Leuze

Original operating instructions

AMS 338i
Optical laser measurement system – EtherCAT

The main menus

```
AMS 338i 120
Leuze electronic
GmbH & Co. KG
SW: V 1.3.0HW:1
SN: ----------------------
```

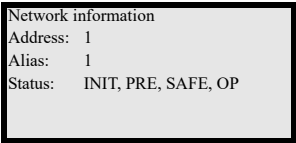### Device information - main menu

This menu item contains detailed information on
- Device type
- Manufacturer
- Software and hardware version
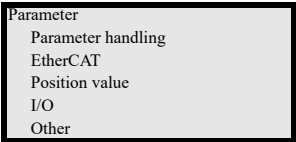- Serial number

No entries can be made via the display.

▲ ▼

```
Network information
Address:   1
Alias:     1
Status:    INIT, PRE, SAFE, OP
```

Network information - main menu

Explanations of address, alias, status.
No entries can be made via the display.

▲ ▼

Device buttons:

▲ Navigate
upward/sideways

▼ Navigate
downward/sideways

ESC **ESCAPE**
leave

⏎ **ENTER**
confirm

```
IO1   LSR   PLB          ECAT
IO2   TMP   ATT
ERR

+ 87.000 m
```

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.
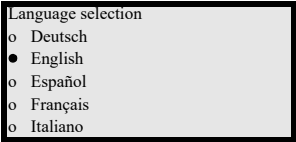- Activated interface.
- Measurement value

No entries can be made via the display.
See "Indicators in the display" on page 40.

▲ ▼

```
Parameter
    Parameter handling
    EtherCAT
    Position value
    I/O
    Other
```

Parameter - main menu

- Configuration of the AMS.

See "Parameter menu" on page 46.

Input of values

▲ ▼

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

◄ + ⏎   **Delete character**

🔢...🔢 + ⏎ **Enter digit**

save + ⏎ **Save input**

```
Language selection
o   Deutsch
●   English
o   Español
o   Français
o   Italiano
```
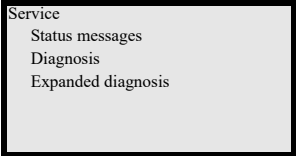
Language selection - main menu

- Selection of the display language.

See "Language selection menu" on page 50.

▲ ▼

```
Service
    Status messages
    Diagnosis
    Expanded diagnosis
```
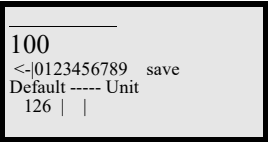
Service - main menu

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

No entries can be made via the display.
See "Service menu" on page 50.

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 338*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.

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

1.3   Description of functions AMS 338*i*

The AMS 338*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 338*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 response time are designed for position control applications.

With its AMS 3xx*i* 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*i* model.

PROFIBUS	SSI	AMS 304*i*
PROFINET		AMS 348*i*
DeviceNet		AMS 355*i*
EtherNet/IP		AMS 358*i*
CANopen		AMS 335*i*
EtherCAT		AMS 338*i*
Ethernet		AMS 308*i*
INTERBUS		AMS 384*i*
RS485		AMS 301*i*
RS232	RS422	AMS 300*i*

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 [1]
- 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.

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[1] 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** 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.

A Laser aperture
B Laser warning sign
C Laser information sign with laser parameters
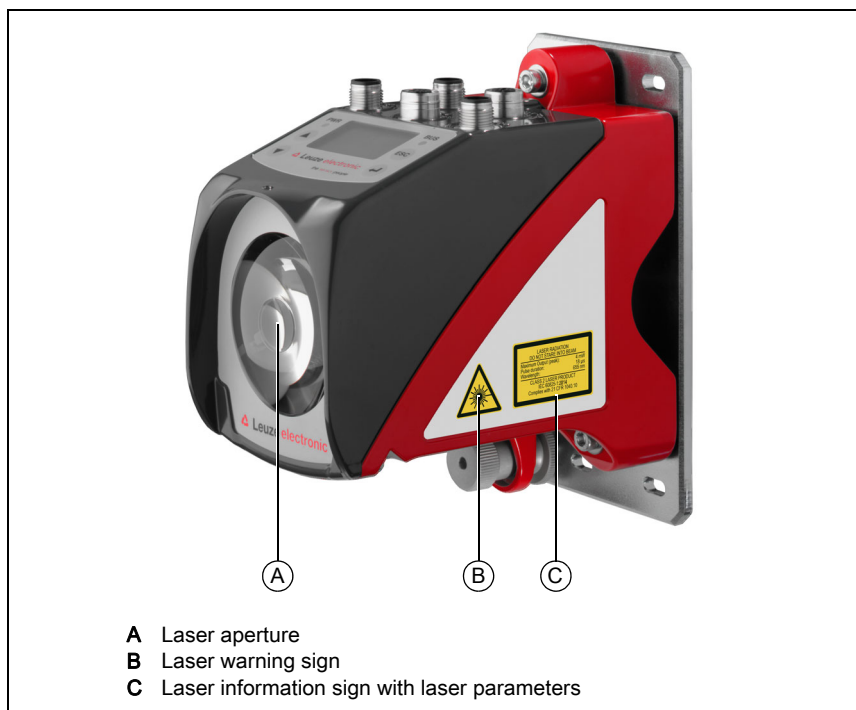
Figure 2.1: Laser apertures, laser warning signs
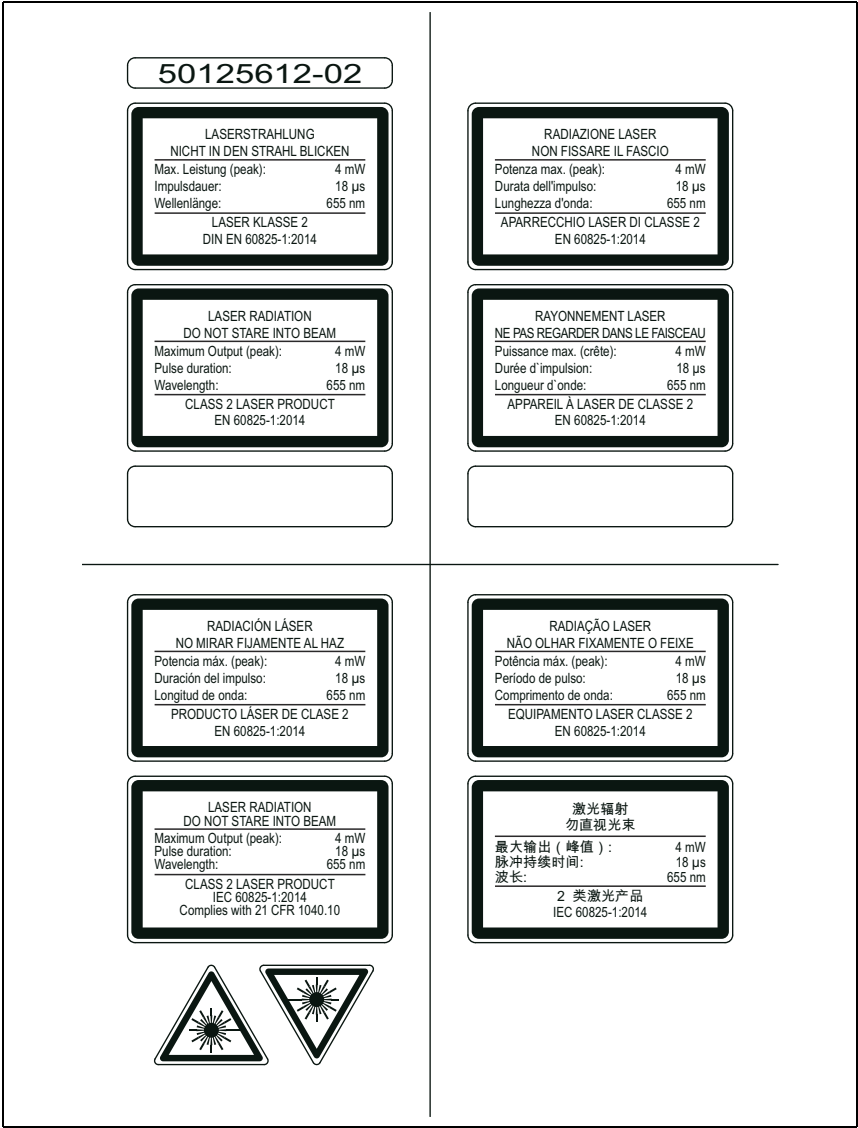
Figure 2.2: Laser warning and information signs – supplied stick-on labels

3   Fast commissioning / operating principle

Note!

*Below you will find a **short description for the initial commissioning** of the AMS 338**i**. Detailed explanations for the listed points can be found throughout the handbook.*

3.1   Mounting the AMS 338*i*

The AMS 338*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 338**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 (18 … 30 VDC). 2 freely programmable switching inputs/outputs for individual adaptation to the respective application are also available here.

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.

Detailed information can be found in Chapter 8.

3.4   AMS 338*i* on the EtherCAT

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 338*i*

Measurement data	AMS 338*i*40 (H)	AMS 338*i*120 (H)	AMS 338*i*200 (H)	AMS 338*i*300 (H)
Measurement range	0.2 … 40m	0.2 … 120m	0.2 … 200m	0.2 … 300m
Accuracy	± 2mm	± 2mm	± 3mm	± 5mm
Reproducibility [1]	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		7ms		
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		

Electrical data

Supply voltage Vin [2]	18 … 30VDC
Current consumption	Without device heating: ≤ 250mA / 24VDC
	With device heating: ≤ 500mA / 24VDC

Optical data

Transmitter	Laser diode, red light
Laser class	2 in acc. with IEC 60825-1:2014
Wavelength	655nm
Impulse duration	≤ 18µs
Max. output power (peak)	≤ 4mW

Interfaces

Interface type	EtherCAT
Baud rate	100Mbit/s
Vendor ID	0x121$_h$ or 289$_{Dec}$
Device type	0x00080196$_h$ (absolute linear encoder)

Controls and indicators

Keyboard	4 keys
Display	Monochromatic graphical display, 128 x 64 pixels
LED	4 LEDs, 2 of which are used to display the EtherCAT connection
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 [3]

Environmental conditions

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

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 [6]

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 connectors 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 338*i*.
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 338*i* is designed in accordance with protection class III for supply with PELV (protective extra-low voltage).

4.1.2   AMS 338*i* dimensioned drawing

A M5 screw for alignment
B Knurled nut with WAF 4 hexagon socket and
   M5 nut for securing
C Optical axis
D Zero point of the distance to be measured
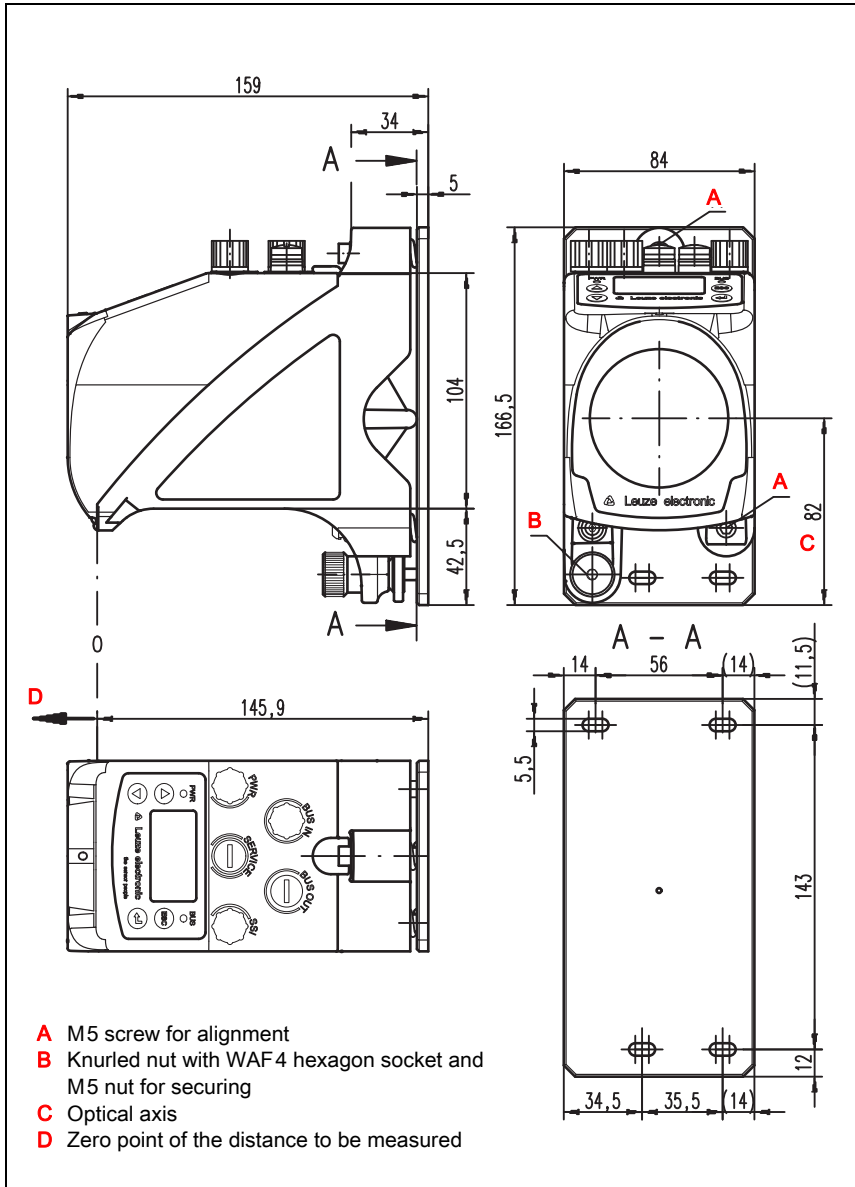
Figure 4.1: AMS 338*i* dimensioned drawing

4.1.3   Overview of AMS 338*i* types

AMS 338*i* (EtherCAT)

Type designation	Description	Part no.
AMS 338*i*40	40m operating range, EtherCAT interface	50113701
AMS 338*i*120	120m operating range, EtherCAT interface	50113702
AMS 338*i*200	200m operating range, EtherCAT interface	50113703
AMS 338*i*300	300m operating range, EtherCAT interface	50113704
AMS 338*i*40 H	40m operating range, EtherCAT interface, integrated heating	50113705
AMS 338*i*120 H	120m operating range, EtherCAT interface, integrated heating	50113706
AMS 338*i*200 H	200m operating range, EtherCAT interface, integrated heating	50113707
AMS 338*i*300 H	300m operating range, EtherCAT interface, integrated heating	50113708

Table 4.1:   Overview of AMS 338*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 338*i* type your device is. For specific information, please refer to Chapter 11.1.1.

Name plates
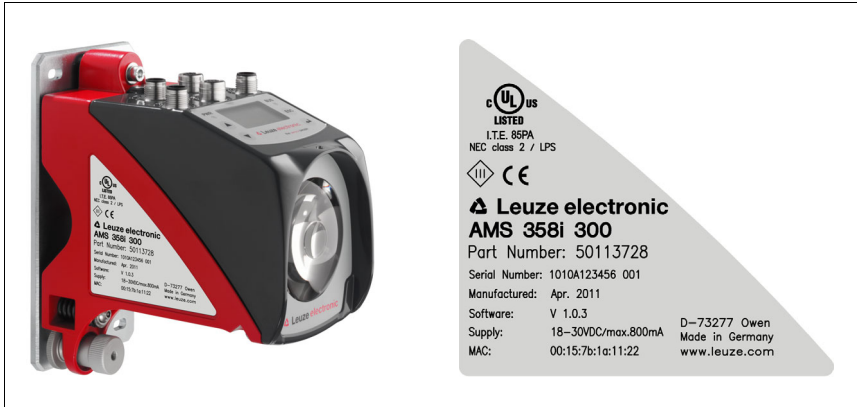
Figure 5.1: Device name plate using the AMS 358*i* as an example

ℹ️ *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 338*i*

A M5 screw for align-ment
B Knurled nut and nut with WAF 4 hexagon socket for securing
C Optical axis
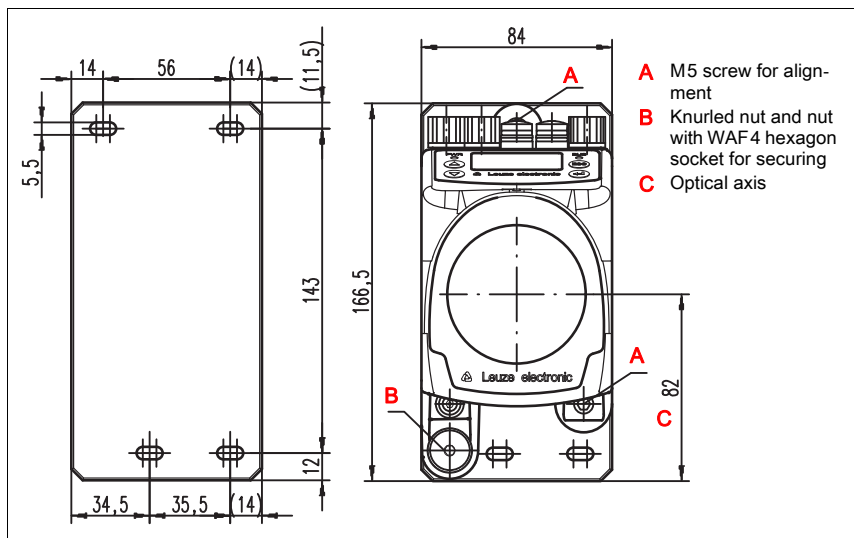
Figure 5.2: Mounting the device

The AMS 338*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 between the AMS 338*i* 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 338*i* on a flat, horizontal surface is available as an optional accessory.

Type designation: MW OMS/AMS 01

Part no.:   50107255

A   Laser beam
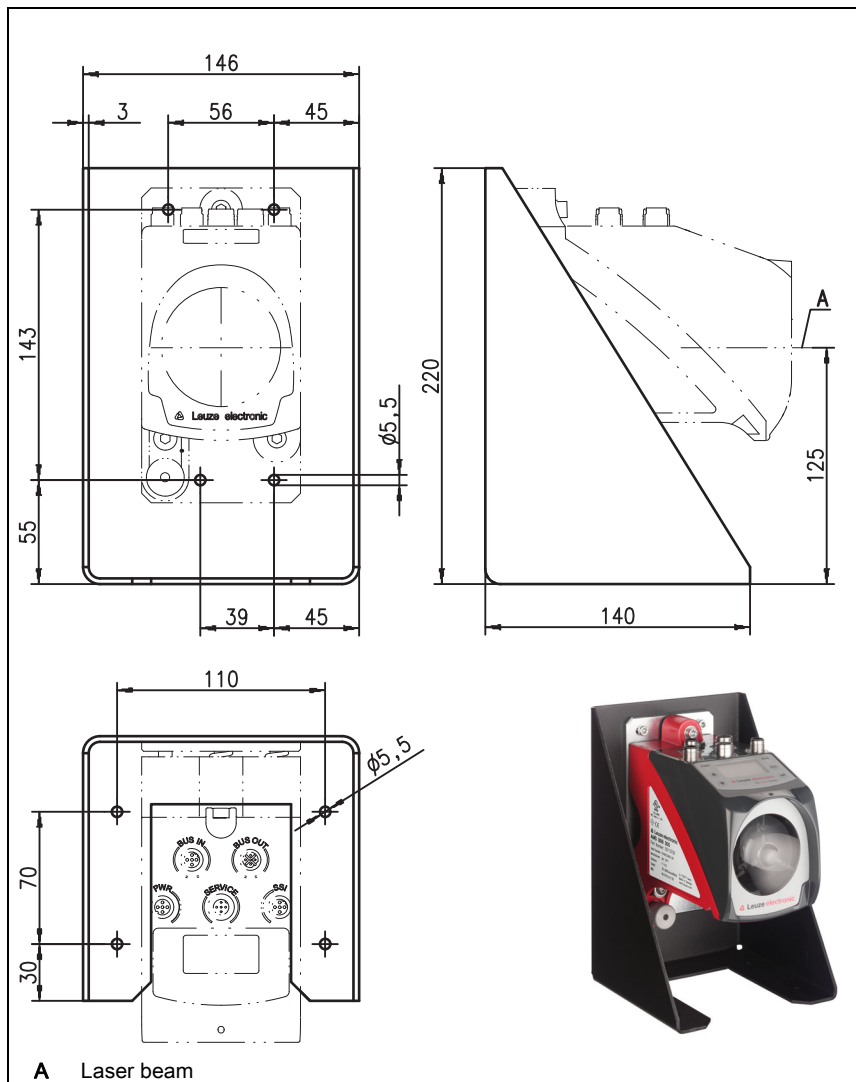
Figure 5.3: Optional mounting bracket

5.2.2   Parallel mounting of the AMS 338*i*

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.
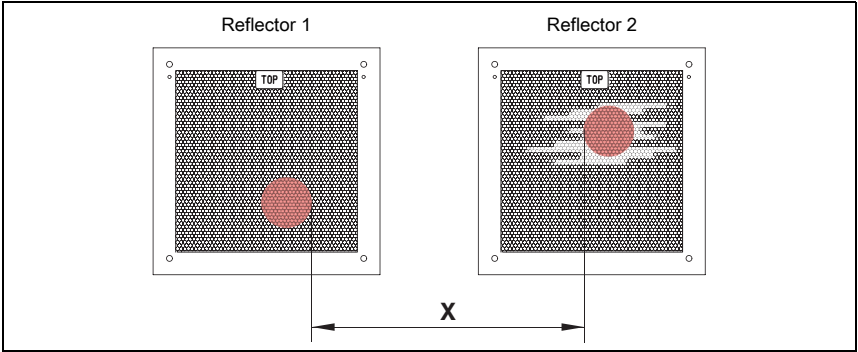
Figure 5.4: Minimum parallel spacing X between adjacent AMS 338*i*

The diameter of the light spot increases with distance.

	AMS 338*i*40 (H)	AMS 338*i*120 (H)	AMS 338*i*200 (H)	AMS 338*i*300 (H)
Max. measurement distance	40 m	120 m	200 m	300 m
Light spot diameter	≤ 40 mm	≤ 100 mm	≤ 150 mm	≤ 225 mm

Thus, the center-to-center spacing of the two AMS 338*i* 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 338*i*, it is necessary to distinguish between three different arrangements of AMS 338*i* and reflectors.

The AMS 338*i* are mounted stationary and in parallel on one plane.
Both reflectors move independently of one another at different distances to the AMS 338*i*.
Minimum parallel spacing X of the two laser light spots:

X = 100 mm + (max. measurement distance in mm x 0.01)

The AMS 338*i* are mounted stationary and in parallel on one plane.
Both reflectors move in parallel at the same distance to the AMS 338*i*.
Measurement distance **up to 120 m**: minimum parallel spacing **X ≥ 600 mm**
Measurement distance **up to 200 m**: minimum parallel spacing **X ≥ 750 mm**
Measurement distance **up to 300 m**: minimum parallel spacing **X ≥ 750 mm**

The reflectors are mounted stationary and in parallel on one plane.
Both AMS 338*i* move independently of one another at different or the same distances to the reflectors.

Measurement distance **up to 120 m**: minimum parallel spacing **X ≥ 600 mm**

Measurement distance **up to 200 m**: minimum parallel spacing **X ≥ 750 mm**

Measurement distance **up to 300 m**: minimum parallel spacing **X ≥ 750 mm**

Note!

Please note that when the AMS 338 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 338 i.

5.2.3   Parallel mounting of AMS 338*i* and DDLS optical data transmission

The optical data transceivers of the DDLS series and the AMS 338*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 100 mm to the AMS 338*i*. The parallel spacing is independent of the distance.

5.3 Mounting the AMS 338*i* 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 89.

⚠️ **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 338*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 system parts. For error-free position measurement, there must be an unobstructed line-of-sight between the AMS 338*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 lock washer to protect against loosening caused by vibrations.
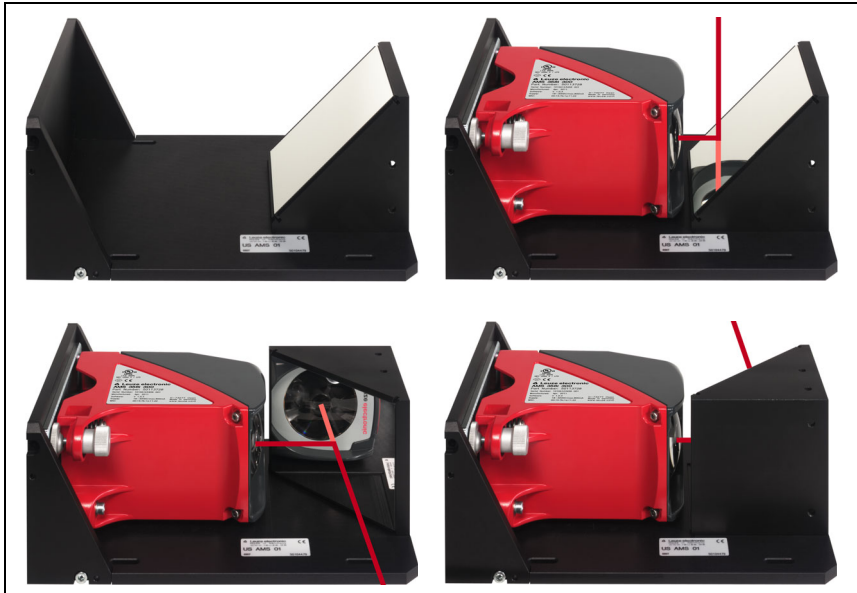
Figure 5.5: Mounting variants of the US AMS 01 laser beam deflector unit

5.3.2   Dimensioned drawing of US AMS 01 deflector unit

A   Laser beam
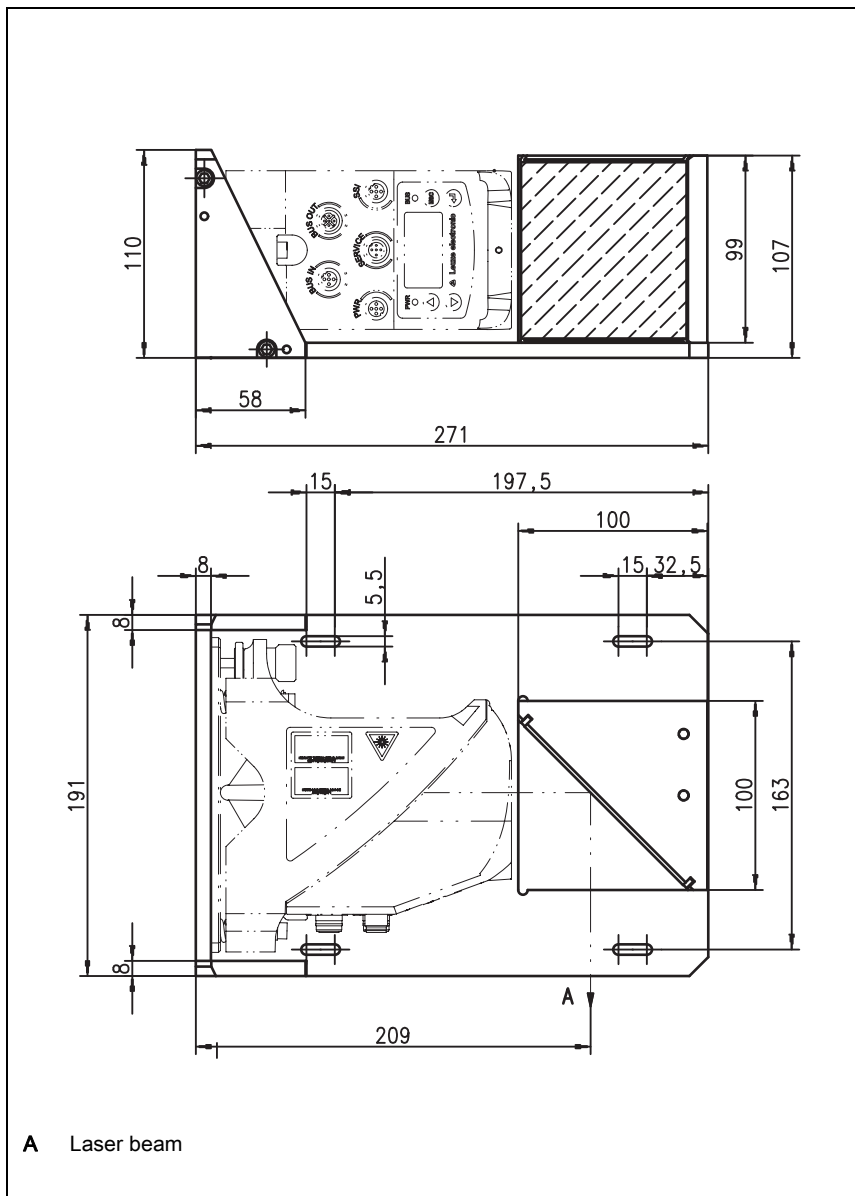
Figure 5.6: Dimensioned drawing of US AMS 01 deflector unit

5.3.3 Mounting the US 1 OMS deflector unit without mounting bracket

The US 1 OMS deflector unit and the AMS 338*i* are mounted separately.

Note!

When mounting, make certain that the laser light spot of the AMS 338i is aligned with the center of the deflection mirror.
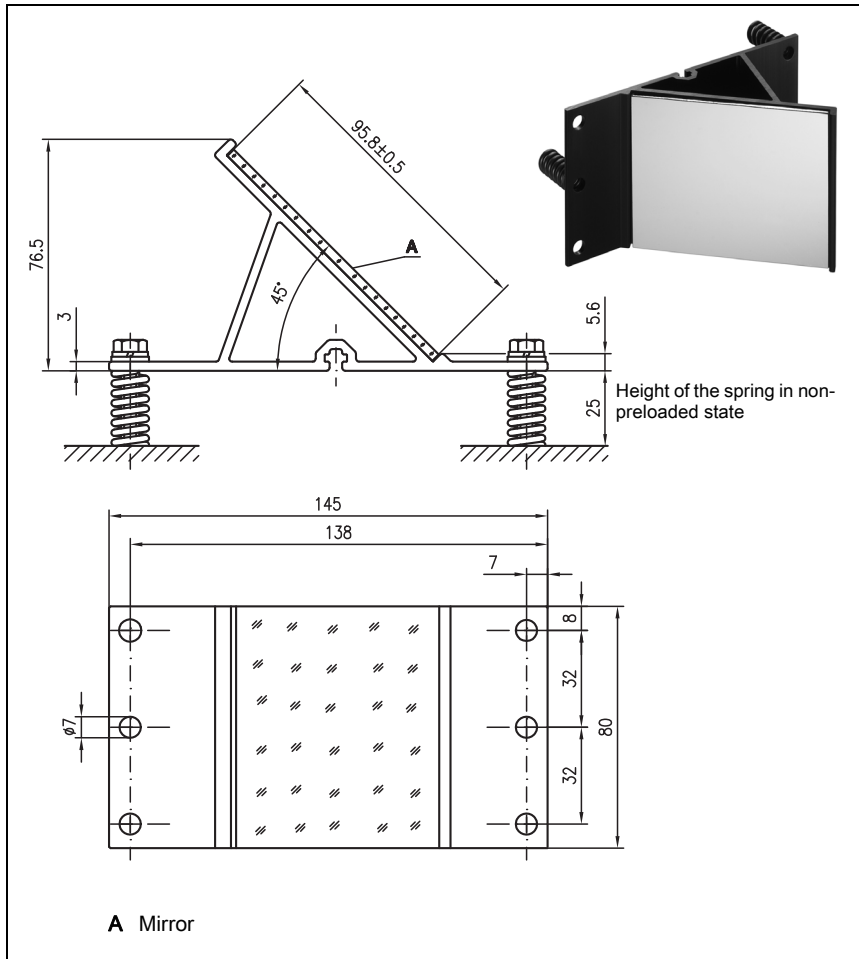
Figure 5.7: Photo and dimensioned drawing of the US 1 OMS deflector unit

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

6 Reflectors

6.1 General information

The AMS 338*i* measures distances against a reflective tape specified by Leuze. All technical data given for the AMS 338*i*, 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 338*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 36.

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 200x200-S	Reflective tape 500x500-S	Reflective tape 914x914-S	REF 4-A-150x150	REF 4-A-300x300
Part no.	50104361	50104362	50108988	50141015	50141014
Film size	200 x 200 mm	500 x 500 mm	914 x 914 mm	150 x 150 mm	300 x 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 carrier 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 200x200-M	Reflective tape 500x500-M	Reflective tape 914x914-M
Part no.	50104364	50104365	50104366
Film size	200 x 200 mm	500 x 500 mm	914 x 914 mm
Outer dimensions of carrier plate	250 x 250 mm	550 x 550 mm	964 x 964 mm
Weight	0.4 kg	1.6 kg	6 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

Always align the **TOP** marking with the AMS connections! (Chapter 6.4.2)
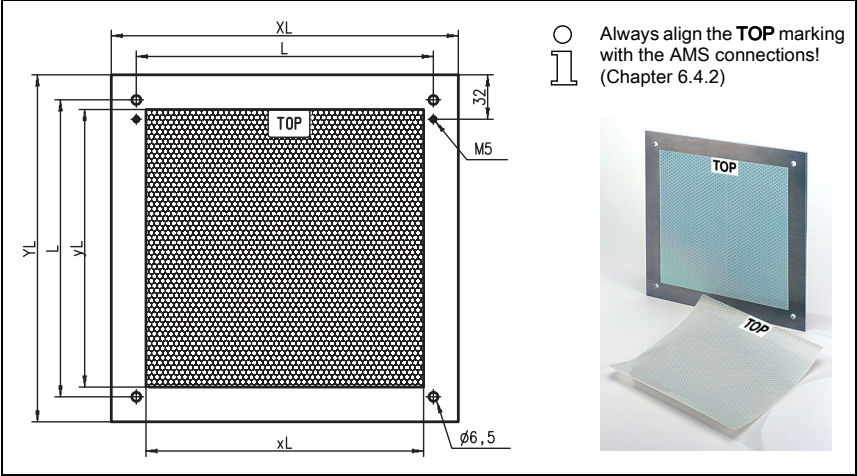
Figure 6.1: Dimensioned drawing of reflectors

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 200x200-H	Reflective tape 500x500-H	Reflective tape 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
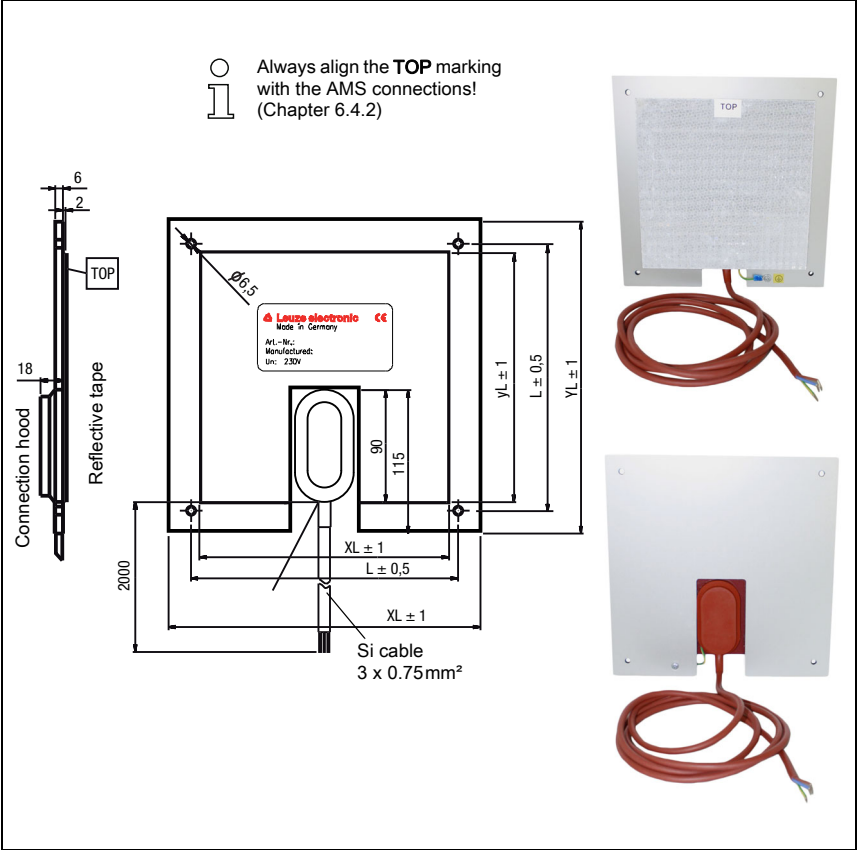
Figure 6.2: Dimensioned drawing of heated reflectors

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 338i. For stationary mounting of the AMS 338i, 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 338i, 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 338i (operating range in m)	**Recommended reflector size (H x W)**	**Type designation** …-S = self-adhesive …-M = Carrier plate …-H = heating	**Part no.**
AMS 338i 40 (max. 40m)	200x200 mm	REF 4-A-150x150[1) Reflective tape 200x200-S Reflective tape 200x200-M Reflective tape 200x200-H REF 4-A-300x300[1)	50141015 50104361 50104364 50115020 50141014
AMS 338i 120 (max. 120m)	500x500 mm	Reflective tape 500x500-S Reflective tape 500x500-M Reflective tape 500x500-H	50104362 50104365 50115021
AMS 338i 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 338i 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

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 2 m-long connection cable for supplying with 230 V AC. 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 338*i*… (see chapter 5.2 "Mounting the AMS 338i"). 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 338i.

Example:
If the AMS 338*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 338i is mounted so that the M12 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

Pitch approx. 1°

Direct reflection due to the triple structure

Deflected surface reflection due to the pitch of the reflective tape
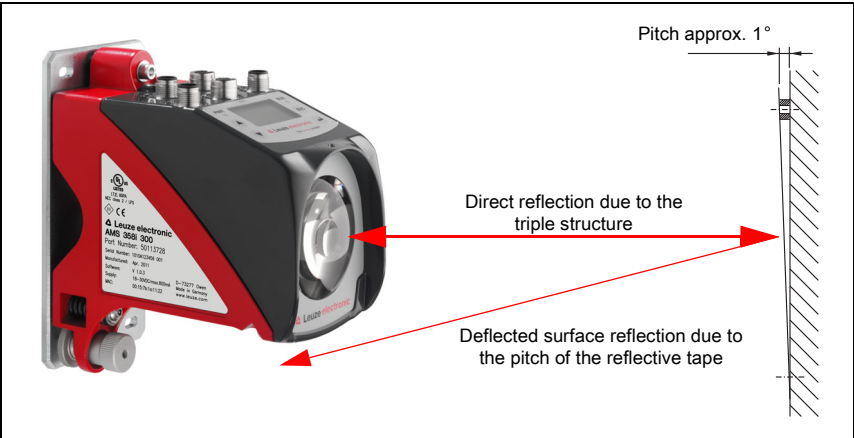
Figure 6.3: Mounting the reflector

Pitch approx. 1°

Spacer sleeves

TOP
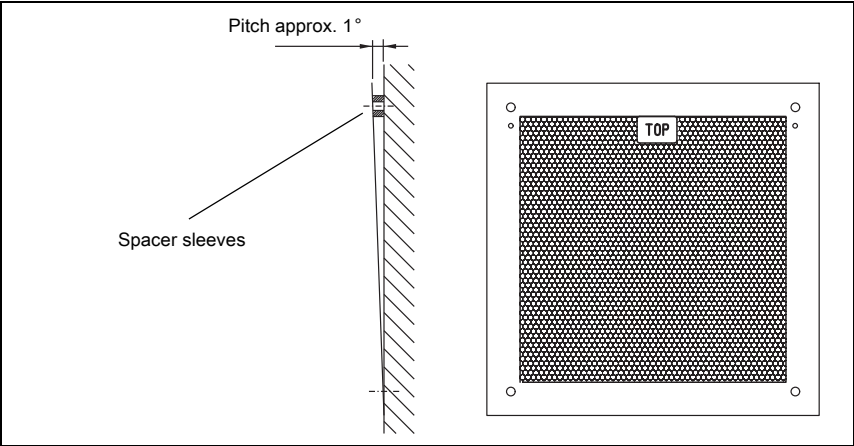
Figure 6.4: Pitch of the reflector

Reflective tapes …-H

Pitch approx. 1°

Direct reflection due to the triple structure

Deflected surface reflection due to the pitch of the reflective tape
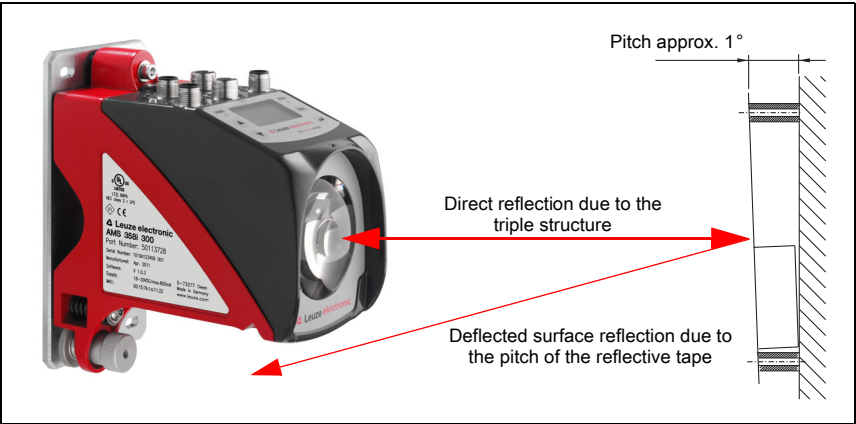
Figure 6.5: Mounting of heated reflectors

Pitch approx. 1°

Spacer sleeves

TOP
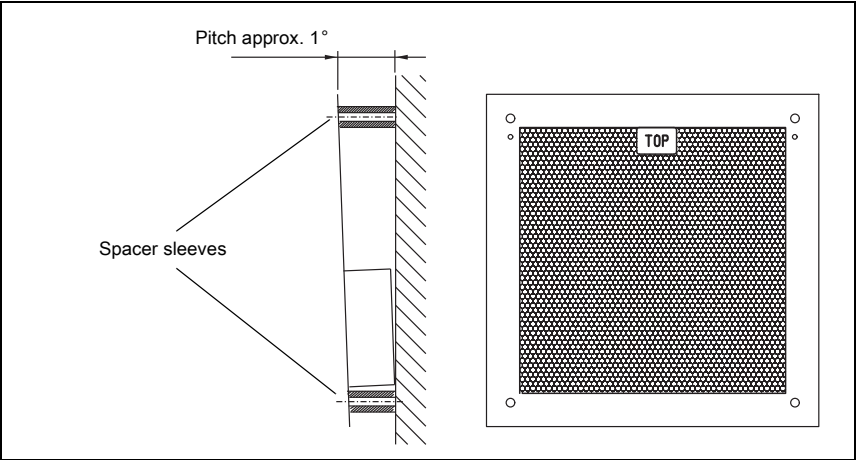
Figure 6.6: Pitch of the heated reflector

6.4.3   Table of reflector pitches

Reflector type	Pitch resulting from spacer sleeves [1]	
Reflective tape 200x200-S Reflective tape 200x200-M	**2 x 5mm**	
Reflective tape 200x200-H	**2 x 15mm**	**2 x 20mm**
Reflective tape 500x500-S 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 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 338***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 338*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".

BUS IN
M12 socket
(D-coded)

BUS OUT
M12 socket
(D-coded)

PWR / IOs
M12 connector
(A-coded)

Leuze SERVICE
M12 socket
(A-coded)

Figure 7.1: Connections of the AMS 338*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
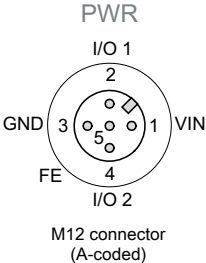
PWR (5-pin connector, A-coded)			
PWR	**Pin**	**Name**	**Comment**
	1	VIN	Positive supply voltage +18 … +30VDC
	2	I/O 1	Switching input/output 1
	3	GNDIN	Negative supply voltage 0VDC
	4	I/O 2	Switching input/output 2
	5	FE	Functional earth
M12 connector (A-coded)	Thread	FE	Functional earth (housing)

Table 7.1:   Pin assignments - PWR

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

7.3 EtherCAT BUS IN
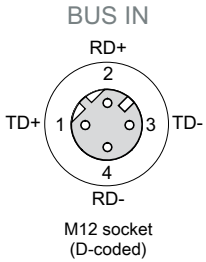
BUS IN (4-pin socket, D-coded)			
BUS IN	**Pin**	**Name**	**Comment**
	1	TD+	Transmit Data +
	2	RD+	Receive Data +
	3	TD-	Transmit Data -
	4	RD-	Receive Data -
M12 socket (D-coded)	Thread	FE	Functional earth (housing)

Table 7.2:   BUS IN pin assignment

7.4 EtherCAT BUS OUT
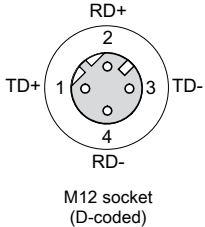
BUS OUT (4-pin socket, D-coded)			
BUS OUT RD+ 2 TD+ 1 ⊙ 3 TD- 4 RD- M12 socket (D-coded)	**Pin**	**Name**	**Comment**
	1	TD+	Transmit Data +
	2	RD+	Receive Data +
	3	TD-	Transmit Data -
	4	RD-	Receive Data -
	Thread	FE	Functional earth (housing)

Table 7.3:   Pin assignment BUS OUT

7.5 Service
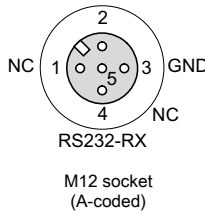
Service (5-pin socket, A-coded)			
SERVICE RS232-TX 2 NC 1 ⊙5 3 GND 4 NC RS232-RX M12 socket (A-coded)	**Pin**	**Name**	**Comment**
	1	NC	Not assigned
	2	RS232-TX	Transmission line RS 232/service data
	3	GND	Voltage supply 0 VDC
	4	RS232-RX	Receiving line RS 232/service data
	5	NC	Not used
	Thread	FE	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 338*i*

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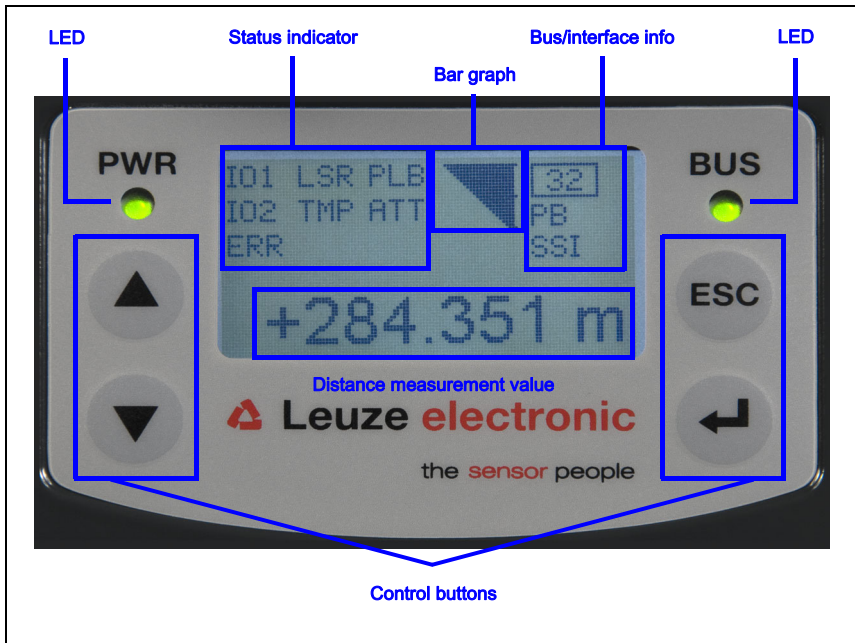
Figure 8.1: Structure of the control panel using the AMS 304*i* PROFIBUS device variant as an example

Note!

The figure is for illustration purposes only and does not correspond to the AMS 338i 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 abbreviation "ECAT" indicates an activated EtherCAT interface.
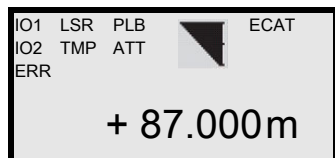
Activated interface

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 338*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

PWR

Orange continuous light   **Power LED orange**
- Parameter enable active
- No data on the host interface

BUS LED

BUS

Off   **BUS LED off**
- No voltage supply
- State "INIT"

BUS ☀️	**Flashing green**	**BUS LED flashes green** - "PRE-OPERATIONAL" state - "SAFE-OPERATIONAL" state
BUS 🟢	**Green continuous light**	**BUS LED green** - "OPERATIONAL" state
Net ☀️	**Flashing green/red**	**BUS LED flashes green/red** - Bus error - Time out - Process Data Watchdog Timeout
BUS ☀️	**Flashing red**	**BUS LED flashes red** - Invalid configuration

LINK LED for BUS IN and BUS OUT

A green/yellow multicolor LED below the BUS IN and BUS OUT connectors indicates the EtherCAT connection status.

LINK LED for BUS IN   LINK LED for BUS OUT

🟢	**Green continuous light**	**LINK LED green** - The link exists, the hardware connection to the next connected participant is OK.
🟠	**Flashing yellow**	**LINK LED flashes yellow** - Data is exchanged with the connected participants.

8.2.3   Control buttons

▲	**Up**	Navigate upward/sideways.
▼	**Down**	Navigate downward/sideways.
ESC	**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 (ESC) 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.
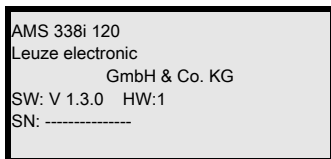
```
AMS 338i 120
Leuze electronic
            GmbH & Co. KG
SW: V 1.3.0    HW:1
SN: --------------
```

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
Address:        1
Alias:          1
Status:         INIT, PRE, SAFE, O
P
```

Network information - main menu

- Explanations of address, alias, status.

No entries can be made via the display.

▲ ▼

```
IO1  LSR  PLB          ECAT
IO2  TMP  ATT
ERR

      + 87.000 m
```
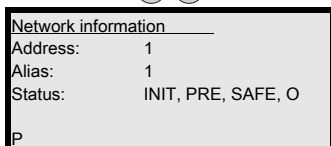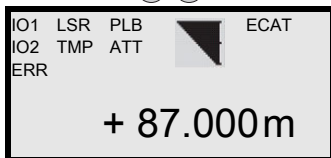
Status and measurement data - main menu

- 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 40..

▲ ▼

```
Parameter
   Parameter handling
   EtherCAT
   Position value
   I/O
   Other
```
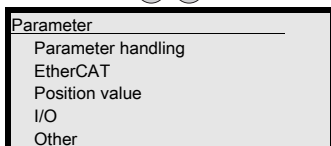
Parameter - main menu

- Configuration of the AMS.

See "Parameter menu" on page 46.

▲ ▼

```
Language selection
o  Deutsch
o  English
o  Español
o  Français
o  Italiano
```

Language selection - main menu

- Selection of the display language.

See "Language selection menu" on page 50.

▲ ▼

```
Service
   Status messages
   Diagnosis
   Expanded diagnosis
```
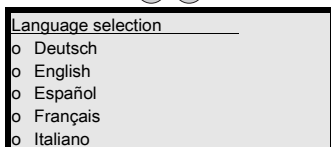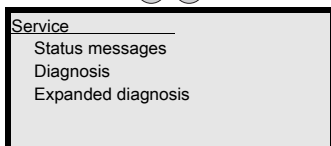
Service - main menu

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

No entries can be made via the display.
See "Service menu" on page 50.

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 338*i* to the default settings

Table 8.1:   Parameter handling submenu

Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
Parameter enable			ON/OFF The standard setting (OFF) prevents unintended parameter changes. 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 To enter a password, parameter enable must be activated. If a password is assigned, changes to the AMS 338*i* can only be made after the password is entered. 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. 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.

EtherCAT submenu

Tabelle 8.2:   EtherCAT submenu

Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
Activation			ON/OFF	ON
Address (station alias)			Configuration option 0 - 65535	0

Note regarding the second station address - in short SSA- (formerly station alias)

The SSA is a freely configurable position-independent address which is often used for the so-called hot connect. The values range from 0 to 65535. The SSA is persistently stored on the AMS 338i and is available after the next start-up. A second option is to write the SSA to

the Eeprom and the associated ESC register via the master (typically TwinCAT). In this case, too, the SSA is persistently stored in the AMS 338i. The master (TwinCAT) can determine whether it wants to use the EtherCAT address (auto-increment address) or the SSA to address the AMS. For SSA, the position-dependent EtherCAT address is also set to the value of the SSA. Otherwise, the auto-increment address is entered into the ESC register which contains the EtherCAT address. The EtherCAT address is not stored in persistence memory, but written into the respective register by the master when the status changes from INIT to PREOP.

Position value submenu

Note!

All parameters mentioned must be entered via startup parameters of the control software (TwinCAT). If parameters from the position value submenu are changed via the display, these are overwritten via the startup sequence created in the control with the values stored there.

Table 8.3:   Position value submenu

Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
Unit			Metric/Inch Specifies the units of the measured distances	Metric
Counting 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 "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 0.875mm per digit is required, the parameter is set to 875.	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 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 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 con-figuration		Input/Output Defines whether I/O 1 functions as an output or input.	Output
	Switching input	Function	No function/teach preset/laser ON/OFF	No function
		Activa-tion	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), hard-ware (ERR)
		Activa-tion	Low active/High active	Low active
I/O 2	Port con-figuration		Input/Output Defines whether I/O 2 functions as an output or input.	Output
	Switching input	Function	No function/teach preset/laser ON/OFF	No function
		Activa-tion	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)
		Activa-tion	Low active/High active	Low active
Limit values	Upper pos. limit 1	Activa-tion	ON/OFF	OFF
		Limit value input	Value input in mm or inch/100	0
	Lower pos. limit 1	Activa-tion	ON/OFF	OFF
		Limit value input	Value input in mm or inch/100	0
	Upper pos. limit 2	Activa-tion	ON/OFF	OFF
		Limit value input	Value input in mm or inch/100	0
	Lower pos. limit 2	Activa-tion	ON/OFF	OFF

Table 8.4:   I/O submenu

Level 3	Level 4	Level 5	Selection/configuration option Description	Standard
		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 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. This parameter is available as standard, but functions only for devices with integrated heating (AMS 338*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		57.6 kbit/s / 115.2 kbit/s The service interface is only available to Leuze personnel.	115.2 kbit/s
	Format		8,e,1 / 8,n,1 The service interface is only available to Leuze personnel.	8,n,1

8.3.3 Language selection menu

```
Language selection
o  Deutsch
●  English
o  Español
o  Français
o  Italiano
```
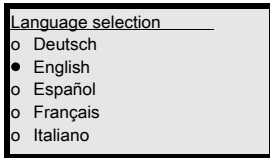
5 display languages are available:

- German
- English
- Spanish
- French
- Italian

The AMS 338*i* is delivered from the factory with the display preset to English.

Note!

When operating the AMS 338i on the EtherCAT, the language configured is used in the display.

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

```
Service
 Status messages
 Diagnosis
 Expanded diagnosis
```
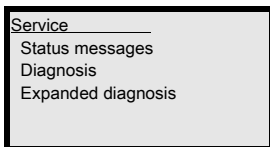
A detailed description of the individual functions can be found in Chapter 10.

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.
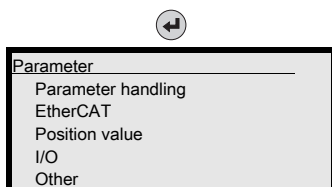
<table>
<tr>
<td>

Parameter
   Parameter handling
   EtherCAT
   Position value
   I/O
   Other

</td>
<td>

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

Use the ▲▼ buttons to select the Parameter handling menu item.

</td>
</tr>
<tr>
<td>

Parameter handling
o   Parameter enable
o   Password
☐   Parameters to default

</td>
<td>

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.

</td>
</tr>
<tr>
<td>

Parameter enable
o   OFF
o   ON

</td>
<td>

Press the enter button to enter the Parameter enable menu.

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

</td>
</tr>
<tr>
<td>

Parameter enable
o   OFF
●   ON

</td>
<td>

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.

</td>
</tr>
</table>
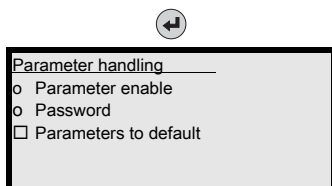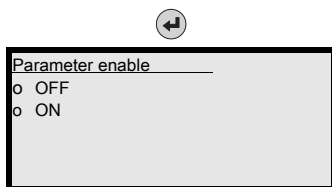
Press the ESC button twice to return to the Parameter menu.

⚠ **Viewing and editing parameters**

As long as parameter enable is active, the entire AMS 338*i* display is inverted.

As long as parameter enable is active, communication between control and AMS 338*i* is interrupted. The extended networking via BUS OUT is retained.

Note!

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 338*i* can be protected with a password. The password can be changed via the CoE online dictionary, object $0x2300_h$, sub-index $0x05_h$.

For parameter enable via the display, the password must be entered. If parameter enable has been activated after successfully entering the password, parameters can be temporarily changed via the display.

After parameter enable has been deactivated, all changes made at the display are overwritten by the CoE online dictionary, object $0x2300_h$, sub-index $0x05_h$ (see above). If a new password has been assigned, this, too, is overwritten by the password defined in the online dictionary.

Note!

The **master password 2301** *can enable the* AMS 338*i at any time.*

9 EtherCAT interface

9.1 General information on EtherCAT

EtherCAT is an Ethernet-based fieldbus initiated by the Beckhoff corporation. The EtherCAT Technology Group (ETG) is the official standardization partner of the IEC working groups.

EtherCAT has been an IEC standard since 2005.

- IEC 61158: Protocols and services
- IEC 61784-2: Communication profiles for the specific device classes

All EtherCAT-specific communication mechanisms are described in detail in the standards mentioned above. The technical description of the AMS 338*i* describes parts of the IEC standard if this assists general understanding.

9.2 EtherCAT topology

EtherCAT permits a multitude of topologies such as line, tree, ring, star and combinations of these. The bus or line structure known from the fieldbuses is thus also available for EtherCAT.

Telegrams are sent on a wire pair in the "processing direction" from the master to the slave. The EtherCAT device processes the frames only in this direction and passes them on to the subsequent device until the telegram has passed through all devices. The last device sends the telegram back to the master on the second wire pair in the cable in the "forward direction". Here, the EtherCAT always forms a logical ring structure regardless of the topology installed.

From an Ethernet point of view, an EtherCAT bus segment is nothing more than a single, large Ethernet participant which sends and receives Ethernet telegrams. Within the "participant", however, there is a multitude of EtherCAT slaves rather than one single Ethernet controller.
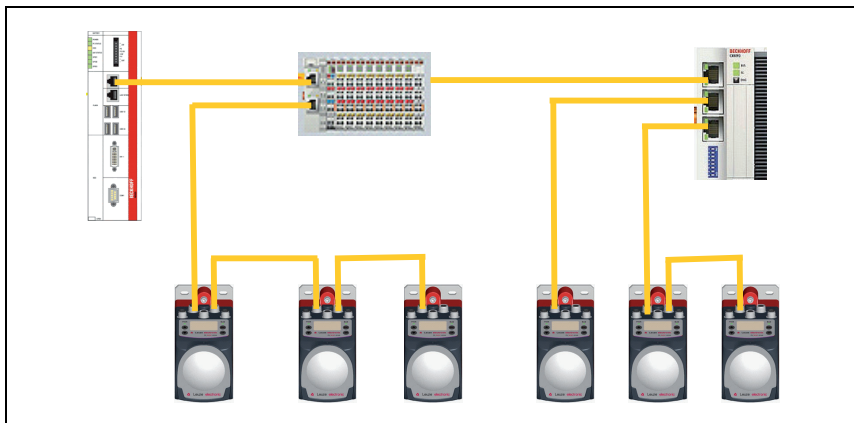
Figure 9.1: Topology example

9.3   EtherCAT – General information on wiring

Wiring is performed using the industry-standard Industrial Ethernet fieldbus cables. On the AMS 338*i*, D-coded M12 connectors are used for the EtherCAT connection. A Cat. 5 Ethernet cable should be used for wiring.

Leuze offers cables with preassembled D-coded M12 connectors at one end and open cable at the other end.

For further information, see chapter 7 "Electrical connection" and see chapter 11.3.5 "Accessory ready-made cables for EtherCAT".

The connection between the individual AMS 338*i* devices in a linear topology is performed with the "KB ET - … - SSA" cable, with preassembled D-coded M12 connector at each end; see Table "Order codes for EtherCAT connection cables" on page 92.

If the desired cable lengths are not available, you can assemble the cables yourself. For this purpose, Leuze offers a D-coded M12 round connector for BUS IN and BUS Out. When doing so, make certain that you connect TD+ on the M12 connector with RD+ on the RJ-45 connector and TD- on the M12 connector with RD- on the RJ-45 connector, respectively, etc.

For the connection technology transition from M12 to RJ45, a "KDS ET M12 / RJ 45 W - 4P" adapter is available.

Address Link Label:

The "Address Link Label" is an additional stick-on label that is affixed to the device.

AMS 348i MAC	00:15:7B:20:00:15
IP	
Name	
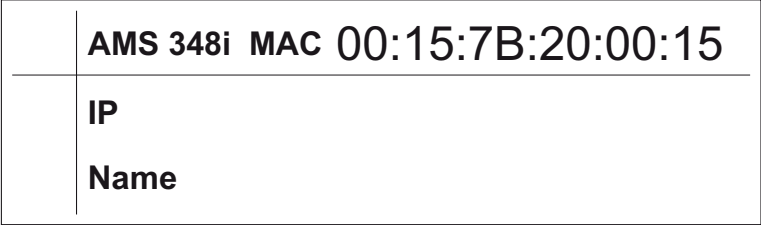
Figure 9.2: Example of an "Address Link Label"; the device type varies depending on the series

- The "Address Link Label" contains the MAC address (Media Access Control address) of the device and makes it possible to enter the IP address and the device name manually. The area of the "Address Link Label" on which the MAC address is printed can be separated from the remainder of the stick-on label if necessary using the perforation.
- The "Address Link Label" can be removed from the device and affixed in the installation and layout diagrams to designate the device.
- Once it is affixed in the documents, the "Address Link Label" establishes a unique reference between the mounting location, the MAC address or the device, and the associated control program. The time-consuming searching, reading, and manually writing down of the MAC addresses of all devices installed in the system are eliminated.

Note!

Each device with Ethernet interface is uniquely identified via the MAC address assigned during production. The MAC address is also listed on the name plate of the device. If multiple devices are commissioned in a system, the MAC address of each installed device must be correctly assigned, e.g., during programming of the control.

↳ *Remove the "Address Link Label" from the device.*

↳ *If necessary, add the IP address and the device name to the "Address Link Label".*

↳ *Affix the "Address Link Label" in the documents, e.g., in the installation diagram, according to the position of the device*

9.4 EtherCAT – Cable lengths and shielding

↳ *Observe the following maximum cable lengths and shielding types:*

Connection	Interface	Max. cable length	Shielding
AMS – host	EtherCAT	100 m	Absolutely required
Network from the first AMS to the last AMS	EtherCAT	The maximum segment length must not exceed 100 m for 100Base-TX Twisted Pair (min. Cat. 5)	Absolutely required

Table 9.1:   Cable lengths and shielding

9.5　　EtherCAT electrical connection

BUS IN

RD+
2
TD+　1　　3　TD-
4
RD-
**M12 socket
(D-coded)**

BUS OUT

RD+
2
TD+　1　　3　TD-
4
RD-
**M12 socket
(D-coded)**

BUS IN (4-pin socket, D-coded)		
Pin	**Name**	**Comment**
1	**TD+**	Transmit Data +
2	**RD+**	Receive Data +
3	**TD-**	Transmit Data -
4	**RD-**	Receive Data -
Thread	**FE**	Functional earth (housing)

BUS OUT (4-pin socket, D-coded)		
Pin	**Name**	**Comment**
1	**TD+**	Transmit Data +
2	**RD+**	Receive Data +
3	**TD-**	Transmit Data -
4	**RD-**	Receive Data -
Thread	**FE**	Functional earth (housing)
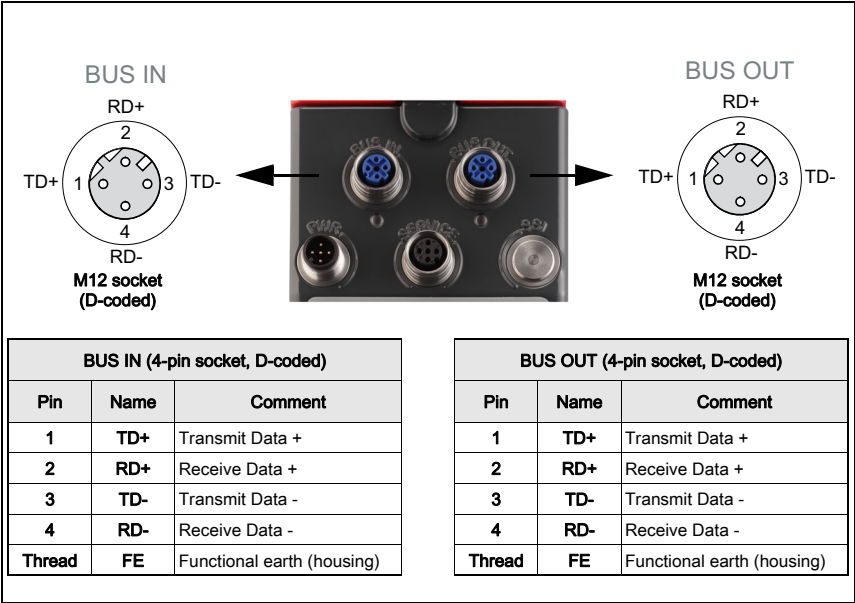
Figure 9.3:　EtherCAT - Electrical connection

Note!

*For connecting **BUS IN** and **BUS OUT**, we recommend our ready-made EtherCAT cables (see chapter 11.3.5 "Accessory ready-made cables for EtherCAT").*

To set up an EtherCAT network, the AMS 338*i* provides a receiving bus under the BUS IN designation given on the device, or a forwarding bus under BUS OUT. On a stub cable, the AMS 338*i* can be connected to BUS OUT or BUS IN.

↳ *For the connection of two AMS 338i, the "KB ET - … - SSA" ready-made cables are preferred, see Table "Order codes for EtherCAT connection cables" on page 92.*

If you use ready-made cables, note the following:

Note!

*The entire interconnection cable must be shielded. The shielding connection must be at the same potential at both ends of the data line. This serves to prevent potential equalization currents over the shield and possible interference coupling through compensating currents. The signal lines must be stranded in pairs.
Use CAT 5 cables for the connection.*

Note!

For the AMS 338i as standalone device or as the last participant in a linear topology, termination on the BUS OUT socket is not mandatory!

9.6 Starting AMS 338i on EtherCAT

INIT

The AMS 338i initializes itself. No direct communication between the master and AMS 338i is possible. The EtherCAT master will transit the AMS 338i step by step into the "operational" state.

In the status change from "INIT" to "PREOP", the TwinCAT or master writes the so-called EtherCAT address (=station address) to the respective register of the EtherCAT slave controller (here: AMS 338i). This EtherCAT address is typically specified in relation to the position, i.e., the master's address is 1000, the first slave's address is 1001, etc. This is also called the auto-increment method.

PRE-OPERATIONAL

The master and the AMS 338i exchange application-specific initializations and device-specific parameters. In the PRE-OPERATIONAL state, configuration is initially possible via SDOs only.

SAFE-OPERATIONAL

The "Start Input Update" command puts the measurement system into the "Safe-Operational" state. The master produces output data, but input data is not considered. This means the AMS 338i does not return output data (= PLC input data) in SAFEOP. The AMS does not process input process data (= PLC output data). Mailbox communication via CoE services is possible.

OPERATIONAL

The "Start Output Update" command puts the measurement system into the OPERATIONAL state. In this state, the AMS 338i supplies valid input data and the master valid output data. After the AMS 338i has detected the data received via the process data service, the state transition is confirmed by the AMS 338i. If the activation of the output data was not possible, the measurement system remains in the SAFE OPERATIONAL state and outputs an error message.

9.7   CANopen over EtherCAT

EtherCAT provides the communication mechanisms described below. In this context, the SDO accesses to the online dictionary via CoE (CANopen over EtherCAT) are carried out via mailbox services. PDO services via CoE mailboxes are not supported.

- Object index
- PDO, process data object
- SDO, service data object
- NMT, network management

Master and slave must be located in the same EtherCAT network.

9.7.1   Device profile

The device profile describes the application parameters and the functional behavior of the AMS 338*i*. For EtherCAT, one does not specify individual device profiles for device classes. Instead, simple interfaces for existing device profiles are provided.

The AMS 338*i* supports the "Device Profile for Encoder" DS406 known from CANopen.

9.7.2   Device description file

The object directory of the AMS 338*i* is saved for the user in a so-called ESI file (EtherCAT Slave Information).

The ESI file contains all objects with index, sub-index, name, data type, default value, minimum and maximum, and access privileges.

The ESI file describes the entire functionality of the AMS 338*i*.

The ESI file has the name AMS 338*i*.xml and is available for download on the Leuze home page **www.leuze.com**.

Vendor ID for the AMS 338*i*

The Vendor ID assigned by Leuze for the AMS 338*i* is 121_h = 289_d.

9.7.3   Object index

Overview of EtherCAT-specific object area of AMS 338*i*

All process data and parameters are stored as objects in the AMS 338*i*. The object directory of the AMS 338*i* is the compilation of all process data and parameters of the AMS.

The following overview table shows the specific communication objects supported by the AMS 338*i*.

Object address in hex	EtherCAT-specific object area
1000	Device type
1001	Error register
1018	Identity object (contains general information regarding the device)
1A00	TPDO 1 position value and status synchronous
1A02	TPDO 3 velocity value and status synchronous

Overview of manufacturer-specific object area of AMS 338*i*

Object address in hex	AMS 338*i*-specific object area
2000	Position value
2001	Static preset
2002	Dynamic preset
2010	Position limit value 1
2011	Position limit value 2
2020	Velocity
2021	Velocity limit value 1
2022	Velocity limit value 2
2023	Velocity limit value 3
2024	Velocity limit value 4
2025	Dynamic velocity limit value
2026	Velocity status
2050	I/O 1
2051	I/O 2
2060	Laser status and control ON/OFF
2070	Error handling procedures
2300	Other

Overview of encoder-specific object area of AMS 338*i* (DS406)

Object address in hex	Objects of AMS 338*i* from encoder profile DS406 Class 1
6000	Operating parameters
6004	Position value
6500	Operating status
6501	Measurement value resolution

9.7.4   Detailed description of EtherCAT-specific object area

Object 1000$_h$ Device type

The object describes the AMS 338i device type.

Index (hex)	Sub-index (hex)	Name	Data type	Access	Value range			Comment
					Minimum	Maximum	Default	
1000	--	Device type	u32	ro	--	--	00080196h	Device profile 196$_h$ Encoder type 8$_h$

Data structure of object

Byte	Bit								Comment
	7	6	5	4	3	2	1	0	
0 1	196$_h$								Device profile (196$_h$)
2 3	8$_h$								Encoder type (8$_h$)

Device profile

The classification 196$_h$ = 406$_d$ describes the profile of an encoder and is taken from CANopen specification DS406 Class 1. The AMS 338i is thus integrated in the profile definition of an encoder.

The object addresses greater than 6000$_h$ describe the specified encoder functions.

Encoder

The classification 8$_h$ = 8$_d$ describes the AMS 338i as an absolute, linear encoder that is described in specification DS406.

Object 1018$_h$ Identity object

This object contains general specifications about the AMS 338i.

Index (hex)	Sub-index (hex)	Name	Data type	Access	Value range			Comment
					Minimum	Maximum	Default	
1018	01	Vendor ID	u 32	ro	--	--	121$_h$	Manufacturer ID number

The Vendor ID assigned by Leuze for the AMS 338i is 121$_h$ = 289$_d$.

9.7.5 Process data objects

The AMS 338*i* provides two process data objects (PDOs). The PDOs describe which objects are mapped to (included in) the PDO.

Object 1A00ₕ TPDO1

Transmission of position and status.

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
1A00	01	Position value	u 32	ro	--	--	6004 00 20	Position value from object 6004
	02	Position value status	u 32	ro	--	--	2060 01 20	Status from object 2060

Data structure of TPDO1 for transmission of position values and position status

Byte	Bit								Comment
	7	6	5	4	3	2	1	0	
0								LSB	Position values See object description 6004ₕ
1									
2									
3	MSB								
4									Status See object description 2060ₕ. Sub-index 01
5									
6									
7									

Object 1A02ₕ TPDO3

Transmission of velocity and status.

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
1A02	01	Velocity value	int 32	ro	--	--	2020 04 20	Velocity value from object 2020 Sub-index 04
	02	Velocity value status	u 16	ro	--	--	2026 00 10	Status from object 2026

Data structure of TPDO3 for transmission of velocity values and velocity status

Byte	Bit								Comment
	7	6	5	4	3	2	1	0	
0								LSB	Velocity value See object description 2020ₕ Sub-index 04

Byte	Bit								Comment
	7	6	5	4	3	2	1	0	
1	MSB								Status
2									See object description 2026$_h$
3									

9.7.6　AMS 338 *i*-specific object area

Object 2000$_h$ Position value

The position value object describes the following entries:

- Sign for negative position values
- Unit of the position value, metric or inch
- Resolution of the position value
- Counting direction of the position value
- Possible offset value
- Value for the free resolution

Index (hex)	Sub-index (hex)	Name	Data type	Access	Value range			Comment
					Minimum	Maximum	Default	
2000	01	Sign	u 8	rw	0	1	0	**0 = Two's com-plement** 1 = Sign + mag-nitude
	02	Unit	u 8	rw	0	1	0	**0 = Metric** 1 = Inch (in)
	03	Resolution	u 8	rw	0	6	4	Value 1 = 0.001 Value 2 = 0.01 Value 3 = 0.1 **Value 4 = 1** Value 5 = 10 Value 6 = free resolution
	04	Counting direction	u 8	rw	0	1	0	**0 = Positive** 1 = Negative See below for further com-ments
	05	Offset value	int 32	rw	-999999	999999	0	See comments below
	06	Value for free reso-lution	u 16	rw	5	50000	1000	See comments below

Sub-index 03 Resolution

Resolution in mm or inch/100 depending on selected unit.

The value for the free resolution must be set in sub-index 06.

Sub-index 04 Counting direction

⚠️ *Attention!*

Encoder specification DS406 specifies that the counting direction can be set in object 6000 bit 3. Object 2000 sub-index 04 and object 6000 bit 3 overwrite each other.

The counting direction changes the sign during velocity measurement.

No negative position values can be transmitted on the EtherCAT interface. In this case, the value 0 is output on the EtherCAT interface.

An appropriate offset must be selected such that only positive values are transmitted.

Counting direction positive:
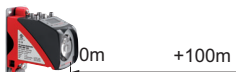
Counting direction negative:
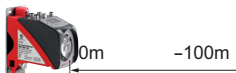
Sub-index 05 Offset value

Offset value in mm or inch/100 depending on selected unit.

Output value = measurement value + offset.

If the preset value is activated by a corresponding trigger signal, the preset value has priority over the offset value.

The preset value and offset value are not offset against each other. The resolution of the offset value is independent of the resolution selected for the position value. The offset value is immediately active without any further release.

Sub-index 06 Free resolution

Free resolution in mm/1000 or inch/100000 depending on the selected unit.

The "free resolution" parameters from sub-index 03 and the "free resolution" value from sub-index 06 are mutually dependent. The value of the free resolution is multiplied in mm/1000 or inch/100000 depending on the selected unit. The product of multiplication is then the set free resolution.

Object 2001ₕ Static preset value

The static preset value is a parameter that is no longer changed after the system has been handed over to the end operating company. It is configured during commissioning and then remains unchanged.

A preset value can be entered in the object. The preset value is activated by "preset teach" and deactivated with "preset reset". After preset teach, the current position value is offset against the configured preset value. After preset reset, the original measurement value is displayed.

Index (hex)	Sub-index (hex)	Name	Data type	Access	Value range			Comment
					Minimum	Maximum	Default	
2001	01	Preset value static	int 32	rw	-999999	999999	0	Preset value in mm or in/100 depending on selected unit
	02	Preset settings	u 8	rw	0	2	0	Value 1 = Preset teach Value 2 = Preset reset

Object 2002ₕ Dynamic preset value

The dynamic preset value can be adapted permanently by the control.

The dynamic preset value is activated by "preset teach" and deactivated with "preset reset". After preset teach, the current position value is offset against the configured preset value. After preset reset, the original measurement value is displayed.

Index (hex)	Sub-index (hex)	Name	Data type	Access	Value range			Comment
					Minimum	Maximum	Default	
2002	01	Preset value static	int 32	rw	-999999	999999	0	Preset value in mm or in/100 depending on selected unit
	02	Preset settings	u 8	rw	0	2	0	Value 1 = Preset teach Value 2 = Preset reset

Object 2010ₕ Position limit value range 1

The "Position limit value range 1" object defines a distance range with lower and upper limit. If the measured value is outside the configured range, the corresponding status bits are set in the objects 2050ₕ, 2051ₕ and 2060ₕ.

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2010	01	Release of position limit value 1	u8	rw	0	1	0	**0 = Deactivated** 1 = Activated
	02	Lower position limit value 1	int 32	rw	-999999	999999	0	See comments below
	03	Upper position limit value 1	int 32	rw	-999999	999999	0	See comments below

Sub-index 02 / Sub-index 03

The lower and upper position limit values are entered in mm or inch/100 depending on the selected unit.

Object 2011ₕ Position limit value range 2

The "Position limit value range 2" object defines a distance range with lower and upper limit. If the measured value is outside the configured range, the corresponding status bits are set in the objects 2050ₕ, 2051ₕ and 2060ₕ.

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2011	01	Release of position limit value 2	u8	rw	0	1	0	**0 = Deactivated** 1 = Activated
	02	Lower position limit value 2	int 32	rw	-999999	999999	0	See comments below
	03	Upper position limit value 2	int 32	rw	-999999	999999	0	See comments below

Sub-index 02 / Sub-index 03

The lower and upper position limit values are entered in mm or inch/100 depending on the selected unit.

Object 2020h Velocity

Outputs the current velocity with the configured resolution. The unit (metric or inch) is set in object 2000 sub-index 02 and also applies to the velocity. If no change is made in object 2000 sub-index 02, the AMS 338*i* uses the default setting "metric".

The sign of the velocity is dependent on the counting direction in object 2000 sub-index 04.

In the default setting, a positive velocity is output when the reflector moves away from the AMS 338*i*. When the reflector moves toward the AMS 338*i*, negative velocities are output. If the "negative" counting direction is configured in object 2000 sub-index 04, the velocity sign is reversed.

The response time for the velocity averages all calculated velocity values over the set time to form one velocity value. This averaged velocity value is output via the interface.

Index (hex)	Sub-index (hex)	Name	Data type	Access	Value range			Comment
					Minimum	Maximum	Default	
2020	01	Velocity resolution	u8	rw	1	5	1	**Value 1: = 1** Value 2: = 10 Value 3: = 100 Value 4: = 1000 Value 5: = free resolution
	02	Response time for velocity	u8	rw	0	6	3	Unit ms Value 0: = 2 Value 1: = 4 Value 2: = 8 **Value 3: = 16** Value 4: = 32 Value 5: = 64 Value 6: = 128
	03	Free velocity resolution	u16	rw	5	50000	1000	The configured value is multiplied in mm/1000/s or in/100000/s.
	04	Velocity value	int 32	ro	-999999	999999	--	See below

The velocity value is mapped to process data objects 1A02h and 1A03h.

Sub-index 01

The current velocity is output with the configured resolution. The unit (metric or inch) is set in object 2000 sub-index 02 and also applies to the velocity.

Object 2021ₕ Configuration of velocity monitoring 1

Objects 2021ₕ to 2024ₕ enable comparison of the velocity currently measured by the AMS 338*i,* with a limit value stored in the respective object.

Note regarding velocity monitoring 1 - 4 and dynamic velocity monitoring

If range start and range end are identical, velocity monitoring is active over the entire traversing range.

If a direction-dependent limit value check is activated via the Direction selection parameter, the values of position start and position end also define the direction. The check is always performed from position start to position end. For example, if the position start is "5500" and the position end is "5000", the direction-dependent check is only performed in the direction from "5500" to "5000". The limit value is not active in the opposite direction.

If the check is independent of direction, the order of position start and position end is irrelevant. Depending on the selected switching type, if the value is above or below the defined limits, the limit value status in object 2026ₕ is set and, if configured, the switching output is set via object 2050ₕ or 2051ₕ.

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2021	01	Limit value check	u8	rw	0	7	0	See below
	02	Velocity limit value 1	u16	rw	0	20000	0	mm/s or (in/100)/s
	03	Hysteresis of velocity limit value 1	u16	rw	0	20000	100	mm/s or (in/100)/s
	04	Monitoring as of position start	int 32	rw	-999999	999999	0	mm or in/100
	05	Monitoring up to position end	int 32	rw	-999999	999999	0	mm or in/100

Sub-index 01

Bit 0: Switching type

   0 = Velocity above upper limit
   1 = Velocity below lower limit

Bit 1: Direction selection

0 = Velocity monitoring not direction-dependent
1 = Velocity monitoring direction-dependent

Bit 2: Velocity monitoring

0 = Deactivated
1 = Activated

Bit 3 - Bit 7: Reserve

Object 2022h Configuration of velocity monitoring 2

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2022	01	Limit value check	u 8	rw	0	7	0	See below
	02	Velocity limit value 1	u 16	rw	0	20000	0	mm/s or (in/100)/s
	03	Hysteresis of velocity limit value 1	u 16	rw	0	20000	100	mm/s or (in/100)/s
	04	Monitoring as of position start	i 32	rw	-999999	999999	0	mm or in/100
	05	Monitoring up to position end	i 32	rw	-999999	999999	0	mm or in/100

Sub-index 01

Bit 0: Switching type

0 = Velocity above upper limit
1 = Velocity below lower limit

Bit 1: Direction selection

0 = Velocity monitoring not direction-dependent
1 = Velocity monitoring direction-dependent

Bit 2: Velocity monitoring

0 = Deactivated
1 = Activated

Bit 3 - Bit 7: Reserve

Object 2023ₕ Configuration of velocity monitoring 3

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2023	01	Limit value check	u 8	rw	0	7	0	See below
	02	Velocity limit value 1	u 16	rw	0	20000	0	mm/s or (in/100)/s
	03	Hysteresis of velocity limit value 1	u 16	rw	0	20000	100	mm/s or (in/100)/s.
	04	Monitoring as of position start	int 32	rw	-999999	999999	0	mm or in/100
	05	Monitoring up to position end	int 32	rw	-999999	999999	0	mm or in/100

Sub-index 01

Bit 0: Switching type
0 = Velocity above upper limit
1 = Velocity below lower limit

Bit 1: Direction selection
0 = Velocity monitoring not direction-dependent
1 = Velocity monitoring direction-dependent

Bit 2: Velocity monitoring
0 = Deactivated
1 = Activated

Bit 3 - Bit 7: Reserve

Object 2024ₕ Configuration of velocity monitoring 4

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2024	01	Limit value check	u 8	rw	0	7	0	See below
	02	Velocity limit value 1	u 16	rw	0	20000	0	mm/s or (in/100)/s
	03	Hysteresis of velocity limit value 1	u 16	rw	0	20000	100	mm/s or (in/100)/s.
	04	Monitoring as of position start	int 32	rw	-999999	999999	0	mm or in/100
	05	Monitoring up to position end	int 32	rw	-999999	999999	0	mm or in/100

Sub-index 01

Bit 0: Switching type
0 = Velocity above upper limit
1 = Velocity below lower limit

Bit 1: Direction selection
0 = Velocity monitoring not direction-dependent
1 = Velocity monitoring direction-dependent

Bit 2: Velocity monitoring
0 = Deactivated
1 = Activated

Bit 3 - Bit 7: Reserve

Object 2025_h Configuration of dynamic velocity monitoring

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2025	01	Limit value check	u 8	rw	0	7	0	See below
	02	Velocity limit value 1	u 16	rw	0	20000	0	mm/s or (in/100)/s
	03	Hysteresis of velocity limit value 1	u 16	rw	0	20000	100	mm/s or (in/100)/s.
	04	Monitoring as of position start	int 32	rw	-999999	999999	0	mm or in/100
	05	Monitoring up to position end	int 32	rw	-999999	999999	0	mm or in/100

Sub-index 01

Bit 0: Switching type

0 = Velocity above upper limit
1 = Velocity below lower limit

Bit 1: Direction selection

0 = Velocity monitoring not direction-dependent
1 = Velocity monitoring direction-dependent

Bit 2: Velocity monitoring

0 = Deactivated
1 = Activated

Bit 3 - Bit 7: Reserve

Object 2026_h Velocity status

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2026	--	Velocity status	u 32	ro	--	--	--	See below

Bit 0: Velocity measurement error

0 = OK
1 = Error

Bit 1: Movement status

0 = No movement
1 = Movement

Bit 2: Movement status

0 = Positive direction
1 = Negative direction

Bit 3: Velocity limit value status 1

0 = Limit value observed
1 = Limit value violated

Bit 4: Velocity limit value status 2

0 = Limit value observed
1 = Limit value violated

Bit 5: Velocity limit value status 3

0 = Limit value observed
1 = Limit value violated

Bit 6: Velocity limit value status 4

0 = Limit value observed
1 = Limit value violated

Bit 7: Velocity limit value status dynamic

0 = Limit value observed
1 = Limit value violated

Bit 8: Velocity comparison – limit value 1

0 = Comparison not active
1 = Comparison active

Bit 9: Velocity comparison – limit value 2

0 = Comparison not active
1 = Comparison active

Bit 10: Velocity comparison – limit value 3

0 = Comparison not active
1 = Comparison active

Bit 11: Velocity comparison – limit value 4

0 = Comparison not active
1 = Comparison active

Bit 12: Velocity comparison – dynamic limit value

0 = Comparison not active
1 = Comparison active

Object 2050ₕ Configuration of I/O 1

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2050	--	I/O1	u 32	rw	--	--	--	See below

The settings in "bold" are the default settings.

Bit 0: Function of I/O 1 connection on PWR M12

0 = Input
1 = Output

Bit 1: activation

If I/O 1 is defined as input (see bit 0):
0 = 1 - 0 transition
1 = 0 - 1 transition
If I/O 1 is defined as output (see bit 0):
0 = low active (the output is set to 0 if the event occurs)
1 = high active (the output is set to 1 if the event occurs)

Bit 2 - Bit 7: Reserve

0 = Reserve
1 = NC

Note!

Bit 8 to bit 23 affect the "OR" linked output.

Bit 8: Position limit value 1

If the position value is outside of configured limit value 1, the output is set.

0 = OFF
1 = ON

Bit 9: Position limit value 2

If the position value is outside of configured limit value 2, the output is set.

0 = OFF
1 = ON

Bit 10: Velocity limit value

If the velocity value is outside of the configured values, the output is set. The monitoring processes from objects 2021h to 2025h are "OR" linked to this bit.

0 = OFF
1 = ON

Bit 11: Intensity monitoring (ATT)

If the intensity of the reception signal drops below the defined limit value, the output is set.

0 = OFF
1 = ON

Bit 12: Temperature monitoring (TMP)

If the internal device temperature is outside the defined limit values, the output is set.

0 = OFF
1 = ON

Bit 13: Laser prefailure monitoring (LSR)

If the laser power drops below the defined limit value, the output is set.

0 = OFF
1 = ON

Bit 14: Plausibility monitoring (PLB)

If implausible measurement values are diagnosed, the output is set.

0 = OFF
1 = ON

Bit 15: Hardware error (ERR)

If a hardware error is diagnosed, the output is set.

0 = OFF
1 = ON

Bit 16 - Bit 23: Reserve

0 = Reserve
1 = NC

Bit 24 - bit 26: Function of I/O 1 when defined as input

Value 000 = No function
Value 001 = Preset teach, valid for static (object 2001) and dynamic (object 2002) pre-set
Value 010 = Laser OFF. Laser diode is switched off

Bit 27 - Bit 31: Reserve

0 = Reserve
1 = NC

Object 2051$_h$ Configuration of I/O 2

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2051	--	I/O2	u32	rw	--	--	--	See below

The settings in "bold" are the default settings.

Bit 0: Function of I/O 2 connection on PWR M12

>   0 = Input
>   **1 = Output**

Bit 1: activation

>   **If I/O 2 is defined as input (see bit 0):**
>   **0 = 1 - 0 transition**
>   1 = 0 - 1 transition
>   **If I/O 2 is defined as output (see bit 0):**
>   **0 = low active (the output is set to 0 if the event occurs)**
>   1 = high active (the output is set to 1 if the event occurs)

Bit 2 - Bit 7: Reserve

>   **0 = Reserve**
>   1 = NC

Note!

Bit 8 to bit 23 affect the "OR" linked output.

Bit 8: Position limit value 1

If the position value is outside of configured limit value 1, the output is set.

>   **0 = OFF**
>   1 = ON

Bit 9: Position limit value 2

If the position value is outside of configured limit value 2, the output is set.

>   **0 = OFF**
>   1 = ON

Bit 10: Velocity limit value

If the velocity value is outside of the configured values, the output is set. The monitoring processes from objects 2021_h to 2025_h are "OR" linked to this bit.

>   **0 = OFF**
>   1 = ON

Bit 11: Intensity monitoring (ATT)

If the intensity of the reception signal drops below the defined limit value, the output is set.

>   0 = OFF
>   **1 = ON**

Bit 12: Temperature monitoring (TMP)

If the internal device temperature is outside the defined limit values, the output is set.

>   0 = OFF
>   **1 = ON**

Bit 13: Laser prefailure monitoring (LSR)

If the laser power drops below the defined limit value, the output is set.

0 = OFF
1 = ON

Bit 14: Plausibility monitoring (PLB)

If implausible measurement values are diagnosed, the output is set.

0 = OFF
1 = ON

Bit 15: Hardware error (ERR)

If a hardware error is diagnosed, the output is set.

0 = OFF
1 = ON

Bit 16 - Bit 23: Reserve

0 = Reserve
1 = NC

Bit 24 - bit 26: Function of I/O 2 when defined as input

Value 000 = No function
Value 001 = Preset teach, valid for static (object 2001) and dynamic (object 2002) pre-set
Value 010 = Laser OFF. Laser diode is switched off

Bit 27 - Bit 31: Reserve

0 = Reserve
1 = NC

Object 2060h AMS 338*i* status and control

The object makes the following status messages of the AMS 338*i* available in sub-index 01.

- Laser status ON/OFF
- Preset status ON/OFF
- Preset teach activated/not activated
- Monitoring of lower position limit value 1
- Monitoring of upper position limit value 1
- Monitoring of lower position limit value 2
- Monitoring of upper position limit value 2
- Intensity (ATT)
- Temperature (TMP)
- Laser (LSR)
- Plausibility (PLB)

In sub-index 02, the laser diode can be switched OFF/ON.

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2060	01	Status	u32	ro	--	--	--	See below
	02	Laser ON/OFF	u8	rw	0	1	0	0 = Laser ON 1 = Laser OFF

Explanations regarding sub-index 01

Bit 0: Hardware error (ERR)
>   0 = OK
>   1 = Hardware error (ERR)

Bit 1 - Bit 3: Reserve
>   **0 = Reserve**
>   1 = NC

Bit 4: Monitoring of lower position limit value 1
>   **0 = OK**
>   1 = Value less than limit

Bit 5: Monitoring of upper position limit value 1
>   **0 = OK**
>   1 = Value greater than limit

Bit 6: Monitoring of lower position limit value 2
>   **0 = OK**
>   1 = Value less than limit

Bit 7: Monitoring of upper position limit value 2
>   **0 = OK**
>   1 = Value greater than limit

Bit 8: Laser status
>   **0 = OK**
>   1 = Laser OFF

Bit 9: Preset status
0 = Preset inactive

1 = Preset active

Bit 10: Preset teach (toggle bit)
This bit toggles with each teach event of a preset value

Bit 11 - Bit 12: Reserve
>   **0 = Reserve**
>   1 = NC

Bit 13: Intensity (ATT)

If the intensity of the reception signal drops below the defined limit value, the warning is set

0 = OK
1 = Warning

Bit 14: Temperature (TMP)

If the internal device temperature is outside the defined limit values, the warning is set.

0 = OK
1 = Warning

Bit 15: Laser (LSR)

If the laser power drops below the defined limit value, the warning is set.

0 = OK
1 = Warning

Bit 16: Plausibility (PLB)

If implausible measurement values are diagnosed, the error is set.

0 = OK
1 = Error

Bit 17 - Bit 31: Reserve

0 = Reserve
1 = NC

Object 2070ₕ Behavior of AMS 338*i* in case of failure

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2070	01	Position value behavior in the case of failure	u8	rw	0	13	13	See below
	02	Position value delay in the case of failure	u16	rw	100	1000	100	Error message delay time in ms
	03	Velocity value behavior in the case of failure	u8	rw	0	13	13	See below
	04	Velocity value delay in the case of failure	u16	rw	200	1000	200	Error message delay time in ms

Explanation regarding sub-index 01

Bit 0: Position value in case of failure

0 = Last valid value
1 = Zero

Bit 1: Static 0

Bit 2: Suppress position status

0 = OFF
1 = ON

Bit 3: Position error delay

0 = OFF
1 = ON

Explanation regarding sub-index 03

Bit 0: Velocity value in case of failure

0 = Last valid value
1 = Zero

Bit 1: Static 0

Bit 2: Suppress velocity status

0 = OFF
1 = ON

Bit 3: Velocity error delay

0 = OFF
1 = ON

Object 2300$_h$ Other

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
2300	01	Display language selection	u8	rw	0	4	0	**0 = English** 1 = German 2 = Italian 3 = Spanish 4 = French

Index (hex)	Sub-index (hex)	Name	Data type	Access	Value range			Comment
					Minimum	**Maximum**	**Default**	
	02	Display illumina-tion dura-tion	u8	rw	0	1	0	**0 = Off after 10 min.** 1 = Always on
	03	Display contrast	u8	rw	0	2	1	0 = Low **1 = Medium** **2 = High**
	04	Password activation	u8	rw	0	1	0	**0 = OFF** 1 = ON
	05	Password	u16	rw	0000	9999	0000	Setting of 4-digit password
	06	Heating control	u8	rw	0	1	0	See below

Note!

Password activation must be set to ON.

Explanation regarding sub-index 06 "Heating control"

> 0 = Standard (10 °C … 15 °C)
> 1 = Extended (30 °C … 35 °C)

Note!

Sub-index 06 is available as standard, but functions only for devices with integrated heating (AMS 338 ***i*** *… H).*

Sub-index 06 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.

9.7.7 Objects of AMS 338*i* from encoder profile DS406 Class 1

The AMS 338*i* applies the profile from CANopen. The profile allocates specified properties of the participant to defined object addresses.

The AMS 338*i* communicates in accordance with the specifications in the profile "DS406" Class 1.

For Class 1, it is essential to describe the following objects.

Object 6000ₕ Operating parameter

Index (hex)	Sub-index (hex)	Name	Data type	Access	Value range			Comment
					Minimum	**Maximum**	**Default**	
6000	--	Operating parame-ters	u16	rw	--	--	--	See below

Bit 0 - Bit 2

Not used

Bit 3: Counting direction

0 = Positive - The measurement value increases with increasing distance.
1 = Negative - The measurement value decreases with decreasing distance.

Bit 4 - Bit 15: Reserve

Object 6004$_h$ Position value

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
6004	--	Position value	int 32	ro	-999999	999999	--	See below

Object 6004$_h$ contains the position value for process data objects (PDOs) 1A00$_h$ (TPDO1)

Byte	Bit								Comment
	7	6	5	4	3	2	1	0	
0								LSB	Position value
1									
2									
3	MSB								

Object 6500_h Display of operating status from object 6000

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
6500	--	Operating parame-ters	u16	ro	--	--	--	See below

Bit 0 - Bit 2

Not used

Bit 3: Counting direction

0 = Positive - The measurement value increases with increasing distance.

1 = Negative - The measurement value decreases with decreasing distance.

Bit 4 - Bit 15: Reserve

Object 6501_h Measuring increment

Index	Sub-index	Name	Data type	Access	Value range			Comment
(hex)	(hex)				Minimum	Maximum	Default	
6501	--	Measur-ing incre-ments	u32	ro	--	--	--	See below

The resolution set in object 2000$_h$ sub-index 03 is specified in object 6501 as a multiple of 0.001 µm (1 nm).

Example:

If the default resolution of 1 mm is set in object 2000$_h$, the resolution is converted to the value 1 000 000 for object 6501. (1 000 000 x 1/1 000 000 = 1)

10   Diagnostics and troubleshooting

10.1   Service and diagnosis in the display of the AMS 338*i*

In the main menu of the AMS 338*i*, expanded "Diagnostics" can be called up under the Service heading.

```
Service
    Status messages
            Diagnosis
Expanded diagnosis

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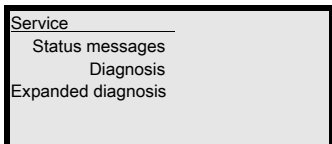
From the Service main menu, press the enter button ⏎ to access the underlying menu level.

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.

```
Status messages
1: - / - / -
2: - / - / -
3: - / - / -

```

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
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 338*i*.

10.1.3 Expanded diagnosis

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

10.2   General causes of errors

LINK LED for BUS IN and BUS OUT

A green/yellow multicolor LED below the BUS IN and BUS OUT connectors indicates the EtherCAT connection status.

LINK LED for BUS IN

LINK LED for BUS OUT

	Green continuous light	LINK LED green
		- The link exists, the hardware connection to the next connected participant is OK.

	Flashing yellow	LINK LED flashes yellow
		- Data is exchanged with the connected participants.

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

For further information on the LED status displays.

Error	Possible error cause	Measure
BUS LED "OFF"	Power off on AMS 338*i*	Check supply voltage.
BUS LED "flashes red"	Invalid configuration	--
Bus LED "flashes green/red"	Bus error Time out Process Data Watchdog Timeout	--

Table 10.2:   Bus error

10.4   Status indicators in the display of the AMS 338*i*

Display	Possible error cause	Measure
PLB (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.
ATT (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.
	Protective film on reflector	Remove protective film from reflector.
TMP (operating temperature outside of specification)	Ambient temperatures outside 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.
LSR Laser diode warning	Laser diode prefailure message	Send in device at next possible opportunity to have laser diode replaced. Have replacement device ready.
ERR 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 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 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 3**xx** *i* **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
	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 **A**bsolute **M**easurement **S**ystem

11.1.1 Type overview AMS 338*i* (EtherCAT)

Type designation	Description	Part no.
AMS 338*i* 40	40m operating range, EtherCAT interface	50113701
AMS 338*i* 120	120m operating range, EtherCAT interface	50113702
AMS 338*i* 200	200m operating range, EtherCAT interface	50113703
AMS 338*i* 300	300m operating range, EtherCAT interface	50113704
AMS 338*i* 40 H	40m operating range, EtherCAT interface, integrated heating	50113705
AMS 338*i* 120 H	120m operating range, EtherCAT interface, integrated heating	50113706
AMS 338*i* 200 H	200m operating range, EtherCAT interface, integrated heating	50113707
AMS 338*i* 300 H	300m operating range, EtherCAT interface, integrated heating	50113708

Table 11.1:   Overview of AMS 338*i* types

11.2   Overview of reflector types

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

Table 11.2:   Overview of reflector types

11.3   Accessories

11.3.1   Accessories – Mounting bracket

Type designation	Description	Part no.
MW OMS/AMS 01	Mounting bracket for mounting AMS 338*i* to horizontal surfaces	50107255

Table 11.3:   Accessories – Mounting bracket

11.3.2   Accessories – Deflector unit

Type designation	Description	Part no.
US AMS 01	Deflector unit with integrated mounting bracket for AMS 338*i* 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

11.3.3   Accessories – M12 connector

Type designation	Description	Part no.
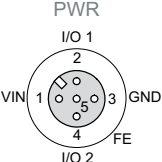
Table 11.5:   Accessories – M12 connector

S-M12A-ET	M12 connector, Ethernet, D-coded, BUS IN, BUS OUT	50112155
KDS ET M12/RJ45 W - 4P	Converter from M12 D-coded to RJ45 socket	50109832
KD 095-5A	M12 connector, A-coded socket, Power (PWR)	50020501

Table 11.5: Accessories – M12 connector

11.3.4 Accessories – Ready-made cables for voltage supply

Contact assignment/core color of PWR connection cable

PWR connection cable (5-pin socket, A-coded)			
PWR I/O 1 2 VIN 1 — 3 GND 5 4 FE I/O 2 **M12 socket (A-coded)**	**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   > 50 mm

Order codes of the cables for voltage supply
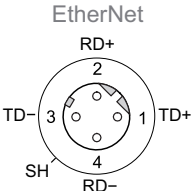
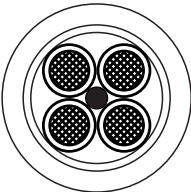| Type designation	Description	Part no.
K-D M12A-5P-5m-PVC	M12 socket, A-coded, axial connector outlet, open cable end, cable length 5 m	50104557
K-D M12A-5P-10m-PVC	M12 socket, A-coded, axial connector outlet, open cable end, cable length 10 m	50104559

11.3.5 Accessory ready-made cables for EtherCAT

General
- Cable **KB ET…** for connecting to PROFINET via M12 connector
- Standard cable available in lengths from 2 … 30m
- Special cable on request.

Contact assignments M12 EtherCAT connection cable KB ET …-SA

M12 EtherCAT connection cable (4-pin connector, D-coded, on both sides)			
EtherNet RD+ 2 TD− 3 1 TD+ SH 4 RD− **M12 connector (D-coded)**	**Pin**	**Name**	**Core color**
	1	TD+	**Yellow**
	2	RD+	**White**
	3	TD-	**Orange**
	4	RD-	**Blue**
	SH (thread)	FE	**Bare**

	Core colors **WH** **YE** **BU** **OG** Conductor class: VDE 0295, EN 60228, IEC 60228 (Class 5)

Accessories M12 EtherCAT connection cable, open cable end

Cable designation: KB ET - .... - SA

Accessory EtherCAT connection cable with both-sided D-coded M12 connector

Cable designation: KB ET - .... - SSA, Kabelbelegung 1:1, nicht gekreuzt

Accessory EtherCAT connection cable, M12-/RJ45

Cable designation: KB ET - .... - SA-RJ45

Notice for connecting the EtherCAT interface!

The entire interconnection cable must be shielded. The shielding connection must be at the same potential at both ends of the data line. This serves to prevent potential equalization currents over the shield and possible interference coupling through compensating currents. The signal lines must be stranded in pairs.
Use CAT 5 cables for the connection.

Technical data of the EtherCAT connection cable

Operating temperature range	In idle state: -50°C … +80°C
	In motion: -25°C … +80°C
	In motion: -25°C ... +60°C
	(when used with drag chains)
Material	Cable sheath: PUR (green), wire insulation: PE foam,
	Free of halogens, silicone and PVC
Bending radius	> 65 mm, suitable for drag chains
Bending cycles	> 10^6, perm. acceleration < 5 m/s^2

Order codes for EtherCAT connection cables

Type designation	Description	Part no.
M12 connector for BUS IN, axial connector, open cable end		
KB ET - 1000 - SA	Cable length 1 m	50106738
KB ET - 2000 - SA	Cable length 2 m	50106739
KB ET - 5000 - SA	Cable length 5 m	50106740
KB ET - 10000 - SA	Cable length 10 m	50106741
KB ET - 15000 - SA	Cable length 15 m	50106742
KB ET - 20000 - SA	Cable length 20 m	50106743
KB ET - 25000 - SA	Cable length 25 m	50106745
KB ET - 30000 - SA	Cable length 30 m	50106746
M12 connector for BUS IN to RJ-45 connector		
KB ET - 1000 - SA-RJ45	Cable length 1 m, cable 1:1, not crossed	50109879
KB ET - 2000 - SA-RJ45	Cable length 2 m, cable 1:1, not crossed	50109880
KB ET - 5000 - SA-RJ45	Cable length 5 m, cable 1:1, not crossed	50109881
KB ET - 10000 - SA-RJ45	Cable length 10 m, cable 1:1, not crossed	50109882
KB ET - 15000 - SA-RJ45	Cable length 15 m, cable 1:1, not crossed	50109883
KB ET - 20000 - SA-RJ45	Cable length 20 m, cable 1:1, not crossed	50109884
KB ET - 25000 - SA-RJ45	Cable length 25 m, cable 1:1, not crossed	50109885
KB ET - 30000 - SA-RJ45	Cable length 30 m, cable 1:1, not crossed	50109886
M12 connector + M12 connector for BUS OUT to BUS IN		
KB ET - 1000 - SSA	Cable length 1 m, cable 1:1, not crossed	50106898
KB ET - 2000 - SSA	Cable length 2 m, cable 1:1, not crossed	50106899
KB ET - 5000 - SSA	Cable length 5 m, cable 1:1, not crossed	50106900
KB ET - 10000 - SSA	Cable length 10 m, cable 1:1, not crossed	50106901
KB ET - 15000 - SSA	Cable length 15 m, cable 1:1, not crossed	50106902
KB ET - 20000 - SSA	Cable length 20 m, cable 1:1, not crossed	50106903
KB ET - 25000 - SSA	Cable length 25 m, cable 1:1, not crossed	50106904
KB ET - 30000 - SSA	Cable length 30 m, cable 1:1, not crossed	50106905

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

B

C

D

E

F

G

H

I

L

M

N

Level 1 ▲▼ : Selection	Level 2 ▲▼ : Selection ESC : Back	Level 3 ▲▼ : Selection ESC : Back	Level 4 ▲▼ : Selection ESC : Back	Level 5 ▲▼ : Selection ESC : Back	Selection/configuration option ▲▼ : Selection ↵ : Activate ESC : Back	Detailed information on
Device information						Page 45
Network information						Page 45
Status and measurement data						Page 45
Parameter	Parameter handling	Parameter enable			ON/OFF	Page 46
		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	
	EtherCAT	Activation			ON/OFF	Page 42
		Address (station alias)				
	Position value	Unit			Metric/Inch	Page 47
		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 48
			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	
				Limit value input	Value input in mm or inch/100	
	Other	Heating control			Standard/extended (10 °C … 15 °C/30 °C … 35 °C)	Page 49
		Display background			10 minutes/ON	

		↵	Display contrast				Weak/Medium/Strong	
		↵	Service RS232	↵	Baud rate		57.6 kbit/s / 115.2 kbit/s	
				↵	Format		8,e,1 / 8,n,1	
Language selection	↵						Deutsch / English / Español / Français / Italiano	Page 50
Service	↵	Status messages					Number of readings, reading gates, reading rate / non-reading rate etc.	Page 50
	↵	Diagnosis					Only for use by Leuze personnel for service purposes	
	↵	Expanded diagnosis					Only for use by Leuze personnel for service purposes	