

After the AMS 301/i is started, the **BUS** LED is always on.

## 10.4 Status indicators in the display of the AMS 301/i

| Display  | Possible error cause  | Measure   |
|--|---|---|
| <b>PLB</b><br>(implausible measurement values)                 | Laser beam interruption   | Laser spot must always be incident on the reflector.  |
|  | Laser spot outside of reflector   | Traverse rate < 10m/s?  |
|  | Measurement range for maximum distance exceeded   | Restrict traversing path or select AMS with larger measurement range.   |
|  | Velocity greater than 10m/s   | Reduce velocity.  |
|  | Ambient temperature far outside permissible range (TMP display; PLB)                                    | Select AMS with heating or ensure cooling.  |
| <b>ATT</b><br>(insufficient received signal level)             | Reflector soiled  | Clean reflector or glass lens.  |
|  | Glass lens of the AMS soiled  |   |
|  | Performance reduction due to snow, rain, fog, condensing vapor or heavily polluted air (oil mist, dust) | Optimize usage conditions.  |
|  | Laser spot only partially on reflector  | Check alignment.  |
| <b>TMP</b><br>(operating temperature outside of specification) | Protective film on reflector  | Remove protective film from reflector.  |
|  | Ambient temperatures outside specified range  | In case of low temperatures, remedy may be an AMS with heating.<br>If temperatures are too high, provide cooling or change mounting location. |
| <b>LSR</b><br>Laser diode warning                              | Laser diode prefailure message  | Send in device at next possible opportunity to have laser diode replaced. Have replacement device ready.                                      |
| <b>ERR</b><br>Hardware error                                   | Indicates an uncorrectable error in the hardware  | Send in device for repair.  |

**Service hotline:**

You can find the contact information for the hotline in your country on our website [www.leuze.com](http://www.leuze.com) under "Contact & Support".

**Repair service and returns:**

Defective devices are repaired at our service centers competently and quickly. We offer you an extensive service packet to keep any system downtimes to a minimum. Our service center requires the following information:

- Your customer number
- Product description or part description
- Serial number and batch number
- Reason for requesting support together with a description

For this purpose, please register the merchandise concerned. Simply register return of the merchandise on our website [www.leuze.com](http://www.leuze.com) under Contact & Support -> Repair Service & Returns:

To ensure quick and easy processing of your request, we will send you a returns order with the returns address in digital form.



**Note!**

*Please use Chapter 10 as a master copy should servicing be required.  
Cross the items in the "Measures" column which you have already examined, fill out the following address field and fax the pages together with your service contract to the fax number listed below.*

**Customer data (please complete)**

|                            |  |
|----------------------------|--|
| Device type:               |  |
| Company:                   |  |
| Contact person/department: |  |
| Phone (direct dial):       |  |
| Fax:                       |  |
| Street / no.:              |  |
| ZIP code / City:           |  |
| Country:                   |  |

**Leuze Service fax number:**

**+49 7021 573 - 199**

## 11 Type overview and accessories

### 11.1 Part number code

AMS 3xx / yyy H

|                 |     |                                |
|-----------------|-----|--------------------------------|
| Heating option  | H = | With heating                   |
| Operating range | 40  | Max. operating range in m      |
|                 | 120 | Max. operating range in m      |
|                 | 200 | Max. operating range in m      |
|                 | 300 | Max. operating range in m      |
|                 | /=  | Integrated fieldbus technology |
| Interface       | 00  | RS 422/RS 232                  |
|                 | 01  | RS 485                         |
|                 | 04  | PROFIBUS DP / SSI              |
|                 | 08  | TCP/IP                         |
|                 | 35  | CANopen                        |
|                 | 38  | EtherCAT                       |
|                 | 48  | PROFINET RT                    |
|                 | 55  | DeviceNet                      |
|                 | 58  | EtherNet/IP                    |
|                 | 84  | Interbus                       |

AMS Absolute Measurement System

### 11.2 Overview of AMS 301/types (RS 485)

| Type designation | Description  | Part no. |
|------------------|--|----------|
| AMS 301/40       | 40m operating range, RS 485 interface                      | 50113669 |
| AMS 301/120      | 120m operating range, RS 485 interface                     | 50113670 |
| AMS 301/200      | 200m operating range, RS 485 interface                     | 50113671 |
| AMS 301/300      | 300m operating range, RS 485 interface                     | 50113672 |
| AMS 301/40 H     | 40m operating range, RS 485 interface, integrated heating  | 50113673 |
| AMS 301/120 H    | 120m operating range, RS 485 interface, integrated heating | 50113674 |
| AMS 301/200 H    | 200m operating range, RS 485 interface, integrated heating | 50113675 |
| AMS 301/300 H    | 300m operating range, RS 485 interface, integrated heating | 50113676 |

Table 11.1: Overview of AMS 301/types



## 11.3 Overview of reflector types

| Type designation             | Description  | Part no. |
|------------------------------|--|----------|
| REF 4-A-150x150              | Reflective tape, 150x150mm, self-adhesive            | 50141015 |
| Reflective tape<br>200x200-S | Reflective tape, 200x200mm, self-adhesive            | 50104361 |
| REF 4-A-300x300              | Reflective tape, 300x300mm, self-adhesive            | 50141014 |
| Reflective tape<br>500x500-S | Reflective tape, 500x500mm, self-adhesive            | 50104362 |
| Reflective tape<br>914x914-S | Reflective tape, 914x914mm, self-adhesive            | 50108988 |
| Reflective tape<br>200x200-M | Reflective tape, 200x200mm, affixed to carrier plate | 50104364 |
| Reflective tape<br>500x500-M | Reflective tape, 500x500mm, affixed to carrier plate | 50104365 |
| Reflective tape<br>914x914-M | Reflective tape, 914x914mm, affixed to carrier plate | 50104366 |
| Reflective tape<br>200x200-H | Reflective tape, 200 x 200mm, heated                 | 50115020 |
| Reflective tape<br>500x500-H | Reflective tape, 500 x 500mm, heated                 | 50115021 |
| Reflective tape<br>914x914-H | Reflective tape, 914 x 914mm, heated                 | 50115022 |

Table 11.2: Overview of reflector types

## 11.4 Accessories

### 11.4.1 Accessories – Mounting bracket

| Type designation | Description   | Part no. |
|------------------|---|----------|
| MW OMS/AMS 01    | Mounting bracket for mounting AMS 301 <i>/</i> to horizontal surfaces | 50107255 |

Table 11.3: Accessories – Mounting bracket

### 11.4.2 Accessories – Deflector unit

| Type designation | Description   | Part no. |
|------------------|---|----------|
| US AMS 01        | Deflector unit with integrated mounting bracket for AMS 301 <i>/</i> .<br>Variable 90° deflection of laser beam in different directions | 50104479 |
| US 1 OMS         | Deflector unit without mounting bracket for simple 90° deflection of laser beam   | 50035630 |

Table 11.4: Accessories – Deflector unit

### 11.4.3 Accessories – M12 connector

| Type designation | Description                                | Part no. |
|------------------|--|----------|
| KD 02-5-BA       | M12 connector, B-coded socket, BUS IN; SSI | 50038538 |
| KD 02-5-SA       | M12 connector, B-coded plug, BUS OUT       | 50038537 |
| KD 095-5A        | M12 connector, A-coded socket, Power (PWR) | 50020501 |

Table 11.5: Accessories – M12 connector

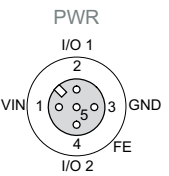
#### 11.4.4 Accessories – Terminating resistor

| Type designation | Description                                 | Part no. |
|------------------|---|----------|
| TS 02-4-SA       | M12 terminating resistor for RS 485 BUS OUT | 50038539 |

Table 11.6: Accessories – Terminating resistor

#### 11.4.5 Accessories – Ready-made cables for voltage supply

Contact assignment/core color of PWR connection cable

| PWR connection cable (5-pin socket, A-coded)  |        |       |            |
|---|--------|-------|------------|
|  <p>M12 socket<br/>(A-coded)</p> | Pin    | Name  | Core color |
|   | 1      | VIN   | Brown      |
|   | 2      | I/O 1 | White      |
|   | 3      | GND   | Blue       |
|   | 4      | I/O 2 | Black      |
|   | 5      | FE    | Gray       |
|   | Thread | FE    | Bare       |

#### Technical data of the cables for voltage supply

Operating temperature range

In idle state: -30°C ... +70°C  
In motion: -5°C ... +70°C

Material

Sheathing: PVC

Bending radius

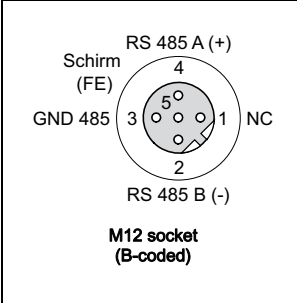
> 50mm

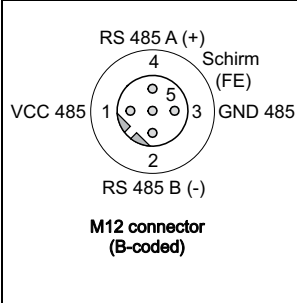
#### Order codes of the cables for voltage supply

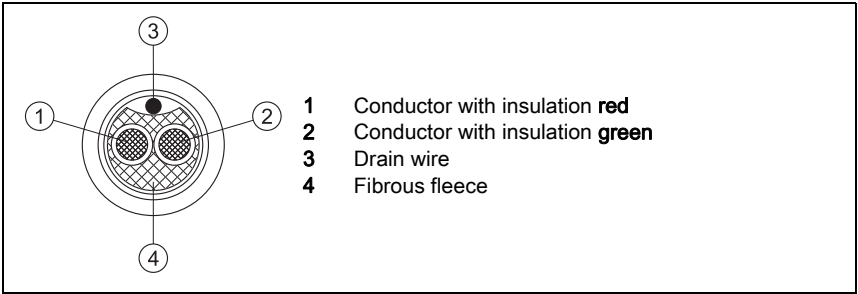
| Type designation    | Description  | Part no. |
|---------------------|--|----------|
| K-D M12A-5P-5m-PVC  | M12 socket, A-coded, axial plug outlet, open cable end, cable length 5m  | 50104557 |
| K-D M12A-5P-10m-PVC | M12 socket, A-coded, axial plug outlet, open cable end, cable length 10m | 50104559 |

11.4.6 Accessories – Ready-made cables for RS 485

Contact assignment of RS 485 connection cable

| RS 485 BUS IN connection cable (5-pin socket, B-coded, 2-pin cable)               |        |              |                            |
|---|--------|--------------|----------------------------|
|  | Pin    | Name         | Core color                 |
|   | 1      | NC           | -                          |
|   | 2      | RS 485B (-)  | Green                      |
|   | 3      | GND 485      | -                          |
|   | 4      | RS 485 A (+) | Red                        |
|   | 5      | FE           |                            |
|   | Thread | FE           | Functional earth (housing) |

| RS 485 BUS OUT connection cable (5-pin plug, B-coded, 2-pin cable)                |        |              |                            |
|---|--------|--------------|----------------------------|
|  | Pin    | Name         | Core color                 |
|   | 1      | VCC 485      | -                          |
|   | 2      | RS 485 B (-) | Green                      |
|   | 3      | GND 485      | -                          |
|   | 4      | RS 485 A (+) | Red                        |
|   | 5      | FE           | -                          |
|   | Thread | FE           | Functional earth (housing) |



### Technical data of RS 485 connection cable

**Operating temperature range**

In idle state: -40°C ... +80°C

In motion: -5°C ... +80°C

**Material**

The lines comply with the RS 485 requirements,  
Free of halogens, silicone and PVC

**Bending radius**

> 80mm, suitable for drag chains

### Order codes for RS 485 connection cables

| Type designation | Comment  | Part no. |
|------------------|--|----------|
| KB PB-2000-BA    | M12 socket for BUS IN, axial connector, open cable end, cable length 2m      | 50104181 |
| KB PB-5000-BA    | M12 socket for BUS IN, axial connector, open cable end, cable length 5m      | 50104180 |
| KB PB-10000-BA   | M12 socket for BUS IN, axial connector, open cable end, cable length 10m     | 50104179 |
| KB PB-15000-BA   | M12 socket for BUS IN, axial connector, open cable end, cable length 15m     | 50104178 |
| KB PB-20000-BA   | M12 socket for BUS IN, axial connector, open cable end, cable length 20m     | 50104177 |
| KB PB-25000-BA   | M12 socket for BUS IN, axial connector, open cable end, cable length 25m     | 50104176 |
| KB PB-30000-BA   | M12 socket for BUS IN, axial connector, open cable end, cable length 30m     | 50104175 |
| KB PB-2000-SA    | M12 connector for BUS OUT, axial connector, open cable end, cable length 2m  | 50104188 |
| KB PB-5000-SA    | M12 connector for BUS OUT, axial connector, open cable end, cable length 5m  | 50104187 |
| KB PB-10000-SA   | M12 connector for BUS OUT, axial connector, open cable end, cable length 10m | 50104186 |
| KB PB-15000-SA   | M12 connector for BUS OUT, axial connector, open cable end, cable length 15m | 50104185 |
| KB PB-20000-SA   | M12 connector for BUS OUT, axial connector, open cable end, cable length 20m | 50104184 |
| KB PB-25000-SA   | M12 connector for BUS OUT, axial connector, open cable end, cable length 25m | 50104183 |
| KB PB-30000-SA   | M12 connector for BUS OUT, axial connector, open cable end, cable length 30m | 50104182 |
| KB PB-1000-SBA   | M12 plug + M12 socket for PROFIBUS, axial connectors, cable length 1m        | 50104096 |
| KB PB-2000-SBA   | M12 connector + M12 socket for PROFIBUS, axial connectors, cable length 2m   | 50104097 |
| KB PB-5000-SBA   | M12 connector + M12 socket for PROFIBUS, axial connectors, cable length 5m   | 50104098 |
| KB PB-10000-SBA  | M12 connector + M12 socket for PROFIBUS, axial connectors, cable length 10m  | 50104099 |
| KB PB-15000-SBA  | M12 connector + M12 socket for PROFIBUS, axial connectors, cable length 15m  | 50104100 |

| Type designation | Comment   | Part no. |
|------------------|---|----------|
| KB PB-20000-SBA  | M 12 connector + M 12 socket for PROFIBUS, axial connectors, cable length 20m | 50104101 |
| KB PB-25000-SBA  | M 12 connector + M 12 socket for PROFIBUS, axial connectors, cable length 25m | 50104174 |
| KB PB-30000-SBA  | M 12 connector + M 12 socket for PROFIBUS, axial connectors, cable length 30m | 50104173 |

## 12 Maintenance

### 12.1 General maintenance information

With normal use, the laser measurement system does not require any maintenance by the operator.

#### **Cleaning**

In the event of dust build-up or if the warning message (ATT) is displayed, clean the device with a soft cloth; use a cleaning agent (commercially available glass cleaner) if necessary. Also check the reflector for possible soiling.



#### **Attention!**

*Do not use solvents and cleaning agents containing acetone. The use of such solvents can dull the reflector, the housing window and the display.*

### 12.2 Repairs, servicing




#### **Attention!**

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

*The device must not be opened. Failure to comply will render the guarantee void. Warranted features cannot be guaranteed after the device has been opened.*

Repairs to the device must only be carried out by the manufacturer.

 *Contact your Leuze distributor or service organization should repairs be required. The addresses can be found on the inside of the cover and on the back.*



#### **Note!**

*When sending laser measurement systems to Leuze for repair, please provide an accurate description of the fault.*

### 12.3 Disassembling, packing, disposing

#### **Repacking**

For later reuse, the device is to be packed so that it is protected.

#### **Note!**

*Electrical scrap is a special waste product! Observe the locally applicable regulations regarding disposal of the product.*

**A**

|                                    |    |
|------------------------------------|----|
| Accessories                        | 61 |
| Accessories – Deflector unit       | 62 |
| Accessories – Mounting bracket     | 62 |
| Accessories – Ready-made cables    | 63 |
| Accessories – Terminating resistor | 63 |
| Accuracy                           | 13 |
| Air humidity                       | 14 |
| Alignment                          | 19 |

**B**

|         |    |
|---------|----|
| BUS LED | 41 |
|---------|----|

**C**

|  |    |
|--|----|
| Cleaning                                 | 67 |
| Communication protocol (binary protocol) | 53 |
| Connections                              |    |
| PWR IN                                   | 37 |
| RS 485 BUS IN                            | 37 |
| RS 485 BUS OUT                           | 38 |
| Service                                  | 38 |
| Contouring error calculation             | 13 |
| Control buttons                          | 42 |
| Control panel                            | 39 |

**D**

|                                  |    |
|----------------------------------|----|
| Declaration of Conformity        | 4  |
| Deflector unit                   |    |
| Maximum operating range          | 23 |
| With integrated mounting bracket | 23 |
| Without mounting bracket         | 25 |
| Deflector unit US 1 OMS          |    |
| Dimensioned drawing              | 25 |
| Deflector unit US AMS 01         |    |
| Dimensioned drawing              | 24 |
| Description of functions         | 5  |
| Diagnosis                        | 56 |
| Dimensioned drawing of AMS 3xxi  | 15 |
| Display                          | 39 |

**E**

|                        |    |
|------------------------|----|
| Electrical connection  | 36 |
| Safety notices         | 36 |
| Expanded diagnosis     | 57 |
| Explanation of symbols | 4  |

**F**

|                    |    |
|--------------------|----|
| Fast commissioning | 11 |
|--------------------|----|

**G**

|                          |    |
|--------------------------|----|
| General causes of errors | 58 |
|--------------------------|----|

**H**

|                     |    |
|---------------------|----|
| Heated reflectors   |    |
| Dimensioned drawing | 30 |
| Technical data      | 29 |

**I**

|                           |    |
|---------------------------|----|
| Installation              | 17 |
| Interface errors          | 59 |
| Interface info in display | 40 |
| Internal hardware error   | 40 |

**M**

|                                |    |
|--------------------------------|----|
| Main menu                      |    |
| Device information             | 43 |
| Language selection             | 43 |
| Network information            | 43 |
| Parameter                      | 43 |
| Service                        | 43 |
| Maintenance                    | 67 |
| Measurement range              | 13 |
| Menus                          |    |
| Language selection menu        | 48 |
| Main menu                      | 43 |
| Parameter menu                 | 44 |
| Service menu                   | 48 |
| Mounting                       | 18 |
| With laser beam deflector unit | 23 |
| Mounting bracket (optional)    | 20 |

**N**

|             |    |
|-------------|----|
| Name plates | 17 |
|-------------|----|

**O**

|                             |        |
|-----------------------------|--------|
| Operating principle         | 11     |
| Operating range             | 61     |
| Operating temperature       | 14     |
| Operation                   | 39, 49 |
| Output time                 | 13     |
| Overview of reflector types | 62     |

## P

|                                 |        |
|---------------------------------|--------|
| Package contents                | 17     |
| Parallel mounting               | 21     |
| Parameter enable                | 49, 50 |
| Parameter menu                  |        |
| I/O                             | 46     |
| Other                           | 47     |
| Parameter handling              | 44     |
| Position value                  | 45     |
| RS 485                          | 44     |
| Parameter settings for AMS 301i | 53     |
| Plausibility error              | 40     |
| Prefailure message              | 40     |
| PWR LED                         | 41     |

## Q

|                   |   |
|-------------------|---|
| Quality assurance | 4 |
|-------------------|---|

## R

|                           |    |
|---------------------------|----|
| Received signal           | 40 |
| Reflective tape           |    |
| Dimensioned drawing       | 28 |
| Technical data            | 27 |
| Reflector                 | 26 |
| Mounting                  | 32 |
| Pitch                     | 35 |
| Size                      | 31 |
| Type overview             | 31 |
| Repair                    | 67 |
| Request for AMS 301i data | 53 |
| Response time             | 13 |
| RS 485 interface          | 51 |
| Default settings          | 53 |

## S

|   |    |
|---|----|
| Servicing                               | 67 |
| Status and measurement data - main menu | 43 |
| Status and warning messages             | 39 |
| Status indicator                        | 39 |
| ATT                                     | 59 |
| ERR                                     | 59 |
| PLB                                     | 59 |

|                                  |    |
|----------------------------------|----|
| TMP                              | 59 |
| Status indicator – LSR           | 59 |
| Status indicators                | 41 |
| Status indicators in the display | 59 |
| Status messages                  | 56 |
| Storage                          | 17 |
| Storage temperature              | 14 |
| Supply voltage                   | 13 |
| Surface reflections              | 33 |
| Symbols                          | 4  |

## T

|                        |        |
|------------------------|--------|
| Technical data         | 13     |
| Dimensioned drawing    | 15     |
| General specifications | 13     |
| Reflective tapes       | 26     |
| Temperature monitoring | 40     |
| Termination            | 38     |
| Transport              | 17     |
| Troubleshooting        | 56     |
| Type overview          | 16, 61 |



| Level 1<br>▲▼ : Selection   | Level 2<br>▲▼ : Selection<br>ESC : Back | Level 3<br>▲▼ : Selection<br>ESC : Back | Level 4<br>▲▼ : Selection<br>ESC : Back | Level 5<br>▲▼ : Selection<br>ESC : Back | Selection/configuration option<br>▲▼ : Selection<br>↔ : Activate<br>ESC : Back   | Detailed information on |
|-----------------------------|---|---|---|---|--|-------------------------|
| Device information          |   |   |   |   |  | Page 43                 |
| Network information         |   |   |   |   |  | Page 43                 |
| Status and measurement data |   |   |   |   |  | Page 43                 |
| Parameter                   | ↔ Parameter handling                    | ↔ Parameter enable                      |   |   | ON/OFF   | Page 44                 |
|                             |   | ↔ Password                              | ↔ Activate password                     |   | ON/OFF   |                         |
|                             |   |   | ↔ Password entry                        |   | For setting a four-digit numerical password  |                         |
|                             |   | ↔ Parameters to default                 |   |   | All parameters are reset to their factory settings   |                         |
|                             | ↔ RS 485                                | ↔ Activation                            |   |   | ON/OFF   | Page 44                 |
|                             |   | ↔ Address                               |   |   | Address of the AMS 301 <i>i</i>  |                         |
|                             |   | ↔ Baud rate                             |   |   | 9.6 kbit/s / 19.2 kbit/s / 38.4 kbit/s / 57.6 kbit/s / 115.2 kbit/s  |                         |
|                             |   | ↔ Format                                |   |   | ... 8,n,1 / ... 8,e,1 / ... 8,o,1  |                         |
|                             |   | ↔ Position resolution                   |   |   | 0.01 mm / 0.1 mm / 1 mm / 10 mm / free resolution  |                         |
|                             |   | ↔ Velocity resolution                   |   |   | 1 mm/s / 10 mm/s / 100 mm/s  |                         |
|                             | ↔ Position value                        | ↔ Unit                                  |   |   | Metric/Inch  | Page 45                 |
|                             |   | ↔ Counting direction                    |   |   | Positive/Negative  |                         |
|                             |   | ↔ Offset                                |   |   | Value input  |                         |
|                             |   | ↔ Preset                                |   |   | Value input  |                         |
|                             |   | ↔ Error delay                           |   |   | ON/OFF   |                         |
|                             |   | ↔ Position value in the case of failure |   |   | Last valid value / zero  |                         |
|                             |   | ↔ Free resolution value                 |   |   | 5 ... 50000  |                         |
|                             | ↔ I/O                                   | ↔ I/O 1                                 | ↔ Port configuration                    |   | Input/Output   | Page 46                 |
|                             |   |   | ↔ Switching input                       | ↔ Function                              | No function/teach preset/laser ON/OFF  |                         |
|                             |   |   |   | ↔ Activation                            | Low active/High active   |                         |
|                             |   |   | ↔ Switching output                      | ↔ Function                              | Pos. limit value 1 / Pos. limit value 2 / Velocity / Intensity (ATT) / Temp. (TMP) / Laser (LSR) / Plausibility (PLB) / Hardware (ERR) |                         |
|                             |   |   |   | ↔ Activation                            | Low active/High active   |                         |
|                             |   | ↔ I/O 2                                 | ↔ Port configuration                    |   | Input/Output   |                         |
|                             |   |   | ↔ Switching input                       | ↔ Function                              | No function/teach preset/laser ON/OFF  |                         |
|                             |   |   |   | ↔ Activation                            | Low active/High active   |                         |
|                             |   |   | ↔ Switching output                      | ↔ Function                              | Pos. limit value 1 / Pos. limit value 2 / Velocity / Intensity (ATT) / Temp. (TMP) / Laser (LSR) / Plausibility (PLB) / Hardware (ERR) |                         |
|                             |   |   |   | ↔ Activation                            | Low active/High active   |                         |
|                             |   | ↔ Limit values                          | ↔ Upper pos. limit 1                    | ↔ Activation                            | ON/OFF   |                         |
|                             |   |   |   | ↔ Limit value input                     | Value input in mm or inch/100  |                         |
|                             |   |   | ↔ Lower pos. limit 1                    | ↔ Activation                            | ON/OFF   |                         |
|                             |   |   |   | ↔ Limit value input                     | Value input in mm or inch/100  |                         |
|                             |   |   | ↔ Upper pos. limit 2                    | ↔ Activation                            | ON/OFF   |                         |
|                             |   |   |   | ↔ Limit value input                     | Value input in mm or inch/100  |                         |

|                    |                    |                    |                           |   |                                  |         |
|--------------------|--------------------|--------------------|---------------------------|---|----------------------------------|---------|
|                    |                    |                    | Lower pos. limit 2        | Activation  | ON/OFF                           | Page 47 |
|                    |                    |                    | Max. velocity             | Limit value input   | Value input in mm or inch/100    |         |
|                    |                    |                    |                           | Activation  | ON/OFF                           |         |
|                    |                    |                    |                           | Max. velocity   | Value input in mm/s or inch/100s |         |
|                    | Other              | Heating control    |                           | Standard/extended (10 °C ... 15 °C/30 °C ... 35 °C)                     |                                  |         |
|                    |                    | Display background |                           | 10 minutes/ON   |                                  |         |
|                    |                    | Display contrast   |                           | Weak/Medium/Strong  |                                  |         |
| Service RS232      |                    | Baud rate          | 57.6kbit/s / 115.2 kbit/s |   |                                  |         |
|                    | Format             | 8,e,1 / 8,n,1      |                           |   |                                  |         |
| Language selection |                    |                    |                           | Deutsch / English / Español / Français / Italiano                       | Page 48                          |         |
| Service            | Status messages    |                    |                           | Number of readings, reading gates, reading rate / non-reading rate etc. | Page 48                          |         |
|                    | Diagnosis          |                    |                           | Only for use by Leuze personnel for service purposes                    |                                  |         |
|                    | Expanded diagnosis |                    |                           | Only for use by Leuze personnel for service purposes                    |                                  |         |