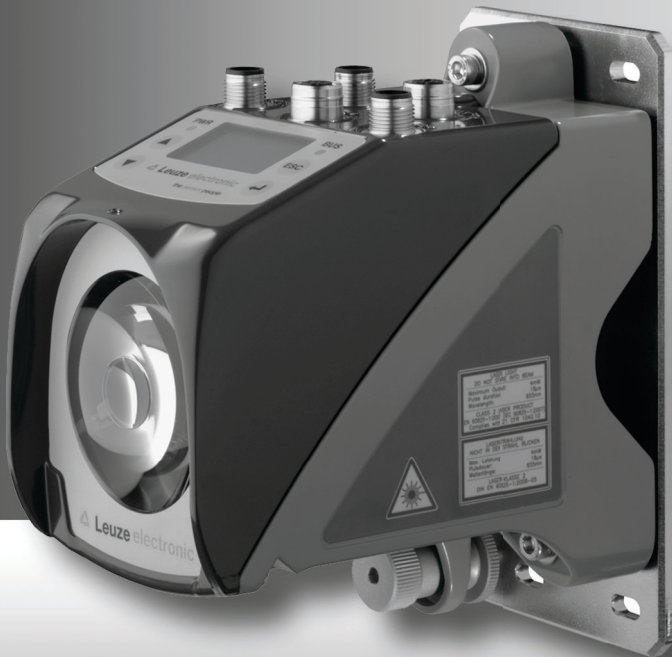


the sensor people

**AMS 301*i***  
Optical Laser Measurement System  
RS 485



en 01-2011/04 50113381

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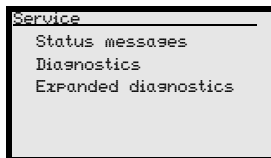
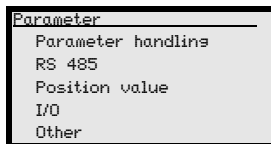
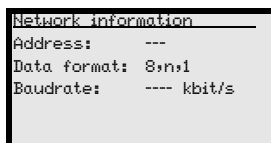
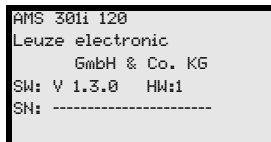
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**The main menus**



**Device information - main menu**

This menu item contains detailed information on

- Device model,
- 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 reception level.
- Activated interface.
- Measurement value.

No entries can be made via the display.

See "Indicators in the display" on page 36.

**Parameter - main menu**

- Configuration of the AMS.

See "Parameter menu" on page 41.

**Language selection - main menu**

- Selection of the display language.

See "Language selection menu" on page 44.





**Service - main menu**

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

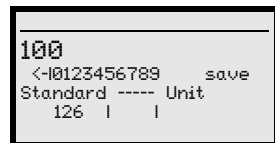
No entries can be made via the display.

See "Service menu" on page 45.

**Device buttons:**

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

**Input of values**



 +  Delete character

 ...  +  Enter digit

save +  Save input

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## 1 General information

### 1.1 Explanation of symbols

The symbols used in this operating manual are explained below.



**Attention!**

*This symbol precedes text messages which must strictly be observed. Failure to comply with this information results in injuries to personnel or damage to the equipment.*



**Attention Laser!**

*This symbol warns of possible danger caused by hazardous laser radiation.*



**Notice!**

*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 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).



**Notice!**

*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/Teck, possesses a certified quality assurance system in accordance with ISO 9001.



### 1.3 Description of functions AMS 301*i*

The AMS 301*i* 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*i* 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 integration time are designed for position control applications.

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

	<b>AMS 304<i>i</i></b>
	<b>AMS 348<i>i</i></b>
	<b>AMS 355<i>i</i></b>
	<b>AMS 358<i>i</i></b>
	<b>AMS 335<i>i</i></b>
	<b>AMS 338<i>i</i></b>
	<b>AMS 308<i>i</i></b>
	<b>AMS 384<i>i</i></b>
	<b>AMS 301<i>i</i></b>
	<b>AMS 300<i>i</i></b>



## 2 Safety notices

### 2.1 General safety notices

#### **Documentation**

All entries in this technical description must be heeded, in particular those in section "Safety notices". Keep this technical description in a safe place. It should be available at all times.

#### **Safety regulations**

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

#### **Repair**

Repairs must only be carried out by the manufacturer or an authorized representative.

### 2.2 Safety standards

The devices of the series AMS 301*i* were developed, manufactured and tested in accordance with the applicable safety standards. They correspond to the state of the art.

### 2.3 Intended use

The AMS 301*i*... device series is an absolute measuring system based on laser technology. The devices use a visible optical laser to measure distances of up to 300m contactlessly. The laser is designed so that distance measurements are made against a reflector.



#### **Attention!**

*The protection of personnel and the device is guaranteed only if the device is operated in a manner corresponding to its intended use.*

#### **Areas of application**

The AMS 301*i*... is suitable for the following areas of application:

- Distance measurements for determining the position of automated, moving plant components such as:
  - Travel and lifting axes of high-bay storage devices
  - Gantry crane bridges and their trolleys
  - Repositioning units
  - Lifts
  - Electroplating plants

## 2.4 Working safely



### **Attention!**

Access to or changes on the device, except where expressly described in this operating manual, are 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.

### **Safety regulations**

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



### **Attention!**

The AMS 301*i*... is not a safety module acc. to EU machinery directives.

### **Qualified personnel**

Mounting, commissioning and maintenance of the device must only be carried out by qualified personnel. Electrical work must be carried out by a certified electrician.



### **Attention, laser radiation!**

The AMS 301*i* operates with a red light laser of class 2 acc. to EN 60825-1. If you look into the beam path over a longer time period, the retina of your eye may be damaged!

**Never look directly into the beam path!**

**Do not point the laser beam of the AMS 301*i* at persons!**

**When mounting and aligning the AMS 301*i*, avoid reflections of the laser beam off of reflective surfaces!**

**Heed the laser safety regulations according to DIN EN 60825-1 in their most current version! The output power of the laser beam at the reading window is at most 4.0mW acc. to EN 60825-1. The average laser power is less than 1 mW in accordance with laser class 2 as well as CDRH class 2.**

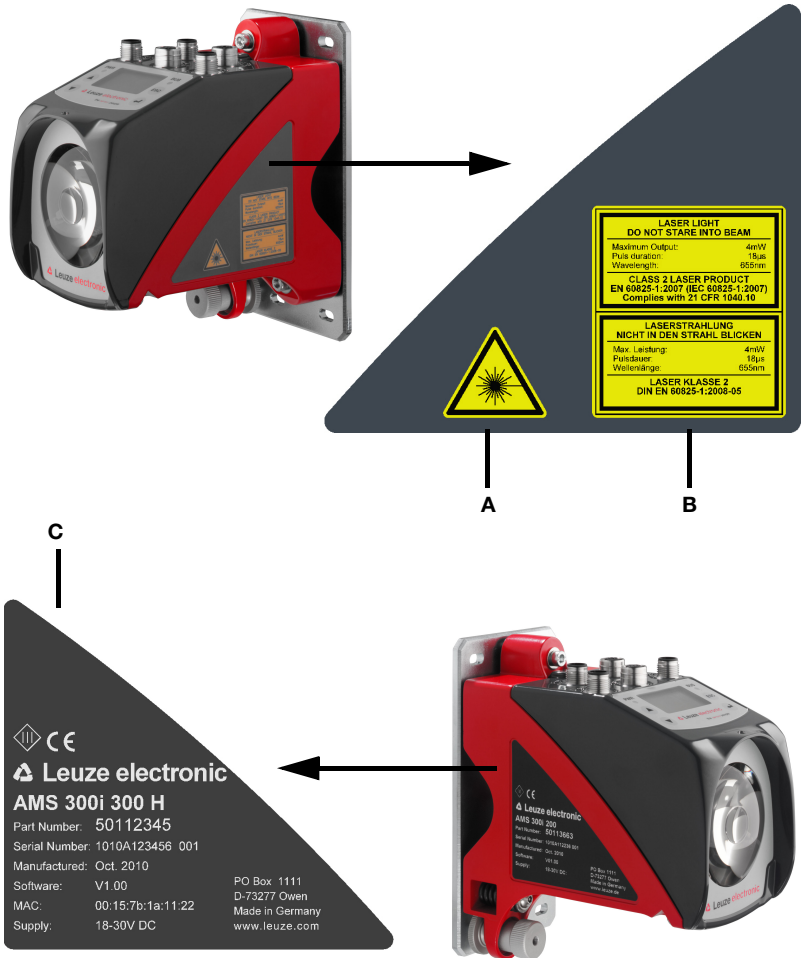
**The AMS 301*i* uses a laser diode with low power in the visible red light range with an emitted wavelength of 650 ... 690nm.**



### **Attention!**

**CAUTION! The use of operating and adjusting devices other than those specified here or carrying out of differing procedures may lead to dangerous exposure to radiation.**

The housing of the AMS 301*i* has been provided with the following labeling:



- A** Hazard warning & logotype
- B** Warning and certification plate
- C** Name plate with part no., version no., date of manufacture and serial no.  
For EtherNet-based devices, the MAC ID is specified on the name plate.  
Please note that the shown name plate is for illustration purposes only; the contents do not correspond to the original.

Figure 2.1: Location of the name plate on the AMS 301*i*

### 3 Fast commissioning / operating principle

**Notice!**

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 on a vertical wall 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 to be secured with the knurled nut and locked with the M5 nut.

**Further information can be found in chapter 5.2 and chapter 5.3.**

##### 3.1.2 Mounting the reflector

The reflector is mounted on a vertical wall with 4 screws (M5). The reflector is angled using the included shims. 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 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 above the menu structure or on the fold-out page at the end of the technical description.

The parameters can be adjusted after activation of parameter enabling.

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

## 4 Specifications

### 4.1 Specifications of the laser measurement system

#### 4.1.1 General specifications AMS 301*i*

Measurement data	AMS 301 <i>i</i> 40 (H)	AMS 301 <i>i</i> 120 (H)	AMS 301 <i>i</i> 200 (H)	AMS 301 <i>i</i> 300 (H)
Measurement range	0.2 ... 40m	0.2 ... 120m	0.2 ... 200m	0.2 ... 300m
Accuracy	± 2mm	± 2mm	± 3mm	± 5mm
Consistency <sup>1)</sup>	0.3mm	0.5mm	0.7mm	1.0mm
Light spot diameter	≤ 40mm	≤ 100mm	≤ 150mm	≤ 225mm
Measurement value output			1.7ms	
Integration time			8ms	
Resolution		adjustable, see chapter of the individual interfaces		
Temperature drift			≤ 0.1 mm/K	
Ambient temperature sensitivity			1 ppm/K	
Air pressure sensitivity			0.3 ppm/hPa	
Traverse rate			≤ 10 m/s	
<b>Electrical data</b>				
Supply voltage $V_{in}$ <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, wavelength 650 ... 690nm		
Laser class		2 acc. to EN 60825-1, CDRH		
Laser life expectancy <sup>3)</sup>		average temperature / year		50°C: 23.000h 25°C: 60.000h 20°C: 75.000h 10°C: 120.000h
<b>Interfaces</b>				
RS 485 / baud rate in kbit/s		9.6 / 19.2 / 38.4 / 57.6 / 115.2		
<b>Operating and display elements</b>				
Keyboard		4 buttons		
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	cast zinc and aluminum
Optics	glass
Weight	approx. 2.45 kg
Protection class	IP 65 acc. to EN 60529 <sup>4)</sup>

**Environmental conditions**

Operating temperature	
without device heating	-5 °C ... +50 °C
with device heating	-30 °C ... +50 °C <sup>5)</sup>
Storage temperature	-30 °C ... +70 °C
Air humidity	max. 90% rel. humidity, non-condensing

**Mechanical/electrical loading capacity**

Vibrations	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 acc. to NEC.
- 3) Switching off the laser diode during system downtime can considerably extend the life expectancy of the device. The laser life expectancy is calculated using a failure rate of 1%.
- 4) With screwed-on M12 plugs or mounted caps.
- 5) With devices with heating, the switch on/off area of the internal heating can be extended to prevent condensation from forming. A 100% prevention of the formation of condensation cannot be guaranteed due to the limited heating capacity of the AMS 301*i*.
- 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.

4.1.2 Dimensioned drawing AMS 301*i*

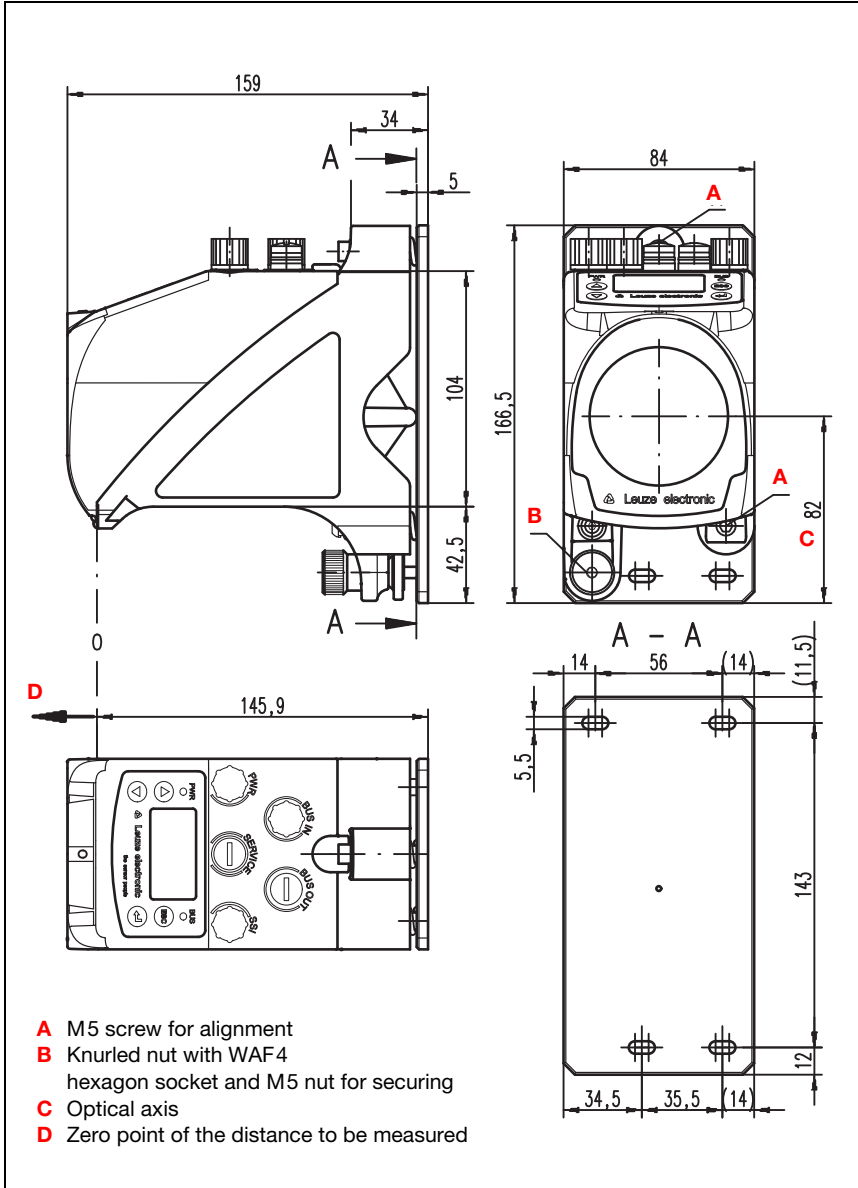


Figure 4.1: Dimensioned drawing AMS 301*i*



4.1.3 Type overview AMS 301*i*

**AMS 301*i* (RS 485)**

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

Table 4.1: Type overview AMS 301*i*

## 5 Installation and mounting

### 5.1 Storage, transportation



#### **Attention!**

When transporting or storing, package the device so that it is protected against collision and humidity. Optimum protection is achieved when using the original packaging. Heed the required environmental conditions specified in the technical data.

#### **Unpacking**

- ✎ Check the packaging 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 nameplate
  - 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 300*i* as an example



#### **Notice!**

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 electronic sales office.

↳ Observe the applicable local regulations when disposing of the packaging materials.

**5.2 Mounting the AMS 301*i***

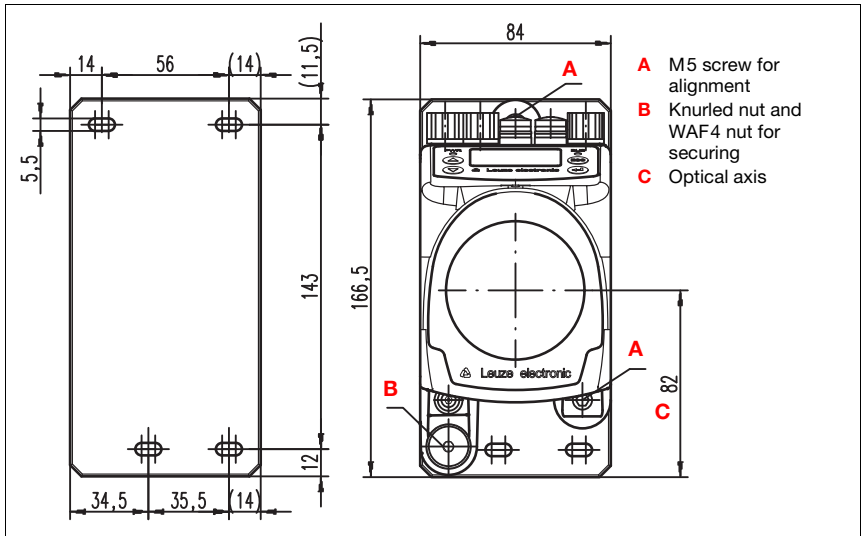


Figure 5.2: Mounting the device

The AMS 301*i* 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 connection between the AMS 301*i* and the reflector.

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

***Aligning the laser light spot in 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 WAF4 nut ("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

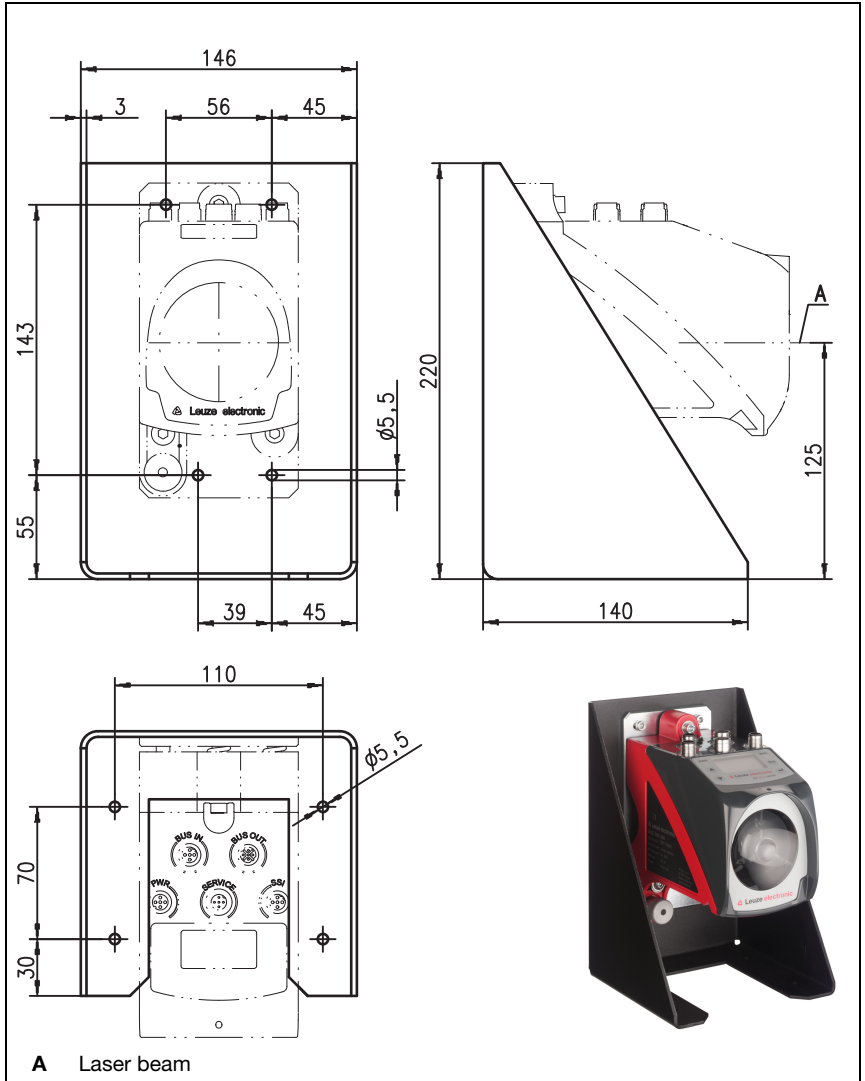


Figure 5.3: Optional mounting bracket

## 5.2.2 Mounting distances

### **Minimum parallel spacing between adjacent AMS 301*i***

The smallest-possible parallel spacing between adjacent AMS 301*i* is determined by the maximum measured distance as well as by the properties of the reflector. To prevent adjacent devices from interfering with each other the parallel distance of the laser light spots on the reflector is crucial.

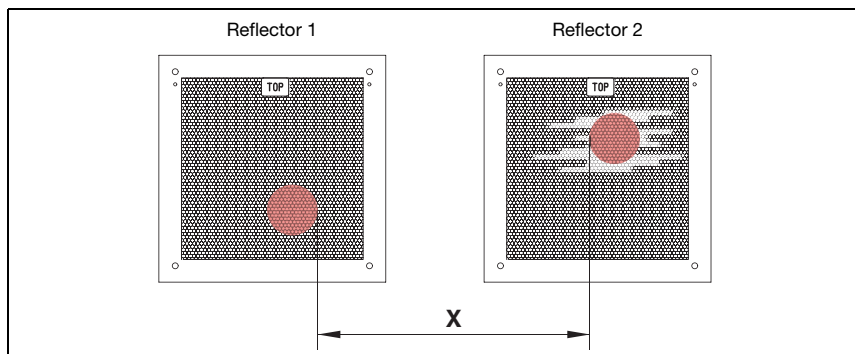


Figure 5.4: Minimum parallel spacing X between adjacent AMS 301*i*

Min. parallel spacing of laser light spot  $X = 100\text{mm} + (\text{max. measurement distance in mm} \times 0.01)$ .



#### **Notice!**

Please note that travel tolerances could cause the two laser light spots to move towards each other.

If both AMS 301*i* are optically separated from one another, e.g., if installed in different shelf alleys, the parallel spacing can be selected smaller, as there is no mutual interference in this case.

### **Minimum distance to an adjacent DDLS 200 optical data transmission device**

The optical data transceivers of the DDLS 200 series and the AMS 301*i* do not mutually interfere with one another. Depending on the size of the used reflector, the optical data transceiver can be mounted with a minimum mounting spacing of 100mm to the AMS 301*i*. The mounting spacing is independent of the distance.

### 5.3 Mounting the AMS 301*i* with laser beam deflector unit

**General information**

The two available deflector units are used for the 90° deflection of the laser beam, see "Accessory deflector unit" on page 56.



**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*i* 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 plant components. For error-free position measurement, there must be an interruption-free line-of-sight between the AMS 301*i*... 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 toothed lock washer to protect against loosening caused by vibrations.

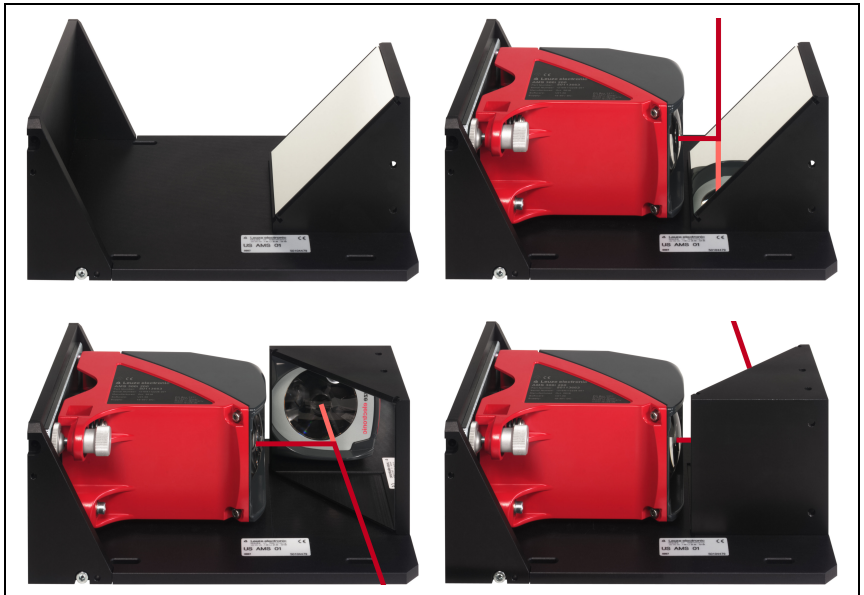


Figure 5.5: Mounting variants of the US AMS 01 laser beam deflector unit

5.3.2 Dimensioned drawing of US AMS 01 deflector unit

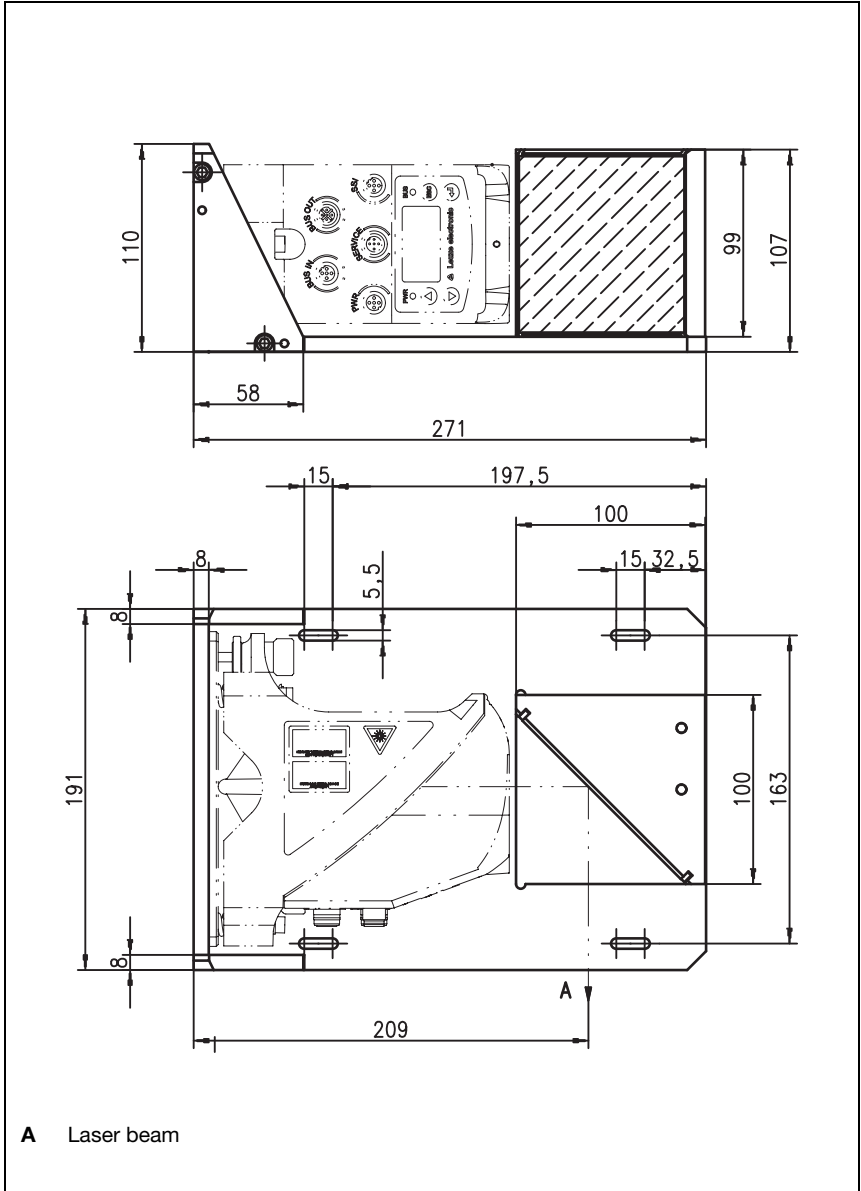


Figure 5.6: Dimensioned drawing of US AMS 01 deflector unit



### 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.



**Notice!**

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

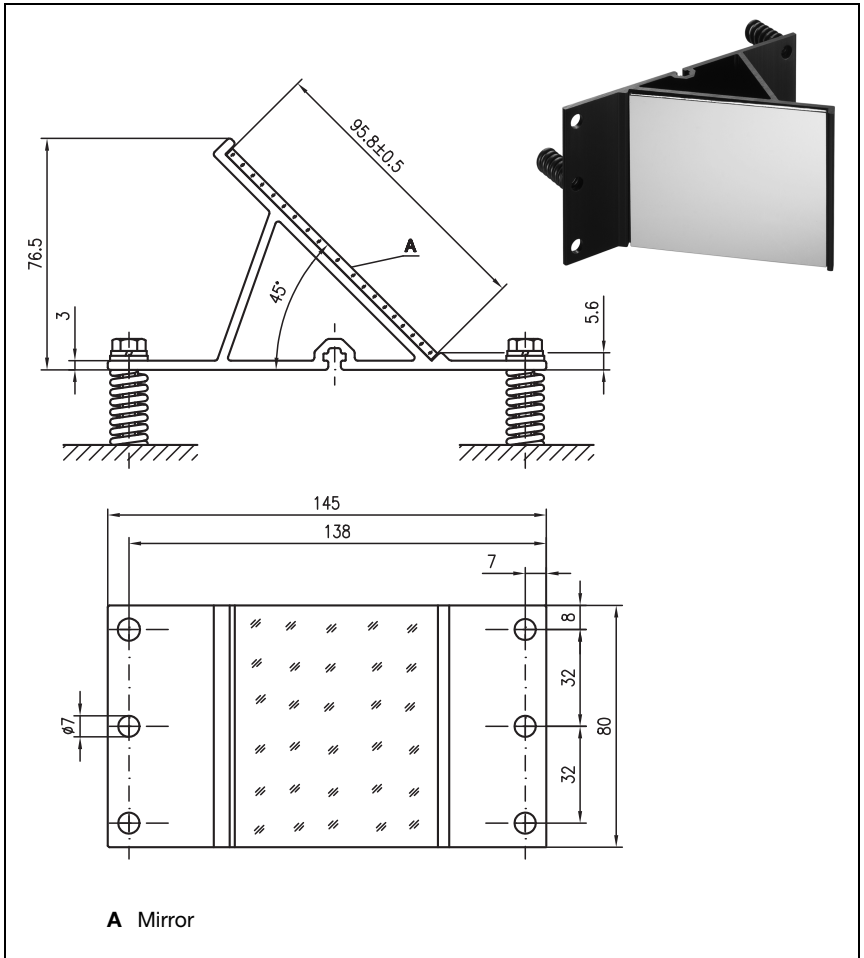


Figure 5.7: Photo and dimensioned drawing of the US 1 OMS deflector unit

Alignment of the laser light spot on the reflector is performed as described in chapter 5.2.

## 6 Reflectors

### 6.1 General information

The AMS 301*i* measures distances against a reflective tape specified by Leuze electronic. All provided specifications for the AMS 301*i*, such as the operating range or accuracy, can only be achieved with the reflective tape specified by Leuze electronic.

The reflective tapes are available as adhesive tapes, affixed to a metal 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 provided as a function of the distance that is to be measured. In any case, the user must check to determine 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 with a highly transparent, hard protective layer.

Under certain circumstances, the protective layer may lead to surface reflections. The surface reflections can be directed past the AMS 301*i* 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 32.

The reflective tapes are provided with a protective foil that can easily be pulled off. This must be removed from the reflector before the complete system is put into operation.

**6.2.1 Specifications of the self-adhesive foil**

	<b>Part</b>		
Type designation	<b>Reflective tape 200x200-S</b>	<b>Reflective tape 500x500-S</b>	<b>Reflective tape 914x914-S</b>
Part no.	50104361	50104362	50108988
Foil size	200x200mm	500x500mm	914x914mm
Recommended application temperature for adhesive tape	+5°C ... +25°C		
Temperature resistance, affixed	-40°C ... +80°C		
Mounting surface	The mounting surface must be clean, dry and free of grease.		
Cutting the tape	Cut with a sharp tool, always on the side of the prism structure.		
Cleaning	Do not use any agents that act with a grinding effect. A conventional household detergent can be used as a cleaning agent. Rinse with clear water and dry the surface.		
Storing the foil	Store in a cool and dry place.		

**6.2.2 Specifications of the reflective tape on a metal plate**

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

	<b>Part</b>		
Type designation	<b>Reflective tape 200x200-M</b>	<b>Reflective tape 500x500-M</b>	<b>Reflective tape 914x914-M</b>
Part no.	50104364	50104365	50104366
Foil size	200x200mm	500x500mm	914x914mm
Outer dimensions of the metal plate	250x250mm	550x550mm	964x964mm
Weight	0.8kg	4kg	25kg
Cleaning	Do not use any agents that act with a grinding effect. A conventional household detergent can be used as a cleaning agent. Rinse with clear water and dry the surface.		
Storing the reflector	Store in a cool and dry place.		

6.2.3 Dimensioned drawing of reflective tape on a metal plate

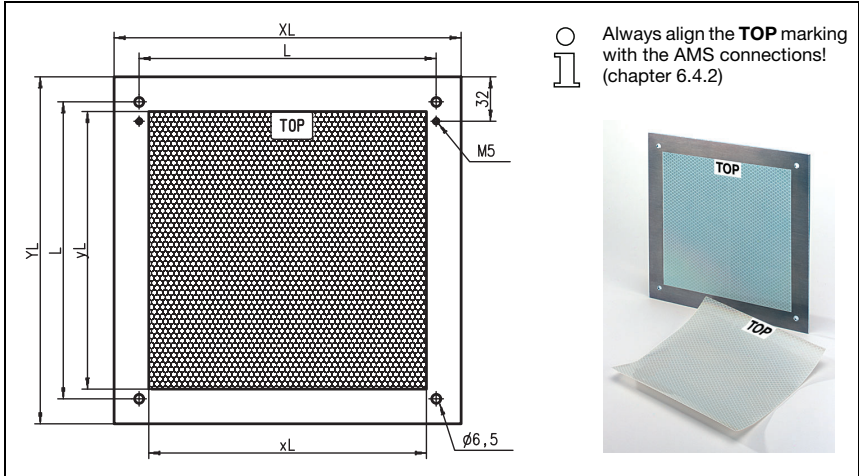


Figure 6.1: Dimensioned drawing of reflectors

Part	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 Specifications of heated reflectors**

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

Only the reflective tape is kept at the specified temperature by the integrated heater. Through the insulation on the back, the generated heat cannot be transferred via the steel construction. Energy costs are greatly reduced in the case of continuous heating.

	<b>Part</b>		
Type designation	<b>Reflective tape 200x200-H</b>	<b>Reflective tape 500x500-H</b>	<b>Reflective tape 914x914-H</b>
Part no.	50115020	50115021	50115022
Voltage supply	230VAC		
Power	100W	150W	500W
Current consumption	~ 0.5A	~ 1A	~ 2.5A
Length of the supply line	2 m		
Size of the reflective tape	200x200mm	500x500mm	914x914mm
Outer dimensions of the base material	250x250mm	550x550mm	964x964mm
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 agents that act with a grinding effect. A conventional household detergent can be used as a cleaning agent. Rinse with clear water and dry the surface.		
Storing the reflector	Store in a cool and dry place.		

**6.2.5 Dimensioned drawing of heated reflectors**

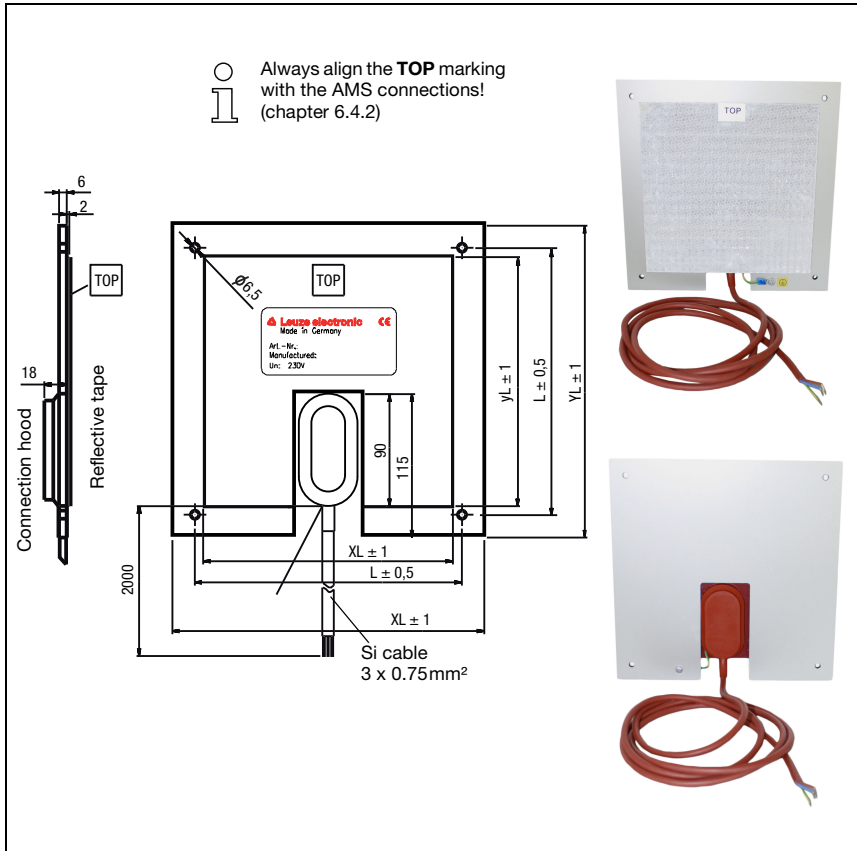


Figure 6.2: Dimensioned drawing of heated reflectors

Part	Reflective tape (mm)		Insulated base 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 sizes

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



**Attention!**

The reflector sizes shown below are a recommendation from Leuze electronic 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.

On the basis of the system planning and design, always check whether mechanical travel tolerances may 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 without interruption. 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 sizes			
AMS 301 <i>i</i> selection (Operating range in m)	Recommended reflector size (H x W)	Type designation ...-S = self-adhesive ...-M = metal plate ...-H = heating	Part no.
AMS 301 <i>i</i> 40 (max. 40m)	200x200 mm	Reflective tape 200x200-S Reflective tape 200x200-M Reflective tape 200x200-H	50104361 50104364 50115020
AMS 301 <i>i</i> 120 (max. 120m)	500x500 mm	Reflective tape 500x500-S Reflective tape 500x500-M Reflective tape 500x500-H	50104362 50104365 50115021
AMS 301 <i>i</i> 200 (max. 200m)	749x914 mm 914x914 mm	Reflective tape 749x914-S Reflective tape 914x914-M Reflective tape 914x914-S Reflective tape 914x914-H	50104363 50104366 50108988 50115022
AMS 301 <i>i</i> 300 (max. 300m)	749x914 mm 914x914 mm	Reflective tape 749x914-S Reflective tape 914x914-M Reflective tape 914x914-S Reflective tape 914x914-H	50104363 50104366 50108988 50115022

## 6.4 Mounting the reflector

### 6.4.1 General information

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

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

As described in table 6.1, the reflective tape must be angled.

#### **Reflective tapes on metal**

The reflective tapes of the "Reflective tape ...x...-M" series are provided with corresponding mounting holes. Spacer sleeves are provided in the packet for achieving the necessary pitch angle. For further information see table 6.1.

#### **Heated reflectors**

The reflective tapes of the "Reflective tape ...x...-H" series are provided with corresponding mounting holes. Due to the voltage supply affixed on the rear, the reflector cannot be mounted flat. Included in the package are four distance sleeves in two different lengths. Use the distance sleeves to achieve a base separation to the wall as well as the necessary pitch for avoiding surface reflection. For further information see table 6.1.

The reflector is provided with a 2 m-long connection cable for supplying with 230VAC. Connect the cable to the closest power outlet. Observe the current consumptions listed in the specifications.



#### **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 tape as centered as possible and without interruption.

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



#### **Attention!**

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

#### **Example:**

*If the AMS 301*i* is mounted so that the M12 connections are on the top, the "TOP" label of the reflector is also on the top. If the AMS 301*i* is mounted so that the M12 connections are on the side, the "TOP" label of the reflector is also on the side.*





**Notice!**

The reflector must be angled. To do this, use the spacer sleeves. Angle the reflectors so that the surface reflections of the foil seal are deflected to the left, right or upwards. Avoid a downward pitch, as additional reflections may occur on the running rails. 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**

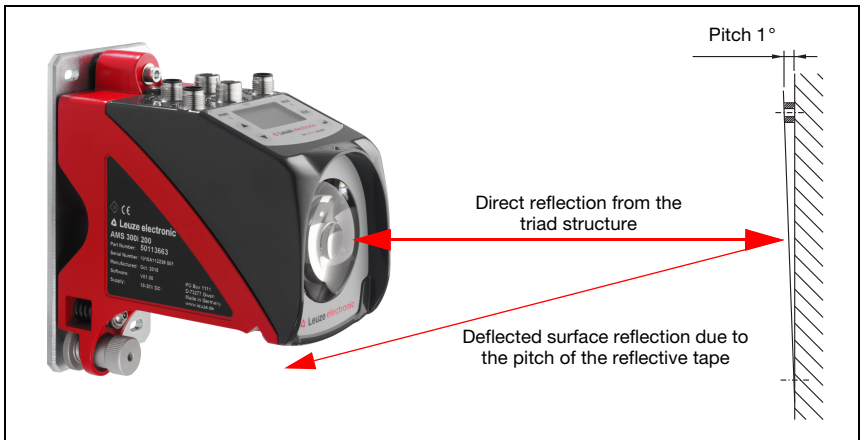


Figure 6.3: Reflector mounting

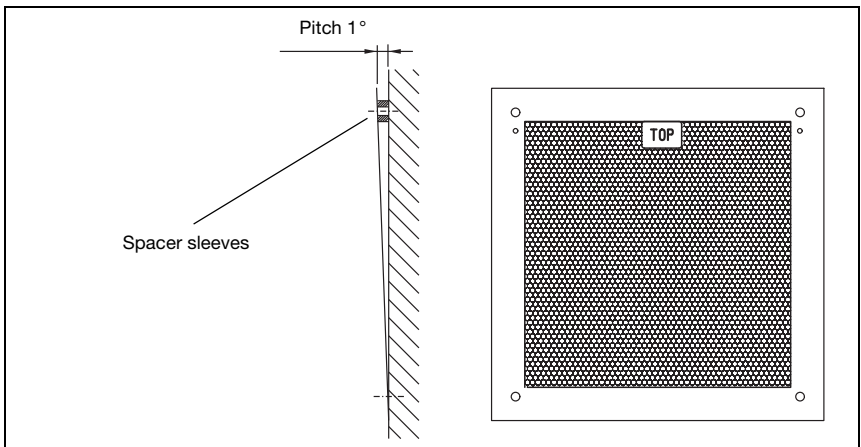


Figure 6.4: Pitch of the reflector

**Reflective tapes ...-H**

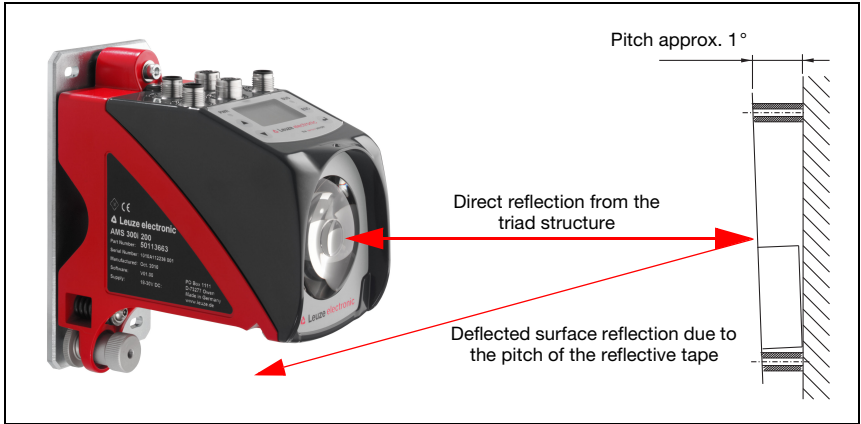


Figure 6.5: Mounting of heated reflectors

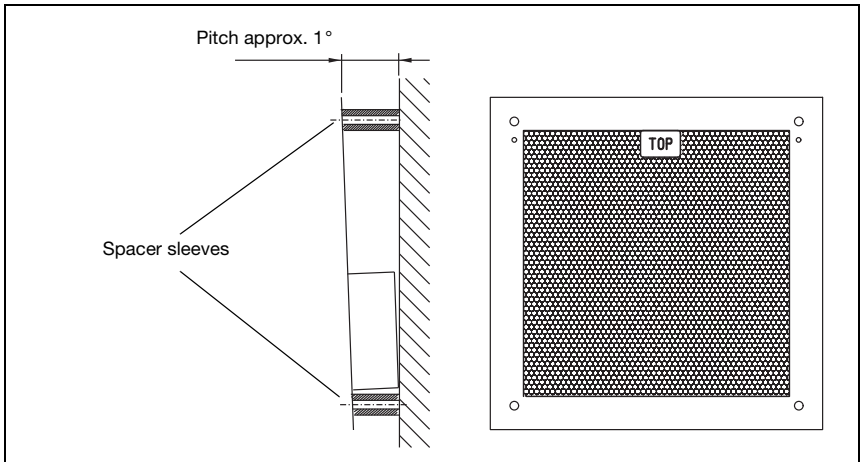


Figure 6.6: Pitch of the heated reflector

**6.4.3 Table of reflector pitches**

<b>Reflector type</b>	<b>Pitch resulting from spacer sleeves <sup>1)</sup></b>	
Reflective tape 200x200-S Reflective tape 200x200-M	<b>2 x 4mm</b>	
Reflective tape 200x200-H	<b>2 x 15mm</b>	<b>2 x 20mm</b>
Reflective tape 500x500-S Reflective tape 500x500-M	<b>2 x 10mm</b>	
Reflective tape 500x500-H	<b>2 x 15mm</b>	<b>2 x 25mm</b>
Reflective tape 749x914-S	<b>2 x 20mm</b>	
Reflective tape 914x914-S Reflective tape 914x914-M	<b>2 x 20mm</b>	
Reflective tape 914x914-H	<b>2 x 15mm</b>	<b>2 x 35mm</b>

1) Spacer sleeves are included in the delivery contents of reflective tape ...-M and ...-H

Table 6.1: Reflector pitch resulting from spacer sleeves



**Notice!**

*Reliable function of the AMS 301*i* and, thus, max. operating range and accuracy can only be achieved with the reflective tape specified by Leuze electronic. No function can 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.



### Notice!

The corresponding mating connectors and ready-made cables are available as accessories for all cables. 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 corrected, the device should be removed from operation and protected against possible use.



#### Attention!

For UL applications, use is permitted exclusively in Class 2 circuits according to NEC (National Electric Code).



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



**Note!**

Protection class 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	Remark
	1	VIN	Positive supply voltage +18 ... +30VDC
	2	I/O 1	Switching input/output 1
	3	GND	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 assignment 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	Remark
	1	NC	Not used
	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	Shield

Table 7.2: RS 485 BUS IN pin assignment

## 7.4 RS 485 BUS OUT

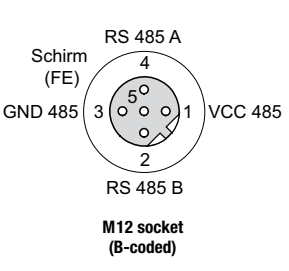
RS 485 BUS OUT (5-pin socket, B-coded)			
	Pin	Name	Remark
	1	VCC 485	Supply voltage +5V (termination)
	2	RS 485 B	Data RS 485 B (-)
	3	GND 485	Data reference potential
	4	RS 485 A	Data RS 485 A (+)
	5	FE	Functional earth
	Thread	Shield	Shield

Table 7.3: RS 485 BUS OUT pin assignment

## 7.5 Service

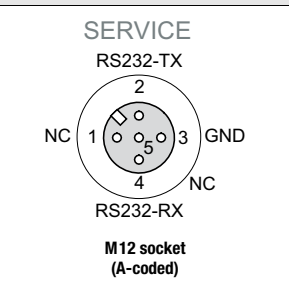
Service (5-pin socket, A-coded)			
	Pin	Name	Remark
	1	NC	Not used
	2	RS232-TX	Transmission line RS 232/service data
	3	GND	Voltage supply 0VDC
	4	RS232-RX	Receiving line RS 232/service data
	5	NC	Not used
	Thread	FE	Functional earth (housing)

Table 7.4: Service pin assignments



**Notice!**

The service interface is designed only for use by Leuze electronic!

## 8 Display and control panel AMS 301i

### 8.1 Structure of the control panel

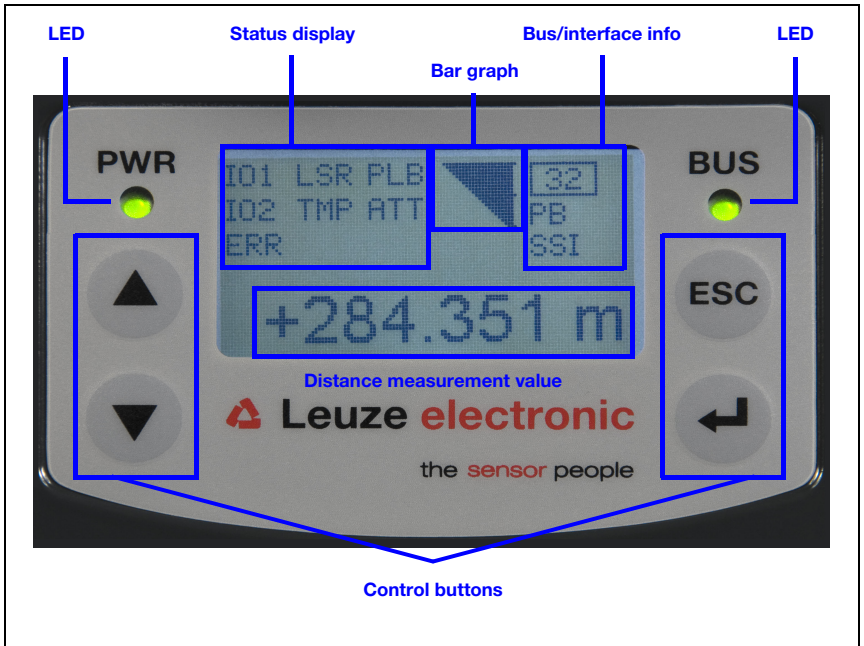


Figure 8.1: Structure of the control panel using the AMS 304i PROFIBUS device variant as an example



**Notice!**

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

## 8.2 Status display and operation

### 8.2.1 Indicators in the display

**Status and warning messages in the display**

- I01 **Input 1 or output 1 active:**  
Function depending on configuration.
- I02 **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:**  
Permissible internal device temperature exceeded / not met.
- 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 outlet 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.

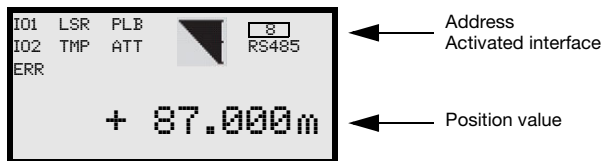
**Bar graph**



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 has thus been assessed as being 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 shows the set address, the designation "RS 485" displays the respectively activated interface.



**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 with **three decimal places**.  
+87.0in    With the **inch** setting, the measurement value is always displayed in inches with **one decimal place**.



### 8.2.2 LED status displays

#### **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*i* 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

-  **Up**      Navigate upward/laterally.
-  **Down**      Navigate downward/laterally.
-  **ESC**      Exit menu item.
-  **ENTER**      Confirm/enter value, change menu levels.

#### ***Navigating within the menus***

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

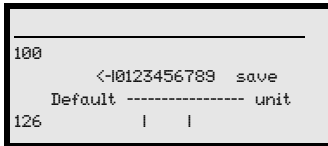
The selected menu item is activated with the enter button .







Press the ESC button  to move up one menu level.





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




#### ***Setting values***

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



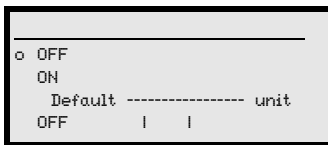
-  +  Delete character
- ... +  Enter digit
- save** +  Save




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

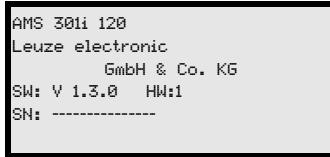


Select the desired option with the   buttons. Activate the option by pressing .

### 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 model,
- Manufacturer,
- Software and hardware version,
- Serial number.

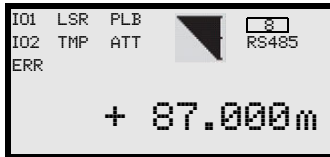
No entries can be made via the display.



#### Network information - main menu

- Explanations of address, data format, baud rate.

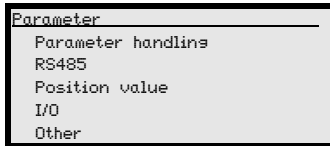
No entries can be made via the display.



#### Status and measurement data - main menu

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

No entries can be made via the display.  
See "Indicators in the display" on page 36.



#### Parameter - main menu

- Configuration of the AMS.

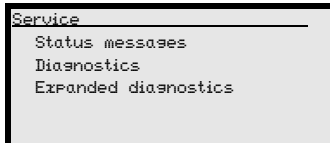
See "Parameter menu" on page 41.



#### Language selection - main menu

- Selection of the display language.

See "Language selection menu" on page 44.



#### Service - main menu

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

No entries can be made via the display.  
See "Service menu" on page 45.



**Notice!**

**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 default settings.

Table 8.1: Parameter handling submenu

Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
Parameter enabling			ON / OFF The standard setting (OFF) prevents unintended parameter changes. With parameter enabling activated (ON), the display is inverted. In this state, it is possible to change parameters manually.	OFF
Password	Activate password		ON / OFF To enter a password, parameter enabling 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. The master password 2301 bridges the individually set password.	OFF
	Password entry		Configuration option of 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. 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 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			9.6kbit/s / 19.2kbit/s / 38.4kbit/s / 57.6kbit/s / 115.2kbit/s Selection of the baud rate for serial communication. It must be the same at the transmission and reception sides to enable communication.	38.4kbit/s
Format			... 8,n,1 / ... 8,e,1 / ... 8,o,1 Selection of the data mode for serial communication. Designation is done in number of data bits, parity (N=none, E=even, O=odd) and number of stop bits. For example, "8N1" therefore means 8 data bits, no parity, 1 stop bit.	8,n,1

Table 8.2: RS 485 submenu

Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
Position resolution			0.01 mm / 0,1 mm / 1 mm / 10 mm / free mm The measurement value can be displayed in these resolutions. The value of the free resolution is determined in the "Position value" submenu in the "Value of free resolution" parameter.	0.1 mm
Velocity resolution			1 / 10 / 100	1

**Position value submenu**

Table 8.3: Position value submenu

Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
Measurement unit			Metric/Inch Specifies the units of the measured distances.	Metric
Count direction			Positive/Negative Positive: The measurement value begins at 0 and increases with increasing distance. 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. The resolution of the offset value is independent of the selected "Resolution position" and is entered in mm or inch/100. The offset value is effective immediately following entry. If the preset value is activated, this has priority over the offset. Preset and offset are not offset against each other.	0mm
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.	0mm
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" ("Resolution position" parameter).	1000
Error delay			ON / OFF Specifies whether, in the event of an error, the position value immediately outputs the value of the "Position value in the case of error" parameter or the last valid position value for the configured error delay time.	ON/100 ms
Position value in the case of error			Last valid value / zero Specifies which position value is output after the error delay time elapses.	Zero

**I/O submenu**

Table 8.4: I/O submenu

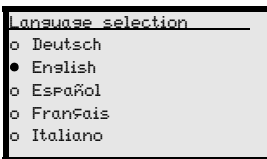
Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
I/O 1	Port configuration		Input/Output Defines whether I/O 1 functions as an output or input.	Output
	Switching input	Function	No function/preset teach/laser ON/OFF	No function
		Activation	Low active/High active	Low active
	Switching output	Function	Pos. limit value 1 / Pos. limit value 2 / Velocity / Intensity (ATT) / Temp. (TMP) / Laser (LSR) / Plausibility (PLB) / Hardware (ERR) 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 Defines whether I/O 2 functions as an output or input.	Output
	Switching input	Function	No function/preset teach/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) 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
		Limit value input	Value input in mm or inch/100	0

**Other submenu**

Table 8.5: Other submenu

Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
Heating control			Standard (10°C ... 15°C)/Extended (30°C ... 35°) Defines a switch-on/switch-off range for the heating control. The extended switch-on/switch-off range for heating may provide relief in the event of condensation problems. There is no guarantee that no condensation will occur on the optics in the extended switch-on/switch-off range due to the limited heating capacity. 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 Display illumination is switched off after 10 minutes or, if the parameter is set to "ON", illumination is always on.	10 min.
Display contrast			Weak/Medium/Strong 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 The service interface is only available to Leuze internally.	115.2kbit/s
	Format		8,e,1 / 8,n,1 The service interface is only available to Leuze internally.	8,n,1

**8.3.3 Language selection menu**



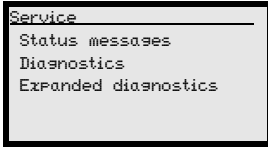
There are 5 display languages available:

- 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 password enabling be activated. The display language is a passive operational control and is, thus, not a function parameter, per se.

### 8.3.4 Service menu



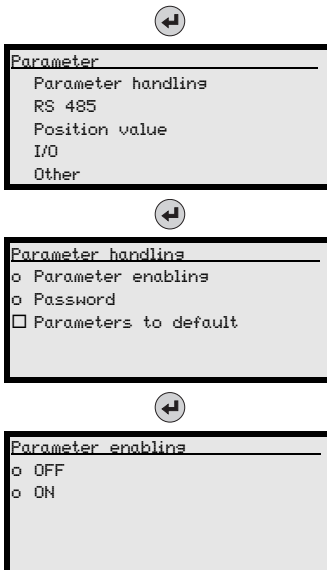
A more detailed description of the individual functions can be found in chapter 10.

## 8.4 Operation



Described here is an operating process using parameter enabling as an example.

### Parameter enabling



During normal operation parameters can only be viewed. 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.

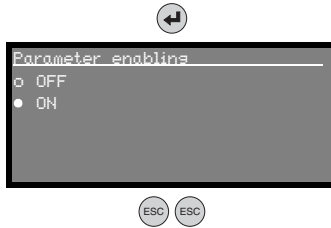
Press the enter button to enter the Parameter handling menu.

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

Press the enter button to enter the Parameter enabling menu.

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





Press the enter button to switch on parameter enabling.

The PWR LED illuminates 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 enabling is activated, 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 enabling is active.



**Notice!**

*Changes to parameters via display entry have immediate effect. If a password was stored, parameter enabling is not possible until this password is entered, see "Password for parameter enabling" below.*

**Password for parameter enabling**

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



**Notice!**

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

## 9 RS 485 interface

### 9.1 General Information about the RS 485 interface

The AMS 301*i* features an integrated RS 485 interface. The RS 485 interface is activated on delivery.



**Notice!**

To activate / deactivate the interface, parameter enabling must be activated (see chapter 8.3.2).

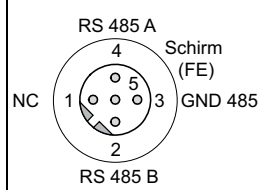
The respectively activated interface appears in the display.



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	Remark
 <p>RS 485 A 4 Schirm (FE) NC 1 5 3 GND 485 2 RS 485 B</p> <p><b>M12 connector (B-coded)</b></p>	1	NC	Not used
	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)			
	Pin	Name	Remark
<p>Schirm (FE) GND 485 3 5 1 VCC 485 RS 485 A 4 RS 485 B 2 M12 socket (B-coded)</p>	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**



**Notice!**

Basic operation of the control panel/display is described in chapter 8.4.

To set the address parameter enabling must be activated. The display is inverted with parameter enabling activated.



**Attention!**

When parameter enabling is activated, all changes made via the control panel/display are active immediately.

**9.3.1 RS 485 address entry**

To do this proceed as follows:

- ↘ Activate parameter enabling.
- ↘ Select the RS485 submenu.
- ↘ Select the address menu item.
- ↘ Select the RS 485 address of the AMS 301*i* to be between 0 and 15.
- ↘ Deactivate parameter enabling.

## 9.4 RS 485 interface data

### 9.4.1 Default settings of the RS 485 interface

On delivery, the RS 485 interface is activated.

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 setting for AMS 301*i*

An overview of all parameters to be set is listed in the fold-out page at the end of the manual.

All parameters can be set via the panel/display.

Basic operation of the display is described in chapter 8.4.

In order to change parameters, parameter enabling must be activated.



#### **Notice!**

*Changed parameters have an immediate effect on the interface.*

### 9.4.3 Communication protocol (binary protocol)

#### **Querying AMS 301*i* data (request)**

The request to transmission of the measured distances or the speed or the control of the laser diode (ON/OFF) is controlled via a protocol which is 3 bytes long.

#### **Query / 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 address used 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 an individual distance value
1111 0100	F4	Laser diode on
1111 0101	F5	Laser diode off
1111 0110	F6	Request of an individual velocity value
1111 1000	F8	Single request of position and velocity value

Under RS 485 in the parameter menu, the output cycle for cyclically requested data can be configured in a range of (1 ... 20) x 1.7 ms.

**Byte 2:** XOR linking from byte 0 and byte 1  
 An uneven binary 1 number (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 query protocol and checked by the receiver (AMS 301*i*). A protocol is correctly transmitted when the XOR checksum of the transmitter is equal to the XOR checksum of the receiver. If the XOR comparison is negative (different checksums), the protocol from the AMS 301*i* is not accepted. The AMS 301*i* does not send an acknowledgement to an uneven checksum.

**Answer of the AMS 301*i* data (response) for the CMD query from F1<sub>19</sub>, F4 -F6<sub>19</sub>, F8<sub>19</sub>**

The AMS 301*i* data (response) is output in a 6 byte length.

**Answer / response of the AMS 301*i***

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

### Answer of the AMS 301*i* data for the query from F8<sub>n</sub>

The AMS 301*i* data (response) is output in an 8 byte length.

### Answer / response of the AMS 301*i*

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:	status AMS 300 <i>i</i> : not ready = 0, ready = 1
LSR:	Laser diode: OK = 0, warning = 1
TMP:	Temperature warning: OK = 0, warning = 1
ERR:	Device error: OK = 0, error = 1
ATT:	Decreasing received signal level: 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:	Measurement value sign: 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 linking of byte 0 to byte 4 An uneven binary 1 number (calculated column by column from top to bottom) sets the XOR bit to 1.

### Example

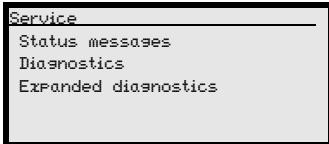
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	1	1	1	1	0	0
1	1	1	1	1	0	1	1	0
XOR	0	1	0	0	1	0	1	0

The XOR checksum is entered by the AMS 301*i* in the answer protocol and checked by the receiver (control). A protocol is correctly transmitted when the XOR checksum of the transmitter is equal to the XOR checksum of the receiver. If the XOR comparison is negative (different checksum), the protocol is discarded by the control or the control will output an error message.

## 10 Diagnostics and troubleshooting

### 10.1 Service and diagnostics 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.



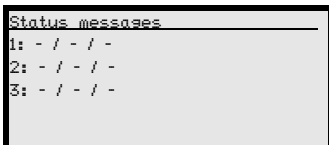
From the Service main menu, press the enter button to access the underlying menu level.

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 sublevel to the next-higher menu item by pressing the ESC button .

#### 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.



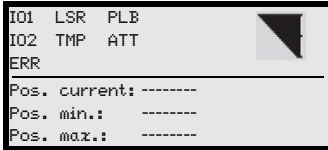
The status messages within the ring memory are selected with the up/down buttons . Use the enter button to call up detailed information about the respective status message that includes the following details:



- Type:** Designates the message type **I** = info; **W** = warning, **E** = error.
- No:** Internal numbering.
- Ref.:** Plain-text explanation of the displayed status.
- Time:** Time stamp in the hh.mm format. The displayed time is added to the time since the last power ON. Power OFF clears the time stamp.

## 10.1.2 Diagnostics

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 are 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 that assists in a Leuze-internal evaluation.



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 the communication to the host interface and can be activated during operation of the AMS 301*i*.

## 10.1.3 Expanded diagnostics

The `Expanded diagnostics` 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, 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

The LED does not show a bus failure with the AMS 301*i*.



**10.4 Status display in the display of the AMS 301*i***

Display	Possible error cause	Measure
<b>PLB</b> (implausible measurement values)	Laser beam interruption	Laser spot must always be incident on the reflector.
	Laser spot outside of reflector	Traverse rate < 10 m/s?
	Measurement range for maximum distance exceeded	Restrict traversing path or select AMS with larger measurement range.
	Velocity greater than 10 m/s	Reduce velocity.
<b>ATT</b> (insufficient received signal level)	Ambient temperature far outside of the permissible range (TMP display; PLB)	Select AMS with heating or ensure cooling.
	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 the reflector	Check alignment.	
<b>TMP</b> (operating temperature outside of specification)	Protective foil on the reflector	Remove protective foil from reflector.
	Ambient temperatures outside of the specified range	In case of low temperatures, remedy may be an AMS with heating. If temperatures are too high, provide cooling or change mounting location.
<b>LSR</b> 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> Hardware error	Indicates an uncorrectable error in the hardware	Send in device for repair.



**Notice!**

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)**

<b>Device type:</b>	
<b>Company:</b>	
<b>Contact partner / department:</b>	
<b>Phone (direct):</b>	
<b>Fax:</b>	
<b>Street / No:</b>	
<b>ZIP code/City:</b>	
<b>Country:</b>	

**Leuze Service fax number:**

**+49 7021 573 - 199**

## 11 Type overview and accessories

### 11.1 Type key

AMS 3xx i **yyy** H

Heating option	H =	With heating
Sensing distance	40	Max. operating range in m
	120	Max. operating range in m
	200	Max. operating range in m
	300	Max. operating range in m
	i =	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 Measuring System

### 11.2 Type overview AMS 301*i* (RS 485)

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

Table 11.1: Type overview AMS 301*i*

### 11.3 Overview of reflector types

Type designation	Description	Part no.
Reflective tape 200x200-S	Reflective tape, 200x200 mm, self-adhesive	50104361
Reflective tape 500x500-S	Reflective tape, 500x500 mm, self-adhesive	50104362
Reflective tape 914x914-S	Reflective tape, 914x914 mm, self-adhesive	50108988
Reflective tape 200x200-M	Reflective tape, 200x200 mm, affixed to aluminum plate	50104364
Reflective tape 500x500-M	Reflective tape, 500x500 mm, affixed to aluminum plate	50104365
Reflective tape 914x914-M	Reflective tape, 914x914 mm, affixed to aluminum plate	50104366
Reflective tape 200x200-H	Heated reflective tape, 200 x 200 mm	50115020
Reflective tape 500x500-H	Heated reflective tape, 500 x 500 mm	50115021
Reflective tape 914x914-H	Heated reflective tape, 914 x 914 mm	50115022

Table 11.2: Overview of reflector types

### 11.4 Accessories

#### 11.4.1 Accessory mounting bracket

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

Table 11.3: Accessory mounting bracket

#### 11.4.2 Accessory deflector unit

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

Table 11.4: Accessory deflector unit

#### 11.4.3 Accessory M12 connector

Type designation	Description	Part no.
KD 02-5-BA	M12 connector, B-coded socket, BUS IN	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: Accessory M12 connector

#### 11.4.4 Accessory terminating resistor

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

Table 11.6: Accessory terminating resistor

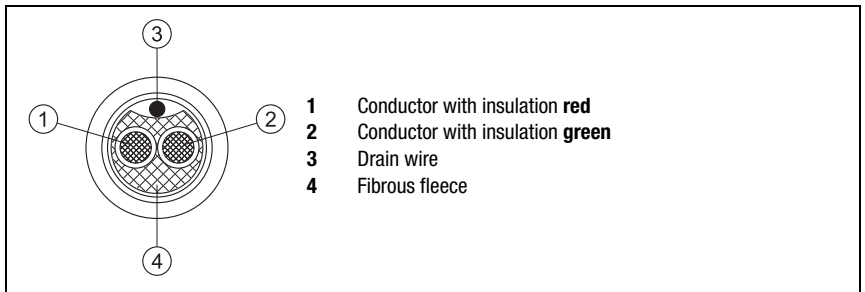


11.4.6 Accessory ready-made cables for RS 485

Contact assignments 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 connector, 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)





<b>Type designation</b>	<b>Remark</b>	<b>Part no.</b>
KB PB-20000-SBA	M12 plug + M12 socket for PROFIBUS, axial connectors, cable length 20m	50104101
KB PB-25000-SBA	M12 plug + M12 socket for PROFIBUS, axial connectors, cable length 25m	50104174
KB PB-30000-SBA	M12 plug + M12 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 (ATT) warning message 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. Use of such solvents could blur 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, are 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.*



#### **Notice!**

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

### 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.*



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Device information						page 40
Network information						page 40
Status- and measurement data						page 40
Parameter	Parameter handling	Parameter enabling			ON / OFF	page 41
		Password	Activate password	ON / OFF		
			Password entry	Configuration option of a four-digit numerical password		
		Parameters to default			All parameters are reset to their factory settings	
	RS 485	Activation			ON / OFF	page 41
		Address			Address of the AMS 301i	
		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	
	Maximum position value	Resolution - velocity			1 / 10 / 100	page 42
		Measurement unit			Metric/Inch	
		Count direction			Positive/Negative	
		Offset			Value input:	
		Preset			Value input	
		Error delay			ON / OFF	
Position value in the case of error				Last valid value / zero		
I/O	I/O 1	Port configuration			Input/Output	page 43
		Switching input	Function	No function/preset teach/laser ON/OFF		
			Activation	Low active/High active		
		Switching output	Function	Pos. limit value 1 / pos. limit value 2 / speed / intensity (ATT) / temp. (TMP) / laser (LSR) / plausibility (PLB) / hardware (ERR)		
			Activation	Low active/High active		
		I/O 2	Port configuration			
	Switching input		Function	No function/preset teach/laser ON/OFF		
			Activation	Low active/High active		
	Switching output		Function	Pos. limit value 1 / pos. limit value 2 / speed / 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	
			↔ Limit value input	Value input in mm or inch/100	
↔ Other	↔ Heating control			Standard/extended (10°C ... 15°C/30°C ... 35°C)	page 44
	↔ Display background			10 minutes/ON	
	↔ Display contrast			Weak/Medium/Strong	
	↔ Service RS232	↔ Baud rate		57.6kbit/s / 115.2kbit/s	
		↔ Format		8,e,1 / 8,n,1	
Language selection ↔				Deutsch / English / Español / Français / Italiano	page 44
Service ↔	↔ Status messages				page 45
	↔ Diagnostics			Exclusively for service purposes by Leuze electronic	
	↔ Expanded diagnostics			Exclusively for service purposes by Leuze electronic	