Acuity AR2000 Series
Laser Distance Meters
Operation and Specification Manual

LLL002001Rev. 1.1

Productivity through Precision.

Acuity®

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Operation and Specification Manual

for the

Acuity AR2000 Series Laser Distance Meters

LLL002001

Manual Revision # 1.1

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Signs and Abbreviations

Signs, abbreviations and references

☐ Enumeration

Important note

→ Reference (to a text passage or illustration)

Warning signs

The **Caution** sign warns against dangers to health which may occur if this advice is not observed.

The **Attention** sign warns against possible damage to the device.

The **Information** sign points to important information.

This sign indicates that special environmental protection guidelines must be observed when disposing of the device.

Table of Contents

1. GENERAL INFORMATION

The laser distance sensors of the AR2000 series have been designed for applications in industrial facilities.

Within the measuring range of 15 cm to 500 meters the sensors work with a high accuracy of up to + 1 mm and at an adjustable measuring frequency of up to 100 Hz.

Due to the excellent optical measuring performance of the AR2000, the sensors can be used both indoors and outdoors, even in bright light. Moreover, they can be used for measuring very hot surfaces such as glowing steel.

When large distances of more than 50 meters need to be measured, the sensor can be used in combination with a reflector. Simple assembly and standard interfaces enable the quick integration of the device into complex measuring and control systems. Data can be displayed and parameters can be set using an internal keypad and display or an external communication program.

2. SAFETY ADVICE

The safety and operating advice must be read carefully and be observed when using the measuring module.

2.1 Basic safety advice

Please read the safety and operating advice carefully, and observe the advice when operating the AR2000 laser distance measurement device.

Danger, laser radiation The AR2000 must not be opened unauthorized, otherwise laser radiation can be emitted that can cause injuries to the eyes. Please observe all information and guidelines for operating the laser.

Danger, electric shock The AR2000 may only be opened for repair purposes by the manufacturer. If the device is opened arbitrarily without authorization, all warranty claims will be voided.

The operating and storage conditions (see chapter 9) have to be observed. The non-observance of this advice and the adverse use of the device can lead to injuries of the user or to damage of the device.

Connectors may not be plugged or unplugged when voltage is applied. All installation work may only be carried out when no voltage is applied.

The device may only be operated as intended and in faultless condition.
Safety installations must not be rendered ineffective.
Safety and warning signs must not be removed.

2.2 Protection Rating

In accordance with the protection rating IP67, the AR2000 is protected against water spray and dust, and against short submersion into water.

When operating the device under extreme outdoor environmental conditions, the use of additional weather protection is recommended (ex. An enclosure with the window closed to the laser sensor. Rapid temperature changes can lead to humidity entering the device. If the device is exposed to humidity, the temperature difference between the device and the environment may be ± 5C maximum.

The device is not shatter-proof. Do not let the device fall onto the ground, and avoid any vibration for best results.

The device may not be used in explosive environments; otherwise there is the danger of damage to the AR2000 and the surrounding equipment, and of injuries of the user.

2.3 Laser Class

Based on the standard EN 60825-1:2007 the AR2000 is in correspondence with laser Class 2. When looking into the laser beam accidentally and for a short moment, the eye will be protected by the eye reflex and blinking. The eyelid closing reflex can be affected by pharmaceuticals, alcohol and other substances.

2.4 Transport and Storage

The AR2000 laser distance sensor is delivered in standard packaging. All kinds of transport are permitted. It is recommended to store the unit inside the transport packaging until it is used. Please observe the storage conditions.

2.5Cleaning and Maintenance

The AR2000 does not require any maintenance. To ensure trouble-free measurements, the optical surfaces through which the laser beam exits and enters must be free of deposits. Dust can be removed using an air brush. In case of dirt that is hard to remove, please contact the manufacturer.

The device must not be cleaned using solvents or mechanical tools.

Mechanical or electrical modifications of the device are not permitted.

2.6 Service

In case that repair work is necessary, please send the device to the nearest address below:

Acuity Service
Schmitt Industries, Inc.
2765 NW Nicolai St.
Portland, OR 97210 USA

If you have any questions, please contact us via telephone, fax or e-mail:

Tel: +1 503.227.7908
Fax: +1 503.223.1258
Email: sales@acuitylaser.com

3. INTENDED USE

3.1 Operating and storage conditions

Operating temperature:	- 10°C to + 60°C (special type – 40°C to + 60°C)
Storage temperature:	- 40°C to + 70°C
Humidity:	15 % to 90 %, non-condensing

3.2 Improper use and possible error sources

- The unit may be used only as prescribed.
- Please do not remove any labels and type plates.
- Repair work must not be performed by the user. In case of questions or doubts, the manufacturer is to be consulted. For contact data see section 2.4.
- In order to obtain correct measuring values the following advice is to be observed:

  1. Measurements against the sun or onto surfaces with low reflectivity in very bright environments can result in faulty measurements.

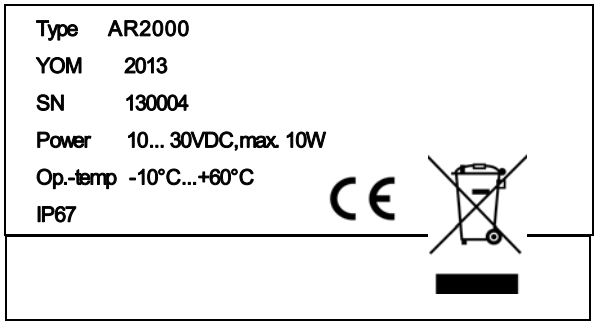
  2. Measurements through glass, optical filters, Plexiglas or other translucent materials are possible to a limited extent but can result in measurement errors.

3.3 Warning signs and type plate

Laser label

The AR2000 works with a class 2 laser.
When looking into the laser beam accidentally and for a short moment, the eye will be protected by the eyelid closing reflex.
The eyelid closing reflex can be affected by pharmaceuticals, alcohol and drugs.
This device may be used without any additional safety precautions when the following advice is observed:

- Do not look directly into the laser beam.
- Do not look at the laser beam using optical instruments.
- Do not point the laser beam at other people.



Type plate

The type plate shown is an example. Type and serial number (SN) may differ from this image..

4. DEVICE DESCRIPTION

4.1 General Information

- The AR2000 distance meter is available in different versions.
- Types can be selected based on the required interface and on the temperature conditions at the place of application.
- AR2000 versions designed for an operating temperature of as low as – 40 °C can be used for applications outdoors or in refrigerated warehouses.
- The required connecting cables are available with straight and angular plug-in connectors.
- In order to prevent the direct incidence of extraneous light into the device optics, a light protector is available as well that can be screwed onto the device.
- Devices with a cable length of up to 10 m are demonstrably EMC-safe.

4.2 Scope of delivery

The AR2000 device versions and accessories are available under the following part numbers:

Designation	Part No.	Remarks
AR2000 LDM51.100	APL222101	RS232/ RS422/ RS485
AR2000 LDM51.200	APL222102	SSI + RS232/ RS422/ RS485
AR2000 LDM51.300	APL222103	Profibus + RS232/ RS422/ RS485
AR2000 LDM51.400	APL222104	SSI + Profibus + RS232/ RS422/ RS485
AR2000 LDM51.110	APL222141	Temperatures as low as – 40°C |RS232/ RS422/ RS485
AR2000 LDM51.210	APL222142	Temperatures as low as – 40°C |SSI + RS232/ RS422/ RS485
AR2000 LDM51.310	APL222143	Temperatures as low as – 40°C |SSI + PB DB + RS232/ RS422/ RS485
	APL222144	Temperatures as low as – 40°C |SSI + PB DB + RS232/ RS422/ RS485

Cables and connectors	Part No.	Remarks
Device cable, 2 METER	APL024144	2 METER CABLE WITH CONNECTOR FOR THE AR2000 LASER WITH BARE WIRES ON ONE END.
Device cable 5 METER	APL024145	5 meter cable with connector for the AR2000 laser with bare wires on one end.
Device cable, 10 METER	APL024146	10 METER CABLE WITH CONNECTOR FOR THE AR2000 LASER WITH BARE WIRES ON ONE END.
Device cable, 2 METER, angular	APL024110	2 meter cable with 90 degree connector for the AR2000 laser with bare wires on one end.
Device cable, 5 METER, angular	APL024111	5 meter cable with 90 degree connector for the AR2000 laser with bare wires on one end.
Device cable, 10 meter, angular	APL024112	10 meter cable with 90 degree connector for the AR2000 laser with bare wires on one end.
SSI cable, 2 meter	APL024101	2 Meter cable for the SSI Output
Profibus in/out cable, 5 meter	APL024170	5 Meter cable In/Out for the Profibus cable
Profibus in cable jack, 5 meter	APL024165	10 Meter cable In for the Profibus cable
Profibus in cable jack, 10 meter	APL024166	5 Meter cable In for the Profibus cable
Profibus out cable plug, 5 meter	APL024160	5 Meter cable Out for the Profibus cable
Profibus out cable plug, 10 meter	APL024161	10 Meter cable Out for the Profibus cable
Profibus female connector protective cap	APL094366	Screw cap for Profibus jack
Profibus male connector protective cap	APL094363	Screw cap for Profibus plug
Profibus terminating resistor M12	APL094145	Profibus Terminator, M12
Profibus5-pin female connector	APL094136	Profibus 5-pole jack
Profibus 5-pin male connector	APl094133	Profibus 5-pole plug
AR2000 Sun Screen	APL025012	Sun Screen tube for the AR2000 Laser
Reflective tape 3M 3279 special	TBD	300 mm x 300 mm; measurements from as low as 0.5 m
Profibus Module & Software Service	APl0095831	Profibus Module & Software

4.3 Mechanical Installation

The AR2000 can be screwed on using 3 (underside) or 2 M6 fastening screws respectively (length to be chosen depending on the mounting piece). 3 M6 fastening screws plus washers and washer springs are included in the scope of delivery**.**

The zero point for measurement is the front face of the laser's housing.

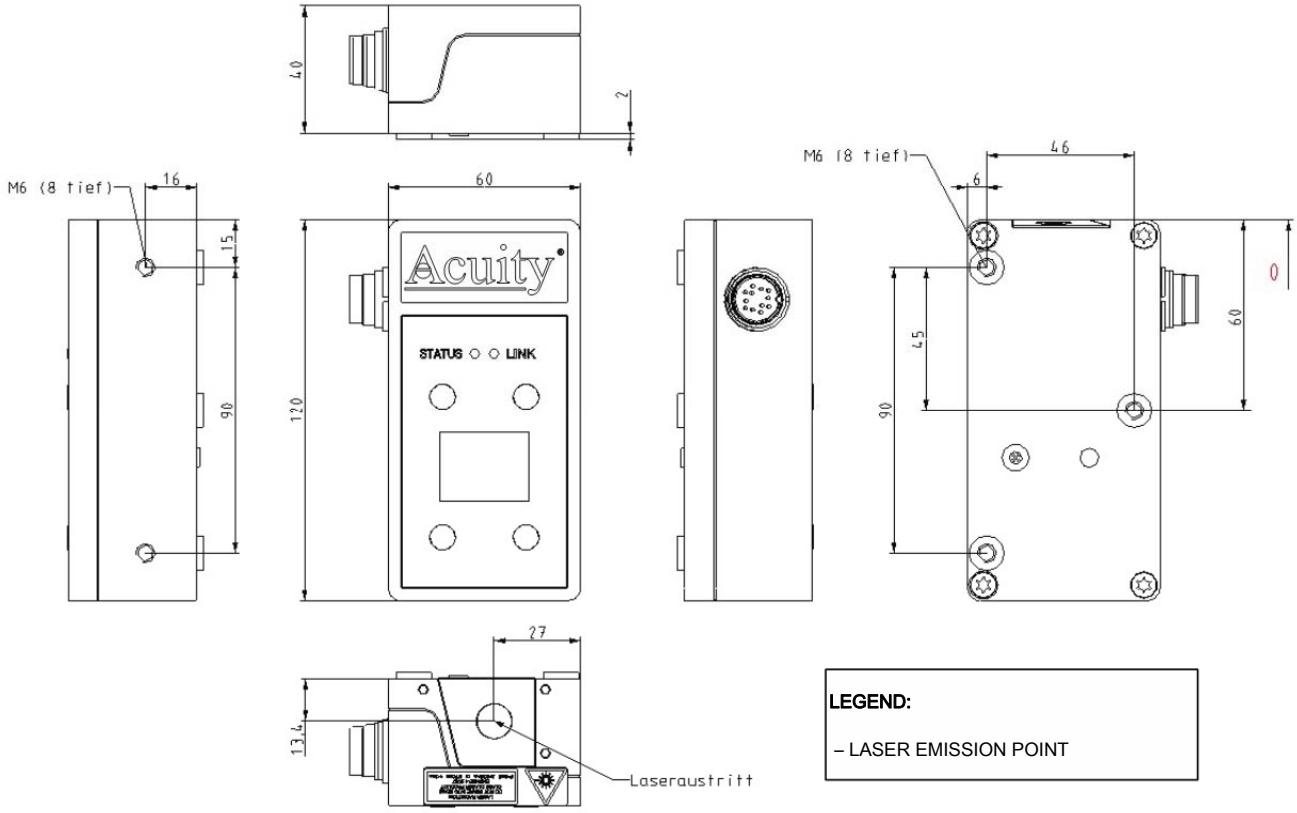
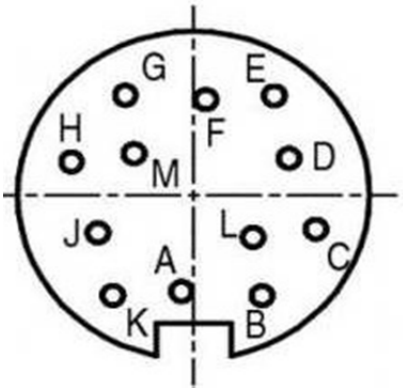


Figure 1. AR2000 dimensions

4.4 Device cable connector pin assignment

PIN	Colorcode	RS232	RS422/RS485	Description
A	White	RxD	Rx+	RS232 received data /RS422 received data+
B	Brown	n.c.	Rx-	RS422 received data-
C	Green	TRIG	TRIG	Trigger input/output
D	Yellow	QA	QA	Analog output (3mA…21 mA)
E	Grey	TxD	Tx-	RS232 transmitted data /RS422 transmitted data-
F	Pink	n.c.	Tx+	RS422 transmitted data+
G	Blue	Q3	Q3	Q3 switching output
H	Red	VCC	VCC	Supply voltage 10… 30 V DC
J	Black	GND_{power}	GND_{power}	Ground supply voltage
K	Violet	Q2	Q2	Q2 switching output
L	Grey/pink	GND_{signal}	GND_{signal}	Ground measurement signal,analog
M	Red/blue	Q1	Q1	Q1switching output



The shield of the device cable is to be connected to the shield connector of the equipment, e.g. PLC.

Inverse polarity protection is provided.

Overvoltage protection is provided up to a maximum of 30 V DC.

Open, unused cable wires must be insulated.

Figure 2. Cable box pin assignment, view from above on the device

4.5 Serial Interface RS232

The serial interface RS232 can be used for
- Measured data transmission
- AR2000 parameterization

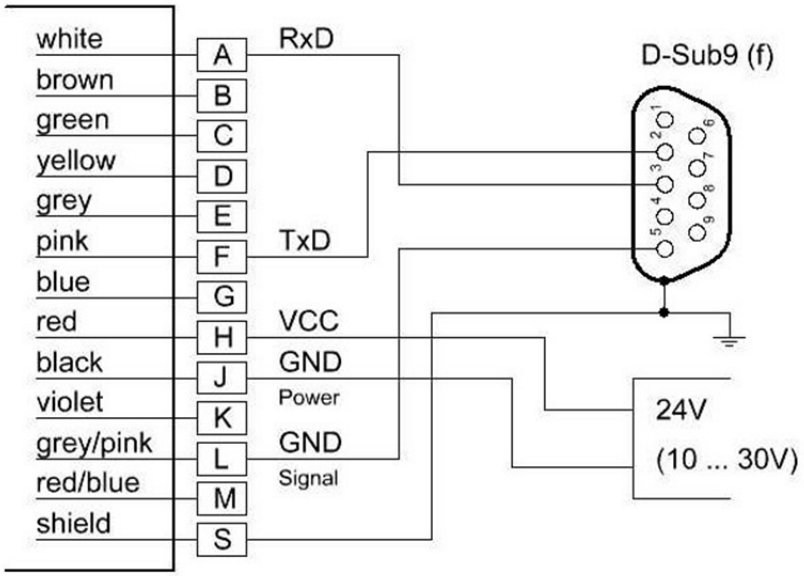


Figure 3. Wiring of serial interface RS232

4.6 Serial Interface RS422

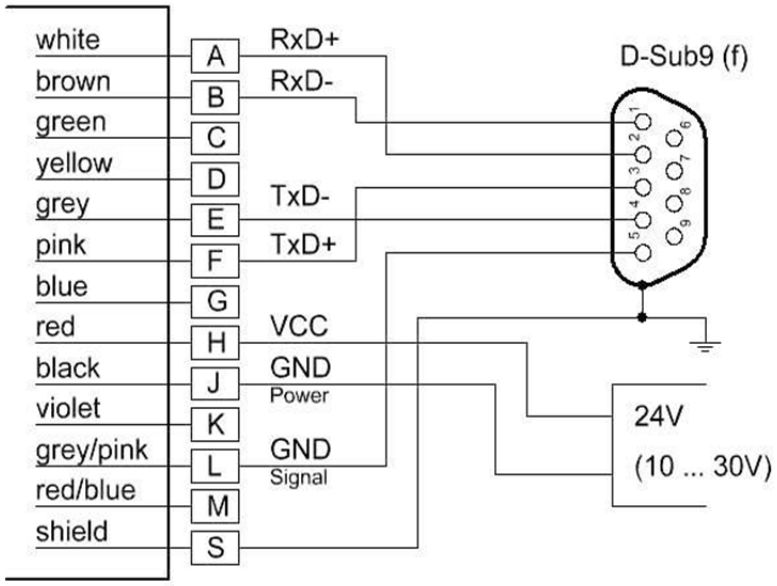


Figure 4. Wiring of serial interface RS422

4.7 Serial interface RS485

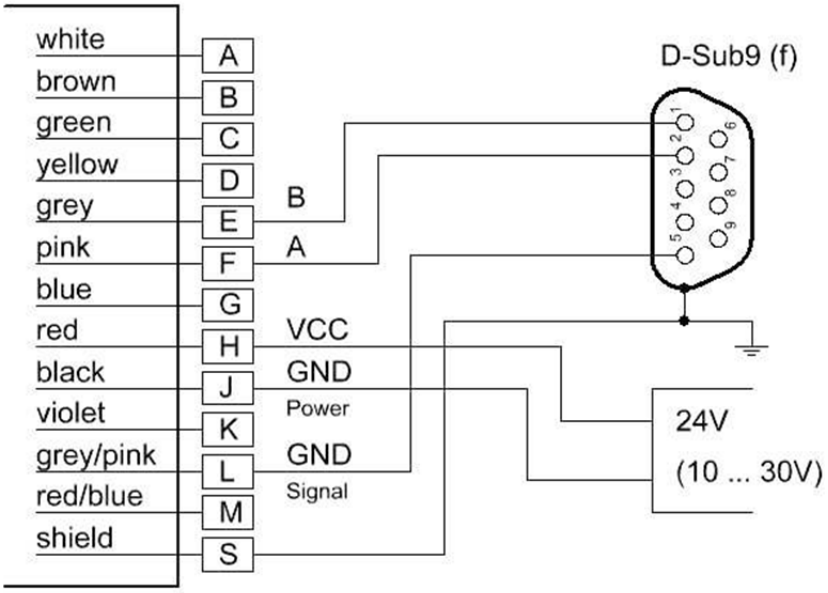


Figure 5. Wiring of serial interface RS485

4.8 Laser Beam Spot Specifications

The laser beam of the AR2000 has a divergence of 0.13 mrad x 0.17 mrad (width x height).

The diameter of the laser spot on the exit lens measures 4 mm.

The table below shows the size of the laser spot in relation to the distancefrom the target. The laser spot has an elliptical shape.

Distance	Laser spot width	Laser spot height
1m	5mm	5mm
5m	3mm	3mm
10m	4mm	5mm
50m	6mm	7mm
100m	26mm	34mm
200m	52mm	68mm
400m	104mm	136mm
500m	130mm	170mm

The above-mentioned laser spot holds approximately 50 % of the entire laser energy. An aura with less energy forms around that spot.

5. INSTALLATION AND COMMISSIONING

5.1 Mechanical installation conditions

There are two different ways to install the AR2000 laser distance meter.

3 M6 socket cap screws are included in the scope of delivery.

1. Fastening through one of the side faces

   Two M6 screws + washer spring + washer

2. Fastening through the housing bottom

   Three M6 screws + washer spring + washer

3. Cable connections

   In order to ensure variability in the application of the device, connecting cables with straight or angular connectors are available (also see chapter 4.3).

   The cables are not included in the scope of delivery. Please order them as required.

4. Attaching the light protector (optional)

   An optional light protector is available for application in very bright environments.

   Part number: APL025012 The light protector is attached to the front face (laser beam emission point) using three M3x8 screws.

   The screws are included in with the Sun Screen.

When the device is used outdoors under extreme environmental conditions, an enclosure is recommended. Otherwise, moisture may enter the device despite the IP 67 rating due to rapid temperature changes.

5.2 Commissioning

5.2.1 Preparatory work prior to installation

- Remove the packaging of the AR2000.
- Check the delivery for completeness.
- Examine the device and the accessories for damage.
- Examine the connections and cables for damage.

5.2.2 Installation work checklist

The following table suggests a commissioning procedure for the AR2000, without claiming to be exhaustive. The user is responsible for the application-specific cabling and for the parameterization of the Profibus (optional), particularly of the slave address. Thus, the latter are taken as a given.

When the AR2000 is taken into operation for the first time, we recommend carrying through the configuration steps at a laboratory or office.

The device can be configured using either the display or a communication program. For example, the program HyperTerminal (included in Win32 operating systems) or any other communication or terminal emulation program can be used.

In order to parameterize the device using a communication program, the AR2000 must be connected to supply voltage and a PC (also see Fig. 2 in chapter 4.4).

SSI and/or Profibus need to be set up separately.

No.	Work step
1	Unpack the AR2000, check it for damage.
2	Mount the AR2000 at the target location (with 2 screws through the side face or 3 screws through the bottom) --> see 5.1. Roughly direct it at the target surface.
3	Plug and firmly screw on the interface cable in the de-energized condition.
4	Connect and firmly screw on the Profibus and SSI connections (optional).
5	Wire the open cable end. Energize. Green status LED must light up.
6	As soon as STATUS LED is green, the red laser beam will be visible. Precondition: AS DT/ CT (default value). Mechanical fine adjustment can be executed.
7	Parameterize the AR2000 via the menu navigation on the display. Alternatively parameterize the device using a terminal emulation program.
8	Activate the distance measurement mode (e.g. DT).
9	Start the distance measurement (laser is switched on). Measurement output and target LED must be checked. Stop the distance measurement mode. Alternative: Start measurement via Profibus. The SSI measurement mode is to be defined in the AUTOSTART AS command.
10	Final visual check

6. PARAMETER SETUP AND MEASURING OPERATION

6.1 General information

The AR2000 is parameterized using the serial interface or the display. Precondition for programming via serial interface is a connection provided by a terminal program (e.g. HyperTerminal --> see chapter 7).

The set parameters are stored in an EEPROM.

The last entered data will be available upon restarting.

- **Retrieval of parameters**

  Input PARAMETER <ENTER> <ENTER> = CR = (0x0D)

- **Setting of parameters**

  Input PARAMETER VARIABLE <ENTER>

  The variables are described with the individual parameters.

  Several variables are separated by spaces (0x20).

- **Starting a measurement** (operating modes) Input COMMAND <ENTER>

- **Stopping a measurement**<ESC> <ESC> = (0x1B)

  Distances are always entered in 0.1 mm (100 µm).

  The scale factor SF has no influence on the input parameters.

  Example: Input: 3.20 m = 320000

The output values shown in the manual are examples. They may vary depending on the settings and environmental conditions.

Whenever an incorrect or incomplete command is entered, the following responses are shown:

?	The input does not contain any parameter or command. e.g.: HELLO<ENTER>
Parameter with current value	Entry of a parameter with incorrect figure/ parameterization e.g.:Input: SAxxx<ENTER> e.g.: Output: SA 10 (where SA = 10 prior to input)

6.2 Measurement involving moving targets

Where measurements involve a moving object or the AR2000 is moved during measuring an impact on the accuracy of the measured value may be observed.

This must be observed particularly when calculating average values (parameter SA).

The speed of the moving object may be 20 m/s at the highest.

Measurement jumps of > 30 cm and/or considerable changes in the reflectivity of the target surface can prolong the measurement period. In case of a fixed measuring frequency (parameter MF), this may result in no measured value being generated within the predefined time. A warning or error message will be displayed instead.

6.3 Identification

6.3.1 ID recognition

When entering the command ID, the AR2000 will respond by displaying the manufacturer's data in the following order: Device type, serial number, manufacturer's part number, firmware version, time stamp.

Query:	ID

Example: AR2000 130007 012890-001-22 V5.13.1021 13-10-23.10:10

6.3.2 ID? – Online help

By entering the command ID?, the user will obtain an overview of all available operations and parametersdescribed in the following sections.

Query:	ID?

Response:

```
Command List: Command must start with correct beginning, e.g.: "DM2" = "DM 2".
       (%u) declares the option of adding a positive integer to change the parameter.
       (%d) declares the option of adding an integer to change the parameter.
       (%f) declares the option of adding a floating-point number to change the parameter.
       (%s) declares the option of adding a string (e.g. "cm" in case of MUN) to change the parameter.
       (%b) declares the option of adding a boolean value (0 = false, or 1 = true) to change the parameter.

**Identifications**
 ID?               - Prints this help.
 ID                - Prints the firmware ID.
**Status/Parameters**
 TP                - Prints the temperature of the device.
 PA                - Prints all parameters.
 PR                - Resets the parameters to firmware defaults.
 SA  (%u)          - Prints/Changes number of to be fused measurements. Co-domain: [0, 50], (0 == auto).
 MF  (%f)          - Prints/Changes measurement frequency. Co-domain: [0.0, 100.0].
 MW  (%u %u)       - Prints/Changes the expected ranged for measurements in decimillimeters.
 MUN (%s)          - Prints/Changes the unit of the measurements. Co-domain: {mm, cm, dm, m, in/8, in/16, in, ft, yd}.
 OF  (%d)          - Prints/Changes the offset in decimillimeters. Co-domain: [-5000000, 5000000].
 SD  (%u %b %b %b) - Prints/Changes the output format.
 Q1  (%d %u %d %b) - Prints/Changes the parameterization of switching output Q1.
 Q2  (%d %u %d %b) - Prints/Changes the parameterization of switching output Q2.
 Q3  (%d %u %d %b) - Prints/Changes the parameterization of switching output Q3.
 QA  (%u %u)       - Prints/Changes the parameterization of the analog switching output QA.
 TRI (%u %u)       - Prints/Changes the parameterization of the input trigger TRI.
 TRO (%u %u)       - Prints/Changes the parameterization of the output trigger TRO.
 BR  (%u)          - Prints/Changes the baudrate of the serial port. Co-domain: {600,1200,2400,4800,9600,14400,19200,28800,38400,56000,57600,115200,128000,230400,256000}.
 SB  (%f)          - Prints/Changes the stopbits of the serial port. Co-domain: {0.5, 1.0, 1.5, 2.0}.
 RS  (%u)          - Prints/Changes the mode of the serial port. Co-domain: {232, 485, 422}.
 AS  (%u)          - Prints/Changes the autostart commands. Co-domain: {1 .. 10}.
 TE  (%u)          - Prints/Changes the terminator. Co-domain: {1 .. 10}.
 SE  (%u)          - Prints/Changes the behaviour on errors. Co-domain: {0 .. 2}.
 SP  (%u)          - Prints/Changes the character that separates the values (e.g. distance and temperature). Co-domain: {1 .. 5}.
 SF  (%f)          - Prints/Changes the scaling factor. To use [MUN] set "SF 0". Co-domain: [(+/-)0.001, (+/-)10.000].
 MCT (%b)          - Prints/Changes the tracking mode, started from the menu. Co-domain: {0 == standard, 1 == continous}.
 DF                - Turns off the OLED-Display.
 DN                - Turns on the OLED-Display.
**Operation Mode**
 DR                - Restarts the device (does not reset parameters).
 TLD               - Prints status of laser diode.
 LF                - Deactivates laser diode.
 DM  (%u)          - Starts precise measurement, uses %u as average parameter if available.
 SDT               - Deactivates tracking modes.
 CT                - Activates/Deactivates contineous tracking mode.
 DT                - Activates/Deactivates tracking mode.
 LN                - Activates laser diode.
```

6.4 Status

6.4.1 Internal temperature

Output of the internal device temperature in °C

The internal temperature is about 10 °C higher than the ambient temperature.

When the specified temperature range is exceeded or is less than the setting, the warning w1904 or w1905 will be generated cyclically. Measurements will not be possible until the temperature has returned to a point within the specified range.

Query:	TP

Response (example): 26°C

The AR2000 user must make sure that the specified ambient temperature (operating temperature) is adhered to. The AR2000 will not be switched off automatically when the temperature is above or below the defined temperature range.

6.4.2 PA – Parameter setting

Output of a parameter list with the current settings

Query:	PA

Output:

```
Baudrate of serial port [BR]:                              115200
Stopbits of serial port [SB]:                              1
Serial port mode (RS232/422/485) [RS]:                     232
Average [SA]:                                              1
Measurement frequency [MF]:                                0.0
Minimum distance from target in 'mm / 10' [MW]:            -5000000
Maximum distance from target in 'mm / 10' [MW]:            5000000
Offset in 'mm / 10' [OF]:                                  0
Parametrization of switching output Q1 [Q1]:               0, 1000000, 2500, 0
Parametrization of switching output Q2 [Q2]:               0, 1000000, 2500, 0
Parametrization of switching output Q3 [Q3]:               0, 1000000, 2500, 0
Parametrization of the analog switching output QA [QA]:    0, 1000000
Unit for the distances [MUN]:                              mm
Trigger (input) [TRI]:                                     0, 0
Trigger (output) [TRO]:                                    0, 0
Autostart commands [AS]:                                   DT
Output format [SD]:                                        0 0 0 0
Terminator [TE]:                                           0x0D0A
Scale factor [SF]:                                         0.000
Error mode [SE]:                                           0
Separator [SP]:                                            0x2C
Standard tracking mode from menu [MCT]:                    0
```

6.4.3 PR – Parameter setting

Resetting of all parameters to factory settings (default values)

The following parameters are not reset by entering PR:

BR	Baud rate
RS	Serial port
SB	Stop bits
SSI	SSI interface parameters
PB	Profibus interface parameters

Setting parameters for serial interface

Input:	PR

Output:

```
Parameters set to firmware defaults.
Baudrate of serial port [BR]:                              115200
Stopbits of serial port [SB]:                              1
Serial port mode (RS232/422/485) [RS]:                     232
Average [SA]:                                              1
Measurement frequency [MF]:                                0.0
Minimum distance from target in 'mm / 10' [MW]:            -5000000
Maximum distance from target in 'mm / 10' [MW]:            5000000
Offset in 'mm / 10' [OF]:                                  0
Parametrization of switching output Q1 [Q1]:               0, 1000000, 2500, 0
Parametrization of switching output Q2 [Q2]:               0, 1000000, 2500, 0
Parametrization of switching output Q3 [Q3]:               0, 1000000, 2500, 0
Parametrization of the analog switching output QA [QA]:    0, 1000000
Unit for the distances [MUN]:                              mm
Trigger (input) [TRI]:                                     0, 0
Trigger (output) [TRO]:                                    0, 0
Autostart commands [AS]:                                   DT
Output format [SD]:                                        0 0 0 0
Terminator [TE]:                                           0x0D0A
Scale factor [SF]:                                         0.000
Error mode [SE]:                                           0
Separator [SP]:                                            0x2C
Standard tracking mode from menu [MCT]:                    0
```

6.4.4 SA – Average value

SA determines the number x of the individual measured values to be averaged for measured value output. SA directly correlates with the measuring frequency MF.

SA and MF determine the output frequency for the measured values.

Query:	SA
Set:	SAx
Range of parameter x:	1 to 50; resolution: 1
Standard:	1

The spread of the measured values can be reduced by determining average values.

$$\sigma_{SA} = \sigma_1 / \sqrt{SA}$$

σ_{SA} Spread after average determination including several distance measurements

σ_1 Spread of individual measured values (+ 1 mm)

SA Average value

Example values of measurements involving a target with 80% reflectivity and a maximum distance of 30 m

Measuring frequency MF (Hz)	Average value SA	Output frequency (Hz)	Spread in mm
20	1	20	± 1.0
20	10	2	± 0.3

6.4.5 MF – Measuring frequency

MF parameterizes the number x of the measured value outputs per second.

When a value x outside of the measurement range is entered, the lowest or highest permissible MF valuewill automatically be set.

Entered value < x → MF 0.0
Entered value > x → MF 100.0

MF 0 = Automatic measurement. The output frequency ranges between 0.3 Hz and 10 Hz in most cases.

Essential factors concerning the measurement period are, among others, the reflectivity of the target surface and the environmental conditions (e.g. light, fog, rain).

Query:	MF
Set:	MFx
Range of parameter x:	0.0 …100.0 (Hz), resolution: 0.1
Standard:	0

Output: Measurement frequency [MF]: 0.0

The measuring period will be longer when an average value SA ≠ 1 is set!

6.4.6 MW – Measurement window

Parameterizes the scope of a measurement window by start x and end y.

Only measured values within the measurement window will be put out.

For example, the measurement window can be used to:

Eliminate interfering objects before or behind a measurement range

Define a measurement range

If there is no target object within the defined measurement window, an error message will be generated cyclically:

e1207 A target before or behind the measurement window is recognized .

e1203 No target was found.

Query:	MW
Set:	MWx y
Range of parameter x:	Resolution: 0.1 mm
Range of parameter y:	Resolution: 0.1 mm
Standard:	-5000000 5000000

Output:

Minimum distance from target [MW]: -5000000 (500 m)

Maximum distance from target [MW]: 5000000 (500 m)

The AR2000 does not check the set measurement window for plausibility. The user is responsible for correct parameterization!

6.4.7 MUN – Unit of the measured value

MUNx enables the definition of a unit for the output value. It is shown together with the measured value.

In order to use MUN, SF 0 must be set.

Query:	MUN
Set:	MUNx
Range of parameter x:	mm, cm, dm, m, in/8, in/16, in, ft, yd
Standard:	mm

Output: Unit for the distances [MUN]: mm

6.4.8 SF – Scale factor

SFx defines a factor by which the output value is multiplied.

Query:	SF
Set:	SFx
Range of parameter x:	-10.000 to 10.000
Standard:	0

Output: Scale factor [SF]: 0.000

At SF ≠ 0 the parameter MUN is ineffective.
At SF = 0 the unit defined by MUN becomes effective.

Example of the data output:

SF	0	1	2	10
Distance 1.23 m	001230.0 mm	001230.0	002460.0	00012300

6.4.9 OF – Offset

OF parameterizes a user-specific offset x that is added to the measured value.

It is entered in 0.1 mm.

Query:	OF
Set:	OFx
Range of parameter x:	-5000000 to 5000000
Standard:	0

Output: Offset in 0.1 mm (100 μm) [OF]: 0

The AR2000 does not check the set offset for plausibility. The user is responsible for correct parameterization!

6.4.10 SD – Data format of the serial interface output

SD parameterizes the output format and the possible output values.

The following outputs are possible:

Distance
Signal quality
Temperature
Switching outputs (active/ inactive)

Query:	SD
Set:	SDw x y z
Range of parameter w:	0 to 5
Range of parameter x, y, z:	0 or 1
Standard:	0 0 0 0

Output: [SD]: 0 0 0 0

Separator in correspondence with parameter TE

Parameter w	Output format	Separators between the values	Unit of measure (SF 0 + MUN x)	Example (SF 0 + MUN mm)
0	Decimal	1 separator	Unit	d002 925.4 mm = 2925.4 mm
1	Decimal	None	None	d002925.4 = 2925.4 mm
2	Hexadecimal (floating point format IEEE-754)	None	None	h4536E9EC = 2926.6 mm
3	Hexadecimal	None	None	h000B6E = 2926 mm
4	Binary	None	None	0x80 0x01 0x64 0x46 = 2925.4 mm
5	SSI and switching outputs only	None	None	SSI: Distance value in 0.1 m Switching output: 0 or 1

Parameter	Value	Signal quality	Temperature	Switching outputs
X	0	Off		
X	1	On		
Y	0		Off	
Y	1		On	
Z	0			Off
Z	1			On

Binary format:

Distance:

4 Byte, MSB = Bit 31
MSB of Byte 3 always 1
MSB of Byte 2, 1 and 0 always 0
Measurement data of each Byte = Bit 6 … Bit 0
Coding: Two´s complement

Signal:

2 Byte
MSB = Bit 15
MSB of Byte 1 and 0 always 0
Measurement data of each Byte = Bit 6 … Bit 0
no sign bit
maximum value: 16383 (14 Bit data)

Temperature:

2 Byte
MSB = Bit 15
Sign bit = Bit 14
MSB of Byte 1 and 0 always 0
Measurement data of each Byte = Bit 6 … Bit 0

Binary format of switching outputs Q1, Q2, Q3

1 Byte
MSB = Bit 7 always 0
Q1 = Bit 2
Q2 = Bit 1
Q3 = Bit 0

1 = switching output on (active)
0 = switching output off

Bit	7	6	5	4	3	2	1	0
	0	0	0	0	0	1	0	1
	MSB					Q1	Q2	Q3
	= 0					on	off	on

For parameterizing of switching outputs see chapter 6.6

6.4.11 BR – Baud rate

BR enables the adjustment of the serial baud rate x.

As soon as a new baud rate is set, the device will start communicating with the new baud rate.

BR will not be modified upon a parameter reset via PR.

Query:	BR
Set:	BRx
Range of parameter x:	600,1200,2400,4800,9600,14400,19200,28800,38400,56000, 57600,115200,128000,230400,256000
Standard:	115200 baud/ 8 data bits /1 stop bit / no parity

Output:

Baud rate of serial port [BR]: 115200

Prior to setting a high baud rate of > 115200 baud, make sure that the subsequent system is capable of processing that baud rate.

6.4.12 SB – Stop bit of the serial output

Sets the parameter of the stop bit for serial data transmission

Query:	SB
Set:	SBx
Range of parameter x:	0.5 / 1.0/ 1.5/ 2.0
Standard:	1.0

Output: Stop bits of serial port [SB]: 1

6.4.13 RS – Serial port

Selection of the serial interface to be used for communication

Query:	RS
Set:	RSx
Range of parameter x:	232/ 422/ 485
Standard:	232

Output: Serial port mode (RS232/422/485) [RS]: 232

If RS is set to a wrong interface, communication will be impossible!
The setting must be adjusted via the device display afterwards:
Parameters --> BUS --> UART --> RS-232/422/485

6.4.14 AS – Autostart

The autostart function defines the behavior of the AR2000 after a cold boot.

After the connection to the supply voltage and the internal start-up routine the AR2000 will automatically execute the command and send the data to the available outputs.

A figure from the table below must be entered.

The display / output shows the command.

Query:	AS
Set:	ASx
Range of parameter x:	1 to 24 (see table below)
Standard:	5

Value x	Command	Meaning
1	ID	Output of device identification
2	ID?	Output of command list
3	TP	Output of internal device temperature
4	DM	Start of individual measurement
5	DT	Start of continuous measurement
6	CT	Start of quick continuous measurement
7	DF	Display is deactivated
8	DF ID	Display is deactivated + output of device identification
9	DF TP	Display is deactivated + output of internal device temperature
10	DF DM	Display is deactivated + start of individual measurement
11	DF DT	Display is deactivated + start of continuous measurement
12	DF CT	Display is deactivated + start of uninterrupted continuous measurement
AR2000 laser with heating only (temperature range -40 °C to +60 °C)		
13	SH	Heating is deactivated
14	SH ID	Heating is deactivated + output of device identification
15	SH TP	Heating is deactivated + output of internal device temperature
16	SH DM	Heating is deactivated + start of individual measurement
17	SH DT	Heating is deactivated + start of continuous measurement
18	SH CT	Heating is deactivated + start of uninterrupted continuous measurement
19	SH DF	Heating is deactivated + display is deactivated
20	SH DF ID	Heating is deactivated + display is deactivated + output of identification
21	SH DF TP	Heating is deactivated + display is deactivated + output of internal device temperature
22	SH DF DM	Heating is deactivated + display is deactivated + start of individual measurement
23	SH DF DT	Heating is deactivated + display is deactivated + start of continuous measurement
24	SH DF CT	Heating is deactivated + display is deactivated + start of uninterrupted continuous measurement

Depending on the measurement mode used, it takes max. 6 s from applying the supply voltage to the point where the first measured value is put out.

Output: Autostart commands [AS]: ID

6.4.15 TE – Terminator

TE is used to set the terminator for the output of measured values in the ASCII format (also see command SD).

Query:	TE
Set:	TEnn
Range of parameter nn:	1 to 10
Standard:	1

Example:

Input: TE 1

Output: TE 1

Value selection:

nn	ASCII	Meaning
1	0x0D 0x0A	CR LF (ENTER)
2	0x0D	CR
3	0x0A	LF
4	0x02	STX
5	0x03	ETX
6	0x09	HTab
7	0x20	Space
8	0x2C	Single Quote
9	0x3A	Colon
10	0x3B	Semicolon

When an invalid character is entered, it will not be set. The current separator will be kept instead.

6.4.16 SE – Error mode

Parameterizes the behavior x of switching outputs Q1, Q2, Q3 and of the analog output QA in case of faulty measurements as well was the condition upon execution of an individual distance measurement.

Query:	SE
Set:	SEx
Range of parameter x:	0, 1 or 2
Standard:	1

X	Q1, Q2, Q3 (z=0)	Q1, Q2, Q3 (z=1)	QA
0	Last value	Last value	Last value
1	High	Low	3 mA
2	Low	High	21 mA

Low: U < 1 V

High: U = operating voltage – 1 V

The AR2000 does not check the set error mode for plausibility!

6.4.17 SP – Separator for parameters

Output values are separated by the character SP.

Query:	SP
Set:	SPx
Range of parameter x:	1 to 5
Standard:	1

Output: Separator [SP]: 0x2C

Value x	Symbol	ASCII
1	Comma	0x2C
2	Semicolon	0x3B
3	Space	0x20
4	Slash	0x2F
5	Tabulator	0x09

6.4.18 HE – Heating adjustment

The parameter HE defines the switching thresholds for switching the heating element on and off.

The command is enabled only where the device is actually equipped with a heating element.

Query:	HE
Set:	HEx y
Range of parameter x: Switching on heating	-40 to 40 (integer)
Range of parameter y: Switching off heating	-40 to 40 (integer)
Standard:	HE10 4

6.4.19 MCT – Output/ modification of the operating mode when starting a measurement using the display

When starting a continuous measurement using the integrated display, you need to define if the AR2000 should measure based on the operating mode DT or CT.

The operating mode is selected via the command MCT.

When starting a measurement using the display, the predefined operating mode will be applied as a rule.

When a measurement is started using a communication program or PLC, the command DT or CT will determine the type of measurement.

6.4.20 Additional commands

Command	Description
DF	Switches off the display (OLED)
DN	Switches on the display
LF	Switches off the laser diode
LN	Switches on the laser diode
SDT or ESC key	Deactivates the continuous measurement mode
SH	Switches off the heating until restart (available only in devices that are equipped with a heating element)
TP	Output of device temperature
DR	Executes a restart (does not reset the parameters; no PR!)

6.4.21 PB – Setting the Profibus parameters

See supplemental Profibus Manual

6.4.22 SSI – Setting the SSI parameters

See supplemental SSI Manual

6.5 Operating modes

6.5.1 DM – Individual distance measurement

The AR2000 will perform exactly one measurement and then wait for new instructions.

The duration of the measurement depends on the number of preset measuring values SA and the preset measuring frequency MF.

Input: DM

Typical parameter settings

MF0, SA1, DM

Execute single measurement, allowing for a sufficient period of time as needed to reliably (accuracy < 1mm) determine the distance to a static (during the measurement) target object.

MFx, SA1, DM

Execute a single measurement, allowing for a period of time of maximally 1 / x seconds to reliably (accuracy< 1 mm) determine the distance to a static (during the measurement) target object.

6.5.2 DT – Continuous distance measurement (distance tracking)

The AR2000 performs a continuous measurement.

The measurement can be interrupted by a command:

Display	STOP
RS232/422/485	Escape = 0x1B

The output frequency of the measured values depends on the selected parameters MF and SA.

The DT mode works with high measuring stability in the collection of the measured values, even in case of beam interruptions and discontinuous motion sequences of the target.

Input: DT

Full measurement (new adjustment of frequencies to define the unambiguous range)will be forced after beam interruptions.

Example response (setting SD 0): D 0002.935 21.1 57.8

Output format =	decimal (D)
Distance =	2.935 m
Signal quality =	21.1
Temperature =	57.8 °C

Remarks:

In case of poor target reflectivity, it cannot be guaranteed at 100 % that the respective measurement will be completed within a period of time of 0.01 s (100 Hz). Thus, a warning will be generated. --> w1910

The output frequency will remain constant.

There are the following alternatives:

1) A variable output frequency can be selected for surfaces with low reflectivity. The AR2000 will keep measuring until a representative distance value can be determined. Normally, the measuring period ranges between 0.01 and 3 seconds (no average determination).
2) Where a measured value output of 100 Hz is not needed, a lower measuring frequency can be set via the parameter MF. While this parameter influences the output frequency, it has no impact on the internal measuring frequency.

The output frequency can also be reduced by using the average determination function.

For example, if an average determination covering 5 measured values (SA 5) includes a warning, only 4 measured values will be used for average determination. Where there is only one measured value, there will be one output. The output of warnings is avoided.

The tables below show the ranges and accuracies in relation to the target surface for out doorapplications. For indoor applications the measuring range could be larger. The measuring range dependson target reflectivity, stray light, measuring frequency and enviromental conditions.

Target	Measuring frequency	Measuring range	Maximum accuracy
white, matt, reflectivity approx. 80 %	variable	15 cm to 100 m	± 1mm
	20 Hz	15 cm to 40 m	± 1mm
	50 Hz	50 cm to 35 m	± 2.5 mm
	100 Hz	50 cm to 30 m	± 2.5 mm
grey, matt, reflectivity approx. 13%	variable	15 cm to 50 m	± 1 mm
	20 Hz	15 cm to 25 m	± 1 mm
	50 Hz	50 cm to 18 m	± 2.5 mm
	100 Hz	50 cm to 10 m	± 2.5 mm
black, matt, reflectivity approx. 6%	variable	15 cm to 20 m	± 1 mm
	20 Hz	15 cm to 10 m	± 1 mm
	50 Hz	50 cm to 10 m	± 2.5 mm
	100 Hz	50 cm to 10 m	± 2.5 mm
Reflective tape 3M 3279 special	variable	50 cm to 100 m	± 1 mm
	20 Hz	50 cm to 100 m	± 1 mm
	50 Hz	50 cm to 100 m	± 2.5 mm
	100 Hz	50 cm to 100 m	± 2.5 mm
Reflective tape Oralite 5200	variable	50 m to 500 m	± 1mm
	20 Hz	50 m to 450 m	± 1 mm
	50 Hz	50 m to 300 m	± 2.5 mm
	100 Hz	50 m to 250 m	± 2.5 mm

Where the output frequency is too high, this may result in the following errors with poor surfaces:

w1910	Generating a measured value within the predefined period of time was impossible(laser searches for suitable parameterization after distance jump/surface change). MF too high.
e1201/e1203	No laser reflection received (unsuitable / poorly reflecting surface). Reduce the value of the measuring frequency MF.
e1206	Target surface too bright or ambient light too intensive.
e1207	Distance is outside of the measurement window MW.

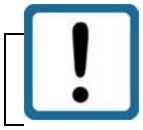
6.5.3 CT – Continuous tracking

The AR2000 performs an uninterrupted continuous measurement, adjusting the laser parameters(unambiguous ranges) in relation to the target only every 6 seconds or when an obvious distance measurement error has occurred.

The measuring accuracy for frequencies > 20 Hz is higher in the mode CT as in the operation mode DT.

Areas of application:

- Scanning of static targets.
- Quick measurements on hot surfaces.
- Tracking of continuously quickly moving targets (e.g. crab [crane], vehicle)



Distance jumps or laser beam interruptions can result in faulty measurements!

6.6 Q1/Q2/Q3 – Switching output

The switching outputs Q1, Q2 and Q3 show distance information as logic switching information. They signalize when values are above or below a preset switching range subject to hysteresis.

Hence, they are perfectly suitable for the direct further processing of monitoring variables such as filling level or object detection. Parameterization is done via the serial interface.

A load resistance of > 150 ohms/ 6W (30 V max. operating voltage : 0.2 A max. load current) must beswitched against GNDpower at the switching output. It is essential that the load current of 0.2 A is notexceeded.

Typical resistance: 1 K ohm against GNDpower (**not** against GNDsignal)!

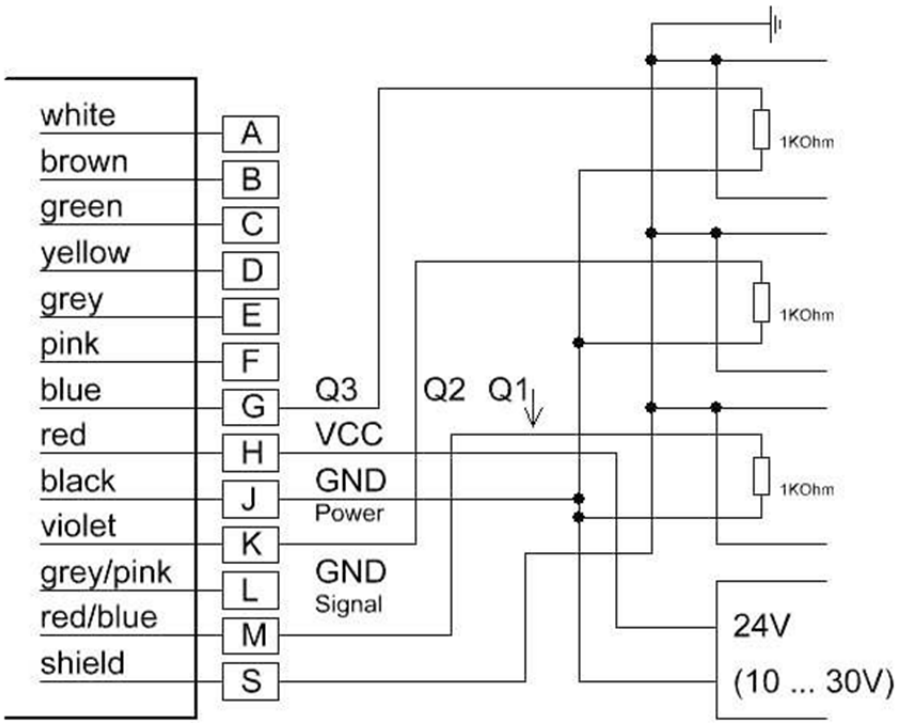


Figure 6.Wiring of switching outputs Q1, Q2, Q3

Q1/Q2/Q3 parameterizes the behavior of the switching outputs.

Parameterization covers the beginning w of the measurement range, i.e. the point where the output will switch, the length x of the measurement range, the hysteresis y and the logic behavior z.

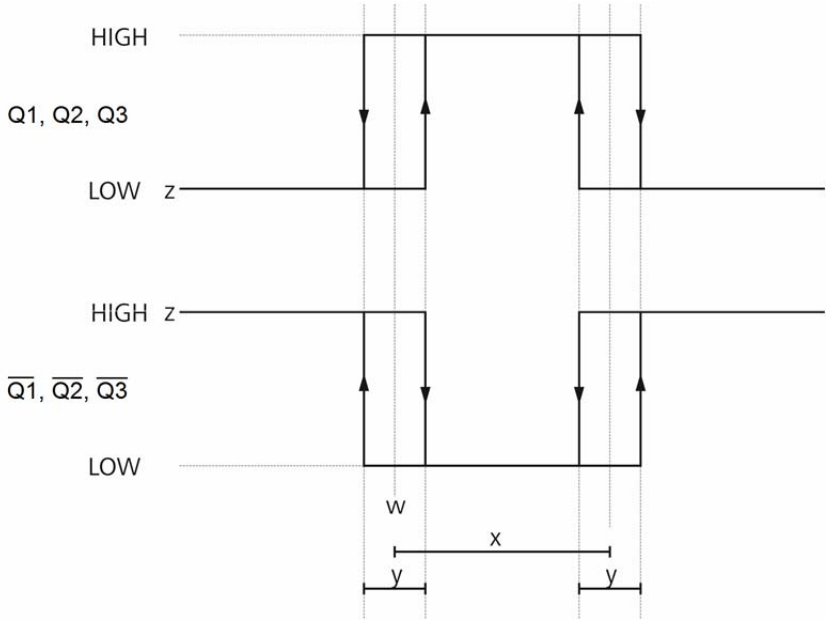


Figure 7. Switching behavior and parameters of the switching outputs

Low = 0 U < 1 V

High = 1 : U = operating voltage – 1V

Variable	Description	Specification
w	Switching threshold (in µm); activate switching status z from this distance	32 bits integer
x	Switching range (in µm); a range of x µm from w	32 bits integer
y	Switching hysteresis (in µm); length of the tolerance range	32 bits integer y ≥ 0
z	Switching status	z = 0 or 1

Query:	Q1 or Q2 or Q3
Set:	Q1w x y z or Q2w x y z or Q3w x y z
Standard:	0 100000 2500 1 (corresponds to: 0 m 10 m 25 cm 1)

The AR2000 does **not** check the settings of Q1, Q2 and/or Q3 for plausibility.

6.7 QA – Analog output

The analog output enables the stable, analog transmission of distance data across large distances using a two-wire line. The 4-20 mA current output is proportional to the measured distance within an adjustable distance interval. Parameterization is done via the serial interface.

The current output when faulty measurements occur is parameterized using the command SEx.

Properties of the analog output:

- 4 mA to 20 mA
- Indication in case of an error: 3 mA or 21 mA or last measured value (selectable via the parameterSE)
- Resolution: 12 bit D/A converter

Where current/ voltage is to be converted, a load resistance of 100 ohms ≤ R ≤ 500 ohms/ 0.5 W is to beswitched between current output QA and GND.

Capacitive load ≤ 10 nF

Operating voltage ≥ 12 V

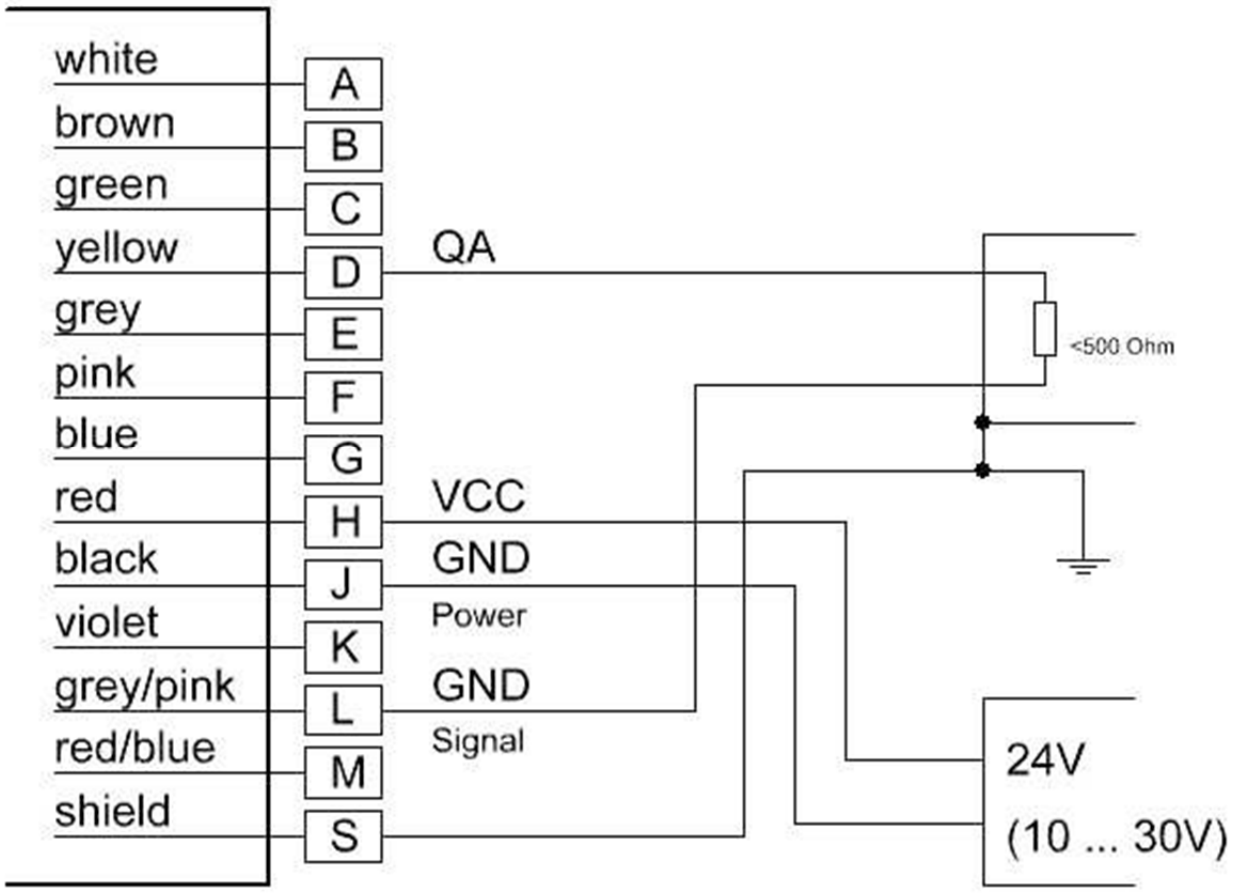
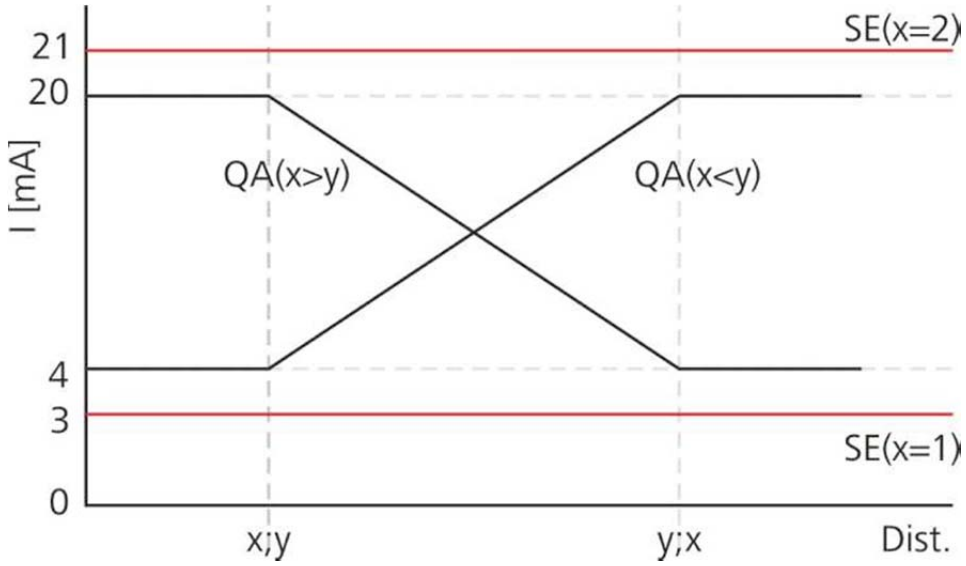


Figure 8. Wiring of analog output

Value	Description	Specification
X	Lower limit	x ≠ y
Y	Upper limit	y ≠ x



The lower limit can be lower or higher than the upper limit. The current range inverts accordingly.Entries of identical limits will be ignored and not accepted.

Query:	QA
Set:	QAx y
Range of parameter x:	-5000000 to 5000000
Range of parameter y:	-5000000 to 5000000
Standard:	0 100000 (0 to 10 m)

The measurement window MW also applies to the analog output.

The AR2000 does not check the QA settings for plausibility. The user is responsible for correct parameterization!

The value of the output current (in mA) is calculated as follows:

x > y

- $QA[mA] = 4mA + 16\frac{\text{Dist}-\text{x}}{\text{y}-\text{x}}\text{mA} QA[mA] = 20mA - 16\frac{Dist-\text{y}}{\text{x}-\text{y}}\text{mA}$

Dist= measuring distance

6.8 TRI + TRO Trigger

6.8.1 Trigger function

The AR2000 Trigger could be used as input or output.

1) Trigger input / external trigger function:

External trigger signal will be sent → start of measurement DM in accordance with parameter TRI.

2) Trigger output / e.g. connection between 2 AR2000:

The output trigger signal of the 1. AR2000 (parameterized with TRO) starts a single measurement DM ofthe second AR2000 (parameterized with TRO).

Differences between trigger input and trigger output

Important is the parameter x of TRI and TRO.

TRI x>0 / TRO x=0	Trigger input
	The measurement starts after an external trigger impulse.
TRI x=0 / Tro x>0	Trigger output
	AR2000 sends a trigger impulse to the second device.

The parametrization of the trigger connection is carried out via the serial interface or the internal display.

For the trigger function may only be activated TRI or TRO. A concurrent use of TRI and TRO is not possible → output of warning information

Voltage levels for the trigger signals

Low level 0 – 1,5 V

High level 3 – 30 V

Threshold 2,25 V

Hysteresis 0,1 V

6.8.2 TRI – Trigger input

The parametrization of trigger input will be set with command TRI.

X edge parameterized the edge of trigger signal

- 0 rising edge (from LOW to HIGH)
- 1 falling edge (from HIGH to LOW)
- 2 every edge

y delay parameterized the time (delay) up to the measurement in milliseconds msec

Query:	TRI
Set:	TRI x y
Value range parameter x:	0, 1, 2
Value range parameter y:	0to 60 000 msec active: from 1 msec upward disabled: 0 msec
Standard:	0 0

Output: Trigger (input) [TRI]: 0, 0

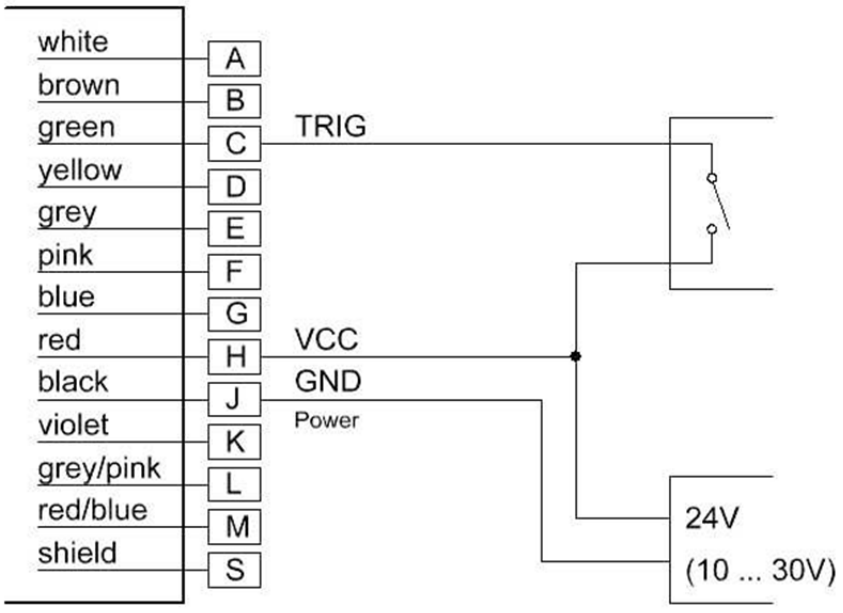


Figure 9. Wiring of trigger input

6.8.3 TRO – Trigger

The parametrization of the trigger output will be set with the command TRO.

x edge parameterized the edge of the trigger signal

- 0 rising edge (from LOW to HIGH)
- 1 falling edge (from HIGH to LOW)
- 2 every edge

y delay parameterized the time (delay) up to the measurement in milliseconds (msec)

Query:	TRI
Set:	TRI x y
Value range parameter x:	0, 1, 2
Value range parameter y:	0 to 60 000 msec active: from 1 msec upward disabled: 0 msec
Standard:	0 0

Output: Trigger (output) [TRO]: 0, 0

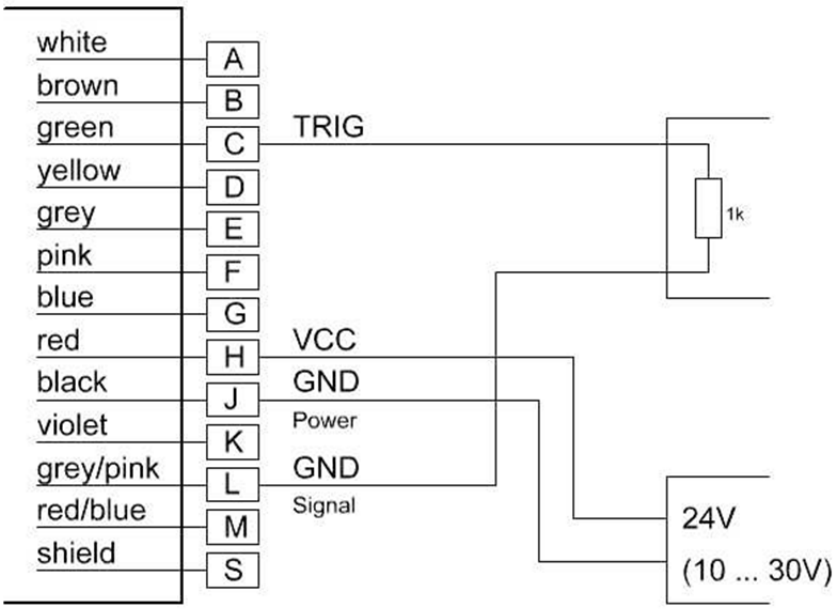


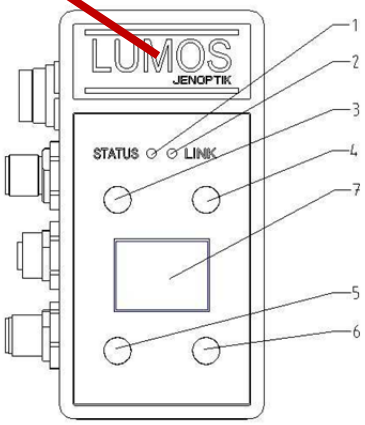
Figure 10. Wiring of trigger output

6.9 Direct controlling of the AR2000

The AR2000 can be programmed directly and set for measurements without a PC interface. The laser will need to be powered up. The AR2000 is ready for operation when the green STATUS LED is lit.

The individual menu items can be selected using 4 membrane keys, 2 above and 2 below the OLED display. The user language is English.

The display can be deactivated during the measurement. It can be switched on again by pressing key T3 or T4.



1	Status LED	off	Power supply off
		red	Power supply on, not ready for operation
		green	AR2000 ready for operation
2	LINK LED	off	no data transfer
		green, flashing	data transfer (Profibus/ serial) active
3	Key T1	Function see display indication	
4	Key T2	Function see display indication	
5	Key T3	Function see display indication	
6	Key T4	Function see display indication	
7	Display		

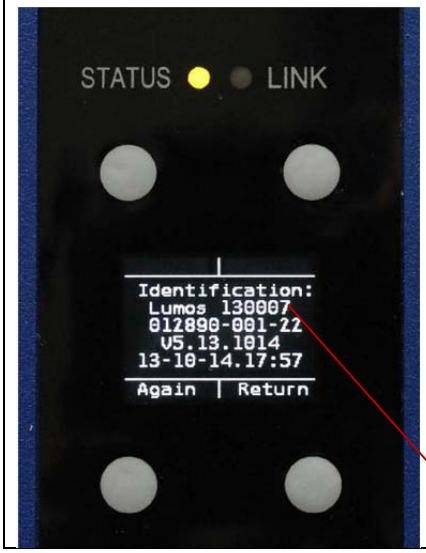
STOP	Measurement will be stopped
Disp.	Display will be disabled

The display can be enabled with key T4 or T3.

Parameter setting

After STOP (measurement) parameters can be set.

Menu↑	move cursor/ selection bar up
Menu↓	move cursor/ selection bar down
Select	select parameter
Meas.on	start measurement



Execute command

Example “Identification”:

→	stop measurement
→	Status → Select
→	Identification → Select
Again	repeat command
Return	return to upper menu

Figure 11. AR2000 Display

7 Serial interface and communication software

7.1 Transmission protocol

- Interface settings: Asynchronous, 8 data bits, no parity, 1 stop bit
- Transmission protocol format / syntax: 7 bit ASCII
- Proprietary transmission protocol
- Commands are not case-sensitive (NO differentiation between lower and upper case).
- Decimal separator in the output of figures is the dot “.” (0x2E).
- The terminator of a command (sending command) is the enter key (0x0D, 0x0A) or CarriageReturn (0x0D) or Line Feed (0x0A)
- Where parameters have several values, they are separated by a space (0x20).
- The response to commands with parameters is the respective command including the parameters.
- The response to commands without parameters is the respective command including the current parameters.
- The response to commands with parameters outside of the valid value range is the respective command including the current parameters.
- The response to unknown commands and faulty parameter formats is a “?” (ox3F).

7.2 Installation of the communication program

HyperTerminal is a terminal program generally included in Win32 operating systems. It can be used as a communication program to parameterize the AR2000.

Start HyperTerminal via the following menu path:

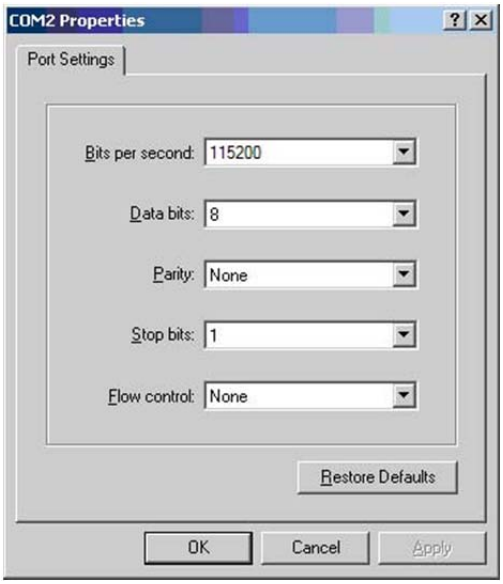
|Start | Programs | Accessories | Communication | HyperTerminal|

Enter the name of the new connection in the dialog box.

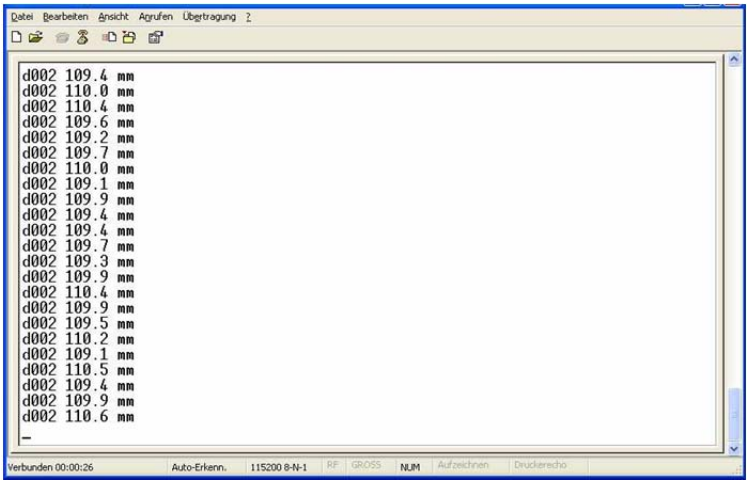
You can select any name. Confirm with [OK].

Select the serial COM interface in the second dialog box.

Upon confirming with [OK] a third dialog box will appear where the parameter settings for the current HyperTerminal session can be selected.



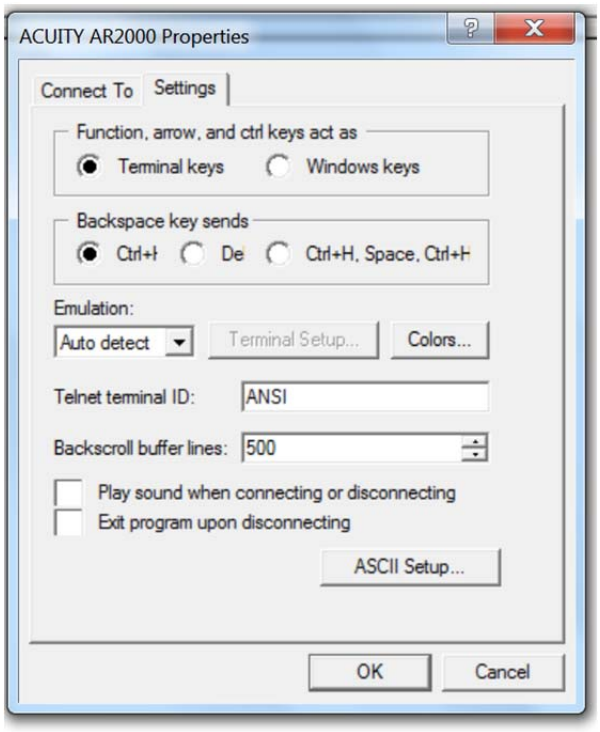
At this point, baud rate (bits per second) and flow control must be initialized correctly. As soon as the settings in the third dialog box are confirmed with [OK], the terminal window will open.

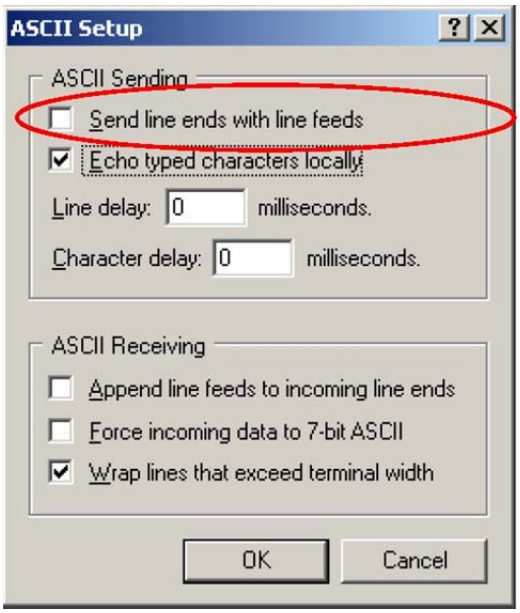


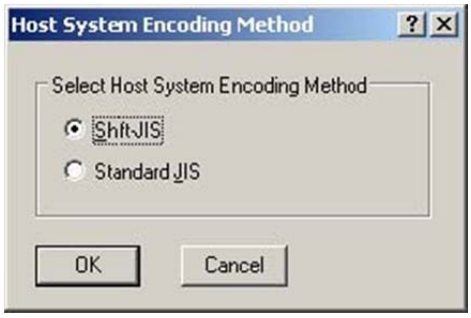
The status indication in the left bottom corner reads “Connected” when the preconditions for communication have been set correctly. As soon as the AR2000 is ready for operation (power supply, connection with PC), the commands can be entered e.g.: ID.

A command just entered will be displayed only when the “Local echo” function has been activated. The function can be parameterized via the menu “File”:

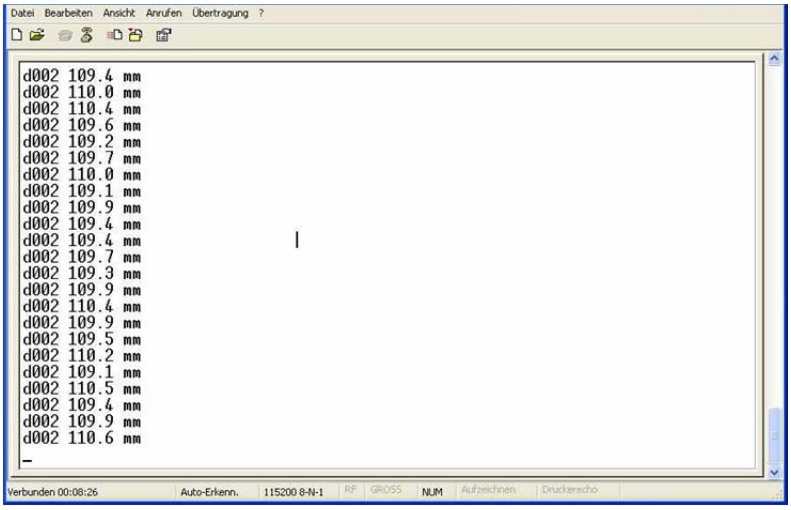
|File | Properties | Settings | |ASCII configuration...|





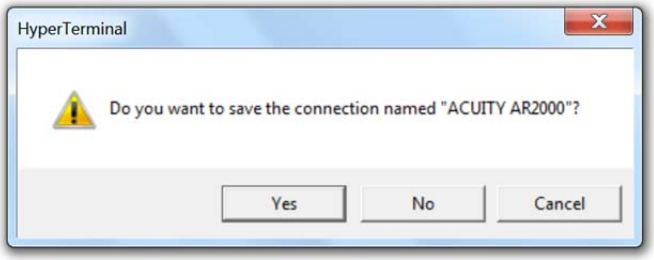


Please note: Do not check the box “Send line end with line feeds”.



End the session with |File | Quit|.

A small window will appear where you are asked if the connection should really be terminated. This question must be responded to by pressing the [Yes] button.



If the current HyperTerminal session has not been saved yet, a small window will appear where you are asked if the session should be saved. Confirm with “Yes”. HyperTerminal will not have to be configured again upon restart.

8 Error processing

In case of errors or when a measured value cannot be determined or output a warning or an error message will be displayed.

Error	Meaning
e1001	Unexpected error / hardware problems
e1002	Unexpected error / hardware problems
e1003	Unexpected error / hardware problems
e1101	Error in communication with PC
e1102	Error in communication with PC
e1103	Laser module error
e1104	Laser module error
e1105	Laser module error
e1106	Hardware error
e1107	Hardware error
e1108	Hardware error
e1109	Hardware error
e1110	Hardware error
e1111	Hardware error
e1112	Hardware error
e1113	Hardware error
e1201	Measurement impossible / no target
e1202	Hardware error
e1203	Target with unsuitable reflectivity
e1204	Measurement interrupted
e1205	Measurement still running
e1206	Target too bright / too much back light
e1207	Target outside of the measurement window (MW)
e1208	Incorrect measurement parameterization
e1209	Hardware error
Warnings	**Meaning**
w1901	Restart being executed
w1902	Input voltage outside of the specification
w1903	Input voltage outside of the specification
w1904	Temperature outside of the specification
w1905	Temperature outside of the specification
w1906	Heating active
w1910	Measurement not completed within predefined period of time
w1911	Measuring frequency too high

9. Technical data

Measurement properties	
Measurement principle	Pulse reflection mixing method
Measured parameter	Distances
Measuring range [1] Total On an Oralite 5200 target board On an 3M 3279 special target board Onto natural surfaces [1]	 0.15 m to 500 m 50 m to 500 m 0.15 m to100 m 0.15 m to100 m
Measurement accuracy [2](1 σ) Up to 20 Hz measuring frequency All measuring frequencies	 ± 1 mm ≤ 2.5 mm
Resolution of measured values	± 0.1 mm
Measuring period, minimum	10 ms
Laser	
Laser classification	Laser class 2, EN 608251:2007
Wavelength	635 nm
Divergence	< 0.2 mrad (50% laser power)
Laser spot in 10 m	4 mm x 5 mm
Electrical connection conditions	
Supply voltage	10 V to 30 V DC
Power consumption	< 10 W (without heating) < 42 W (with heating, 24 V)
Interface/ connections	
Connections[3]	1 x 12-pole (BINDER series 723) M16 2 x 5-pole (BINDER series 766) M12, B-type encoded 1 x 5-pole (BINDER series 763) M12, A-type encoded
Serial interfaces	RS232, RS422, RS485
Switching output	3 x “high side”, can resist up to 0.2 A
Analog output	4 mA to 20 mA Error handling at 3 mA / 21 mA Total output error at 20 mA: + 0.15% at a temp. of 25°C
Trigger, input + output	1 x

Profibus	
Profibus	DPV0 Slave | IEC 61158 / IEC 61784
Transmission rate	9.6 kbaud to12 Mbaud
Identity number	0E36 HEX
Baud rate recognition	Automatic
Terminator	External
Slave address	Can be set via display or SSA command
GSD file:	LDM50E36.GSD, PNOProfile Encoder Class 1/2
	Configuration of measurement parameters, switching outputs, trigger connection and starting behavior
	Output of measured distance values or error messages, monitoring of internal device temperature
	Storage of all parameters and PB address in NVRAM
SSI	
Transmission rate	200 kHz, 25 µs pause
Signal input/output	Difference signal (RS422)
	24 bits, binary or Gray-encoded, adjustable
	1 validity bit
Potential separation	500 V for signal input
LSB	Bit 0
MSB	Bit 23
Indicating and operating elements	2 status LEDs 4 membrane keys 1 OLED matrix display
Environmental and application conditions	
Operating temperature [3]	40°C to + 60°C (10°C … + 60°C)
Storage temperature	40°C to + 70°C
Humidity	15 % to 90 %, noncondensing
Housing protection class	IP 67
EMC	EN 613261

Technical Data

Dimensions	120 mm x 76.5 mm x 40 mm (L x W x H, incl. connections)
Weight [3]	Approx. 700 g

[1] Range for natural, diffusely reflective surfaces; dependent on target reflectivity, stray light, measuring frequency and environmental conditions
[2] Measurement accuracy dependent on target reflectivity, measuring frequency and environmental conditions
[3] Dependent on the type of device

10 Declaration of Conformity Update this page.

JENOPTIK

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EG-Konformitätserklärung
nach EMV - Richtlinie 2004/108/EG, Anhang I

EC Declaration of Conformity
in accordance with the Directive of Electromagnetic Compatibility 2004/108/ *EEC, annex I*

Hiermit erklären wir, vertreten durch die Unterzeichner, dass das nachfolgend bezeichnete Produkt
We herewith declare, represented by the signatories, that the following designated product

Laser-Distanzmessgerät
Laser Distance Meter

LUMOS / LDM51 Serie

folgenden harmonisierten Normen entspricht:
agree with the following harmonized standards:

EN 61326-1:2006 (IEC 61326-1:2005)	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen - Teil 1: Allgemeine Anforderungen / *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements*

Folgende sonstige technische Normen / Spezifikationen wurden berücksichtigt:
The following other standards / specifications were considered:

EN 60825-1:2007 (IEC 60825-1:2007	Sicherheit von Lasereinrichtungen - Teil 1: Klassifizierung von Anlagen und Anforderungen) *Safety of laser products - Part 1: Equipment classification and requirements* Laserklasse 2 / *Laser class 2*

Jena, 2013-10-16

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