OMS1/100 SSI

Operating Manual
Laser Measuring Device

Please keep for future use !

Edition date/Rev. date:	14.08.00
Document/rev. no.:	LZ - ELE - BA - GB - 0001 - 02
Software version:	V1.0
Filename:	LZ-ELE-BA-GB-0001.DOC
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Notation

Italics or **bold** print is used for titles of documents or for emphasis.

″ < > ″ is used to refer to the keys of your computer keyboard (e.g. <RETURN>).

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Revision index

Note

The current revision number and date appears on the front cover of this document. Since the footer of each individual page contains its own revision number and date, the revision status may vary within the same document.

The drawings included in the appendix have their own revision index.

Document issued: 16.09.1999

Revision	Date
General completions	15.05.2000
Connection note for laser devices with heating	14.08.2000

Table of Contents

1 Safety

1.1 General risk potential

The Laser Measuring Device OMS1/100 SSI cannot be operated independently, but is installed as part of an overall system usually consisting of several interacting components. For this reason, the laser measuring device is not equipped directly with a protective device.

It is, however, possible to check for below-minimum intensity via the output "Error output_OUT". To reset the device, the error must be acknowledged via the input "Acknowledge error_IN". It is therefore essential to integrate the error I/O into your **own safety system** via the evaluation software (e.g. a PLC).

All persons responsible for the assembly, start-up and operation of the device must

- be suitably qualified
- adhere strictly to this operating manual.

Your safety and the safety of your equipment depends on this!

1.2 Safety information

This operating manual contains information which must be observed in the interests of your own personal safety and that of your equipment. The safety hints are emphasised by a warning triangle and classified according to the degree of danger as follows:

Warning
means that failure to take the relevant safety precautions can lead to death, serious injury or major damage to property.

Caution
means that failure to take the relevant safety precautions can lead to minor injuries or damage to property.

i ***Note***
refers to important information and features of the product, plus tips on its application.

1.2.1 Hints on installation

Since the Laser Measuring Device is normally used as part of a larger system, these hints are merely intended as a guide for integrating the device safely into its environment.

Warning

- The safety and accident prevention regulations applicable to the specific application must be observed.
- In the case of permanently installed plants or systems without an all-pole mains switch and/or fuses, one of these devices must be installed accordingly and the equipment connected to a PE conductor.
- In the case of devices which run on mains voltage, make sure the set nominal voltage range coincides with the local mains voltage before start-up.
- In the case of 24 V supplies, make sure the extra-low voltage is reliably disconnected. Only use power supply units manufactured to the standards IEC 364 - 4 - 41 / HD 384.04.41 (VDE 0100 Part 410).
- Fluctuations or deviations of the mains voltage from the nominal value must not exceed the tolerance limits stated in the specifications, otherwise operational failures and dangerous states in the electrical assemblies cannot be ruled out.
- Precautionary measures must be taken to allow an interrupted program to be properly resumed following a voltage drop or failure. Dangerous operating conditions must not be permitted to arise even for short periods. If necessary, an ***"EMERGENCY STOP"*** must be forced.
- EMERGENCY STOP devices according to EN 60204/IEC 204 (VDE 0113) must remain operational in all operating modes of the programmable controller. The release of the EMERGENCY STOP devices must not trigger an uncontrolled or undefined reactivation of the equipment.
- Connecting and signal wires must be installed in such a way as to prevent the automation functions from being hampered by inductive and capacitive interference.
- The units of the automation system and their operating elements must be installed in such a way as to ensure adequate protection against accidental actuation.
- In order to prevent a wire or strand breakage on the signal side from causing undefined states in the programmable controller, suitable hardware and software safety precautions must be taken with regard to the I/O interface.

1.2.1.1 General interference suppression measures

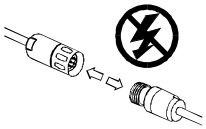
- Lay the (shielded) connecting cable to the device at a sufficient distance or in a separate room from any power cables which are subject to interference.
- To ensure reliable data transmission, use fully shielded cables. For differential data transfer (RS422, RS485 etc.), twisted-pair wires must be used in addition.
- Use a minimum cable cross-section of 0.22 mm^2 for data transfer purposes.
- Avoid crossing cables where possible. If unavoidable, only cross them at right-angles.

1.3 Intended purpose

The measuring system is used for recording linear movements and processing the measured data for a downstream control system with a synchronous/serial interface (SSI).

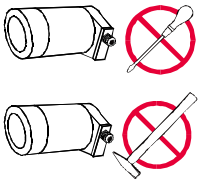
In order to program the device parameters, you will need the PC program "OMS1 PCA", which runs on all commercially available personal computers (PCs) or a Siemens PG 7xx programming unit ***with an MS-DOS the operating system.***
The "OMS1 PCA" program is used to set all the device-specific parameters.
In order to programme the device with "OMS1 PCA" via the serial RS232 interface, you will need a PC adapter V3.3 or higher from Leuze electronic to perform the conversion from RS 232 to RS 485.

Warning



Switch off the voltage supply before carrying out wiring work or opening and closing electrical connections!
Short-circuits, voltage peaks, etc. can cause operating failures and uncontrolled operating states, as well as serious personal injuries and damage to property.

Check all electrical connections before switching on the system!
Incorrectly wired connections can cause operating failures, while wrong connections can lead to serious personal injuries and damage to property.



Mechanical or electrical modifications to the measuring systems ***are prohibited for safety reasons!***

Caution

Laser beam
Do not look into the beam
Laser class : 2
Acc. to EN 60 825-1 : 1994
Max. laser power $P_{max.}$: ≤ 1 mW
Wavelength λ : 670 nm

- In the case of Class 2 laser devices, the eye is protected against brief, accidental glances at the beam by the blinking reflex. For this reason, devices of this class can be used without additional protective measures provided the operator is not required to look into the laser beam deliberately for longer periods, i.e. 0.25 s, or to look repeatedly into the laser beam itself or the directly reflected beam.

- The device must be installed in such a way that the exposure of persons to the laser beam can only happen accidentally.

- The laser beam may only extend as far as is necessary for the range measurement. The beam must be limited at the end of the useful range by a diffusely reflecting target area in such a way as to minimise the danger from direct or diffuse reflection. For this purpose, you should use the Leuze electronic reflecting foil supplied with the device.

- The area outside the operating range where the unshielded laser beam falls should be limited as far as possible and should remain out of bounds, particularly in the area above and below eye level.

Note
The start-up, operating and programming instructions contained in this manual are mandatory.

1.4 Authorised operators

The start-up and operation of this device may only be performed by qualified personnel. For the purposes of this manual, the term "qualified personnel" refers to persons who are authorised to operate, earth and label equipment, systems and power circuits according to recognised safety standards.

1.5 Safety measures at the installation site

Warning

Do not perform any welding work once the device is connected and switched on!
Variations in potential can destroy the device or restrict its operation.

Do not touch plug contacts with your hands!
Static charges may destroy electronic components of the device.

Do not connect unused inputs (see pin assignment)!

Observe the voltage supply range:

Standard device:	18-27 V DC (+/- 5 %)
Device with heating:	24 V DC

i ***Note***
Make sure that the environment of the installation site is protected against corrosive media (acids, etc.)

2 Transportation / Start-up

2.1 Transportation / storage

Transport instructions

Do not drop the device or expose it to shocks or vibrations!
Device contains an optical system with glass elements.

Only use the original packaging!
The wrong packaging material can cause damage to the device during transportation.

Storage

Storage temperature : -20 to +75°C

Store in dry conditions.

2.2 Assembly instructions

Aligning the Laser Measuring Device

The measuring device or reflector is attached to the moving object and the reflector/sensor to the fixed remote station in such a way that the reflector always remains within the visual field of the sensor. This can be done using the light spot of the laser diode, which is still clearly visible on the reflecting foil even at long distance. When aligning the laser measuring device, the user may need to take measures to ensure that it can be mechanically adjusted.

The size of the reflecting foil must be such that the light spot cannot be displaced from the reflector by vibrations. The device comes with a reflecting foil measuring 20 x 20 [cm], but other sizes can be ordered on request.

Once the Laser Measuring Device is optimally aligned with the reflecting foil, the switching output "Error output_OUT" must be acknowledged via the input "Acknowledge error_IN" (only if is configured HARDWARE ACKNOWLEDGEMENT = "YES" and AUTO RESET = "NO"). If the PC program "OMS1 PCA" is active, the intensity display under "Actual values" should not be below minimum.

i ***Note***

Reflecting foils by other manufacturers should be used only after consultation with Leuze electronic, as all the information in the "Specifications" chapter refers to the foil already supplied with the device.

2.3 Start-up

2.3.1 General

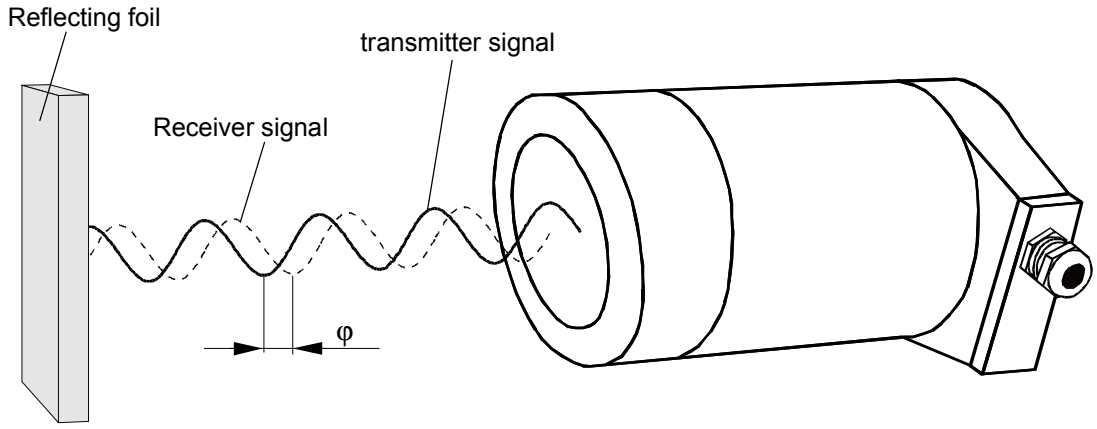
The OMS1 series Laser Measuring Devices are optical sensors for contactless measurement of the distance between the sensor and a reflector.

For this purpose, the measuring device or reflector attached to the moving object and the reflector/sensor to the fixed remote station in such a way that the reflector always remains within the visual field of the sensor.

The laser diode inside the device emits a beam which bounces back off the reflector and is re-received by a detector also housed inside the measuring device. The phase angle of the received signal in relation to the transmitted signal is the measure of distance. The absolute distance value thus obtained is then transferred to the control system via the interface.

Laser Measuring Devices can be configured as required using the programming software OMS1 PCA.

Principle:



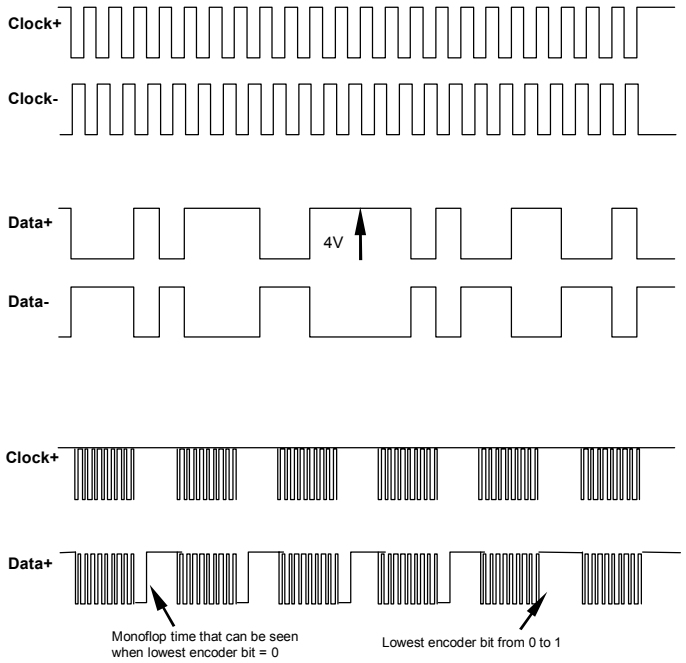
φ = Phase displacement
d = Distance

d = f (φ)

2.3.2 Device interface SSI

The Laser Measuring Device is equipped with an SSI data interface, i.e. the data are transmitted via the synchronous/serial technique.

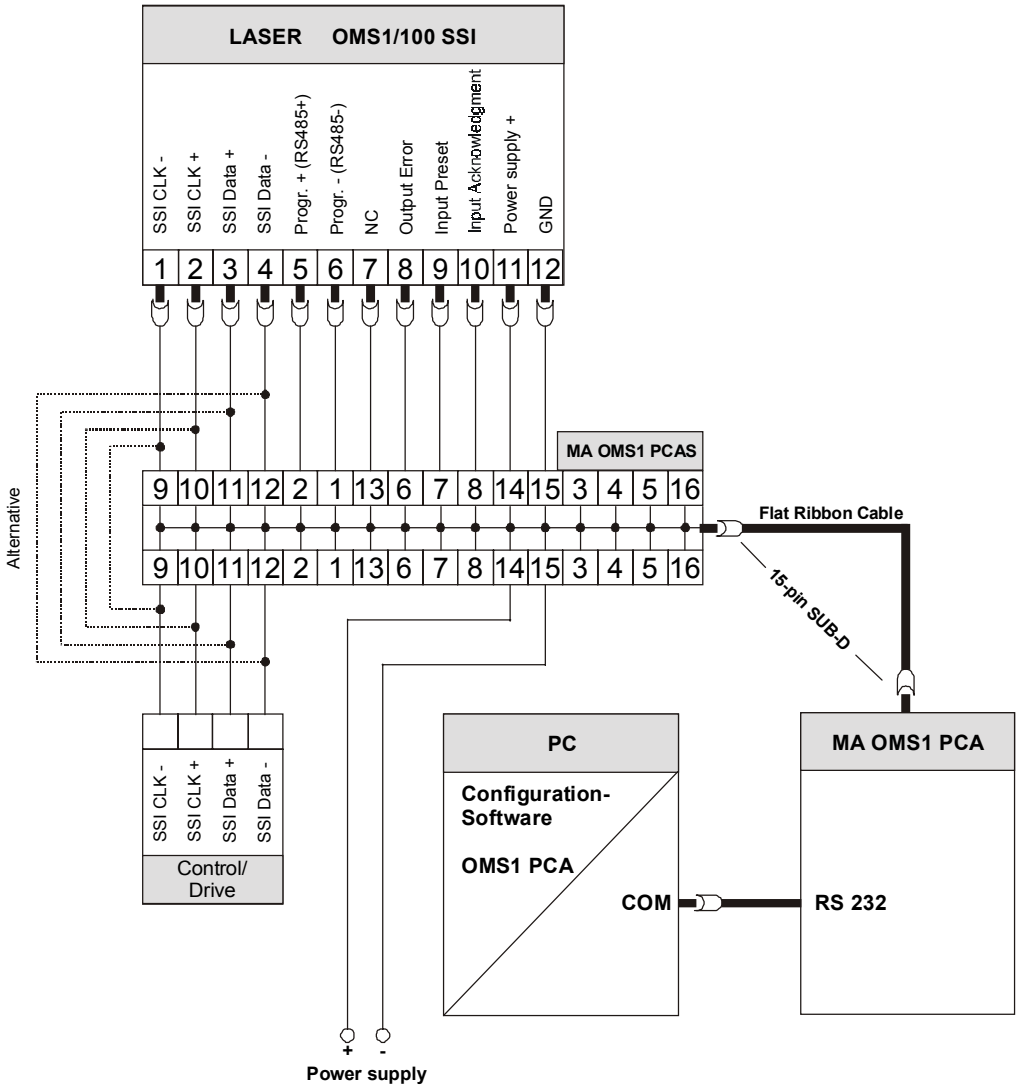
The SSI technique is a synchronous/serial transfer process for the encoder positions, and has become more or less standard for absolute encoders. Using the RS422 interface makes it possible to obtain sufficiently high transfer rates. The device operates at a clock rate of 80 kHz to 820 kHz max.
The transfer process works as follows: the user transmits bundles of clock pulses via the clock-pulse lines. With every incoming pulse, the device returns the information in its shift register bit by bit to the transmitter via the data lines, starting with the most significant bit. The last data bit is followed merely by zero bits. In the interval between the bundles, "1" bits are sent. The interval is detected by a re-triggerable monoflop. Only then can a new bundle begin. The mono-time is 20µs.
In the example below, the receiver reads the value 001 0111 0011 1101 0011 0010 (HEX 173D32) as the encoder position.



i ***Note***
Since this transmission technique affords no protection against faulty transfer data, it is essential to use well shielded twisted-pair cables.

2.3.3 Wiring

The following wire connections need to be made for the laser programming and for the SSI data transfer.



3 Programming with OMS1 PCA

The PC program OMS1 PCA retrieves the screen form from the connected device, uses it to display the actual values and sends new inputs back to the device, where they are corrected if necessary and then stored. The screen form, also called a dialogue, is built up line by line and divided into sections.

The different sections of the OMS1 PCA dialogue for the Laser Measuring Device are described below. The name of each section corresponds to the title in its top line. Dialogue lines can contain four different types of values: integers, floating-point numbers, selections or text.

i ***Note***

All parameter inputs in the OMS1 PCA PC program are in mm!
For accessories, e.g. PC adapter, switch cabinet module, etc. see Ordering information chapter, page 26.

3.1 Device

This contains a description of the device, i.e. designation, manufacturer, program name and date, serial no. and date of manufacture.

3.2 Equipment

This indicates the items with which the device is equipped, i.e. interfaces and other customised optional extras. This information is defined during production and cannot be changed subsequently without modifying the device. It is also found on the nameplate of the device.

3.3 Axis name

You can enter any name here to designate the axis.

3.4 Measuring length

The *Measuring length* line indicates the max. measuring length of the measuring system and cannot be changed.

3.4.1 Resolution

The *Resolution* line offers a choice of resolutions for the measuring system. The available options are:

0.01 mm
0.10 mm
1 mm
10 mm
free resolution [1/1000 mm]

Note

If the mode is activated with "Limit switches" (Parameter section 3.8.4.1, page 20), the setting of the limit switches always is set to 1 mm.

3.4.2 Counting direction

This specifies whether the position values are to be counted in ascending or descending order.

Start = 0 : ascending position values
Start = meas.length : descending position values

3.4.3 Lower range value

The *Input* line is for defining the type of lower range value. You can enter any negative or positive number.
The configured initial value is calculated with the current "Actual Value".

3.5 Preset input

This is for specifying the preset input for the presetting, start edge and response time. The input of the preset value is predefined in "mm".

When connected to the start edge, the preset input triggers a zero shift or adjustment, thus ensuring that the position measured by the device at the time of the start edge corresponds to the presetting. In order to suppress interference, however, the presetting is only performed once the preset signal stops for the duration of the response time without interruption. The start edge and response time are measured with an accuracy of 2 milliseconds.

After expiry of the response time, up to 50 milliseconds elapse before the preset adjustment is completed and actually affects the position. This time is required in order to store and re-retrieve the new zero point with a checksum.

With extended options, the response time can be set over a range of 10 to 1000 milliseconds.

If the preset input is not required, it should be disabled in the first line of the section for the sake of interference suppression. This causes the rest of the section to become invisible.

The zero point adjusted by the preset input is stored in a so-called "FRAM" with 100 million guaranteed write cycles. This means that a preset adjustment can be performed every 3 seconds for 10 years and the last zero point will then be retained for at least another 10 years. 2 copies of the zero point are stored with checksums, so that there is a high probability of any memory failures being detected.

3.6 Error value

This is for specifying which bit pattern is to be output to the SSI interface if the device detects a below-minimum intensity.
The available options are:

- Input (manual)
- "0"
- FF (hex)
- The last valid position value

3.7 Signal bits (Limit switches)

This is for defining the "on" and "off" points of the 4 limit switches.

The position and number of associated signal bits are set individually in the relevant sections later on (see below for further details).
The programming of the "on" and "off" points occurs in the resolution "mm".

3.8 SSI

3.8.1 Repetition

The line *26-bit rpt.* allows you to specify whether the data bits of longer clock-pulse bundles are to be repeated after every 26th clock pulse or whether only 0 bits are to be transmitted after the last data bit. The advantage of this is that it allows easy detection of transmission errors.

Because the data transfer is synchronised by the start of the clock-pulse bundle, multi-step codes such as binary code can be used here without difficulty.

3.8.2 Data and signal bits

The total number of data and signal bits must not exceed 26 if SSI with 26-bit repetition is selected. Otherwise the maximum value is 32.
If it´s necessary to program signal bits (see section 3.7 on page 18), the max. number of data bits (32) are reduced to the programmed signal bits.

3.8.3 Data bits

The *Data type* line is permanently set to the *Position values* function. This means that only position values can be output via the SSI interface.

The *Data bits* line defines the number of bits reserved for the position. These begin with input bit 2^0. Max. 32 data bits can be programmed.

The *Code* line specifies whether binary or Gray code is to be used for the transmitted position values. Although other codes can be selected, they are automatically converted to binary code. If the number of data bits reserved for the position is not sufficient, an error message appears. In this case, it is necessary to either reserve more space, or to reduce the lower range value or increase the resolution in the *Measuring length* section.

If a negative lower range value was selected in the *Measuring length* section, you must specify in the *Negative values* line whether it is to be represented as a signed number or as a complement. The complement option simplifies the calculation process when adding and subtracting.

With negative numbers, the most significant position bit used as a sign is set in both cases. For this reason, negative lower range values normally require an additional data bit. The following table shows a comparison of complement and sign notation for 16-bit binary code:

Value	Binary+compl.	Binary+sign
2	0x0002	0x0002
1	0x0001	0x0001
0	0x0000	0x0000
-1	0xFFFF	0x8001
-2	0xFFFE	0x8002
-3	0xFFFD	0x8003

3.8.4 Signal bits

The least significant data bit can be followed by up to 6 signal bits. The position of the signal bits in the data format of the SSI interface is dependent on the configured data bit number of the SSI interface. The signal bits always follow the LSB of the SSI value. The desired number of bits is entered in the *Signal bits* line. For each signal bit, two sub-lines appear in which you can select the type of signal and invert it if required.

Representation of the signal bits

1.	2.	3.	4.	5.	6.	0	0

MSB LSB

If the number of the SSI data bits is increased respectively to 1 bit, beginning at the 24th bit (24, 25, 26, ... etc.), the signal bits are moved to the corresponding places to the right.

The following types are available:

3.8.4.1 Limit switches 1-4

The signal bit of a limit switch is set as long as the position is at or above the "on" point and below the "off" point. The switching points are entered at the top of the *Signal bits* section. The programming of the limit switches occurs as described in chapter 3.7.

3.8.4.2 Intensity

The "Intensity" signal bit is set if the received laser signal is found to be below minimum intensity. This may be due to the following causes:

- Soiling of the optical measuring system
- Soiling of the reflecting foil
- Interruption of the laser beam

All the above factors cause the "Error" output to be set (see section 3.9 on page 21).

3.8.4.3 Housing temperature

The "Housing temperature" signal bit is set if the temperature exceeds or falls short of the 0 - 50°C range.

3.9 Switching output

The switching output is permanently assigned the "Intensity" function and is set if the received laser signal is found to be below minimum intensity. This may be due to the following causes:

- Soiling of the optical measuring system
- Soiling of the reflecting foil
- Interruption of the laser beam

3.10 Intensity error

"Hardware acknowledgement" yes/no gives the selection, whether an upcoming error shall be deleted via the acknowledgement input of the device.
If the hardware acknowledgement is set to "NO", "Auto. reset" must be configured to "YES".

3.11 Actual values

3.11.1 Position

This serves to display the currently transferred position. The resolution of the measurement corresponds to the configuration as described in chapter 3.4.1 on page 17.

3.11.2 Error

If the proper measurement and transmission of the position data is hindered or likely to be hindered, the cause is displayed here, followed by a list of possible errors together with corrective measures. Unless otherwise specified, the error does **not** need to be acknowledged or deleted, but simply **rectified**. The error message disappears once the error has been acknowledged and rectified.

3.11.2.1 FRAM checksum

The checksum for the characteristics stored in the FRAM is incorrect. If the error is not cancelled by programming the device with OMS1 PCA (see OMS1 PCA operating manual), the FRAM is defective and the device must be replaced.

3.11.2.2 Warm restart

The device checks the settings of its ports and the contents of its main memory continuously. If it detects illogical or illegal states, it assumes an electrical fault and performs a warm restart in order to reset the device. If this happens frequently, the device must undergo electrical interference suppression. Electrical interference can be avoided by means of cables with twisted-pair wires for the clock-pulse, data and supply lines. The cable shields should be earthed at **both ends**. The only case where the shield should be earthed at **one end** only in the switch cabinet is if the machine earth is subject to strong interference in comparison with the switch cabinet earth. If the error persists in spite of these measures, the device must be replaced.

3.11.2.3 Intensity

The device checks the intensity of the received laser signal continuously. If it detects a below-minimum intensity, this may be due to the following causes:

- Soiling of the optical measuring system
- Soiling of the reflecting foil
- Interruption of the laser beam

If the possibility of soiling or interruption of the laser signal can be ruled out, the device must be replaced.

If configured, in order to reset the error output, it is necessary to connect the acknowledge output.

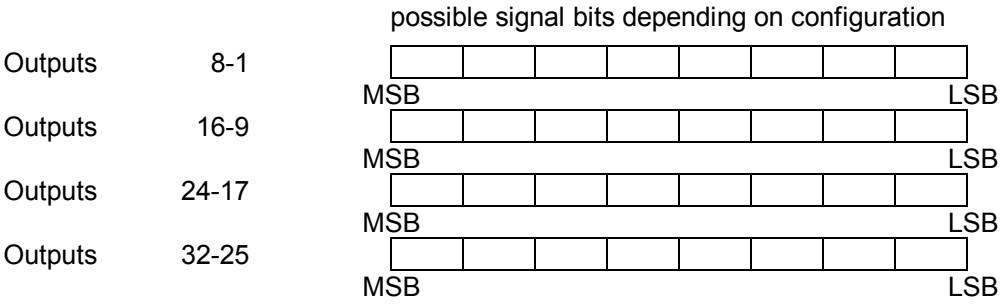
3.11.2.4 Housing temperature

The temperature has exceeded or fallen short of the range of 0 - 50°C in the housing of the device.
Appropriate measures must be taken to prevent the device from overheating or undercooling.

3.11.3 SSI

This indicates the currently transferred bit pattern for the SSI interface in the form of noughts and ones. The display consists of 32 bits, and is left-justified as is the transmission, i.e. the data are assigned to the most significant bits and the least significant bits are filled with noughts. If a short-circuit is detected on a bit, a normal comma or inverted comma appears depending on whether the setpoint value is 0 or 1. This diagnosis is not possible for all bits, however.

SSI



3.11.4 Switching outputs

Switching outputs

Outputs 4-1

0	0	0	**X**

The switching outputs are not activated or the function "Intensity" is connected directly with the switching output 1 (see also chapter 3.9 on page 21).

4 Appendix

4.1 Specifications

4.1.1 Electrical ratings

Measuring principle: ..... Phase delay time measurement

Range (measurement on reflecting foil): ..... 0.2 - 100 m
Range > 100m ..... upon request

Operating voltage
Standard device: ..... 18-27 V DC (+/- 5%)
Device with heating ..... 24 V DC

Power consumption (no-load): ..... < 6 watts

Power consumption with heating: ..... < 60 watts

Opto-transmitter ..... Laser diode (red light)
Wavelength λ: ..... 670 nm
Max. laser power: ..... P ≤ 1 mW
Laser protection class: ..... 2 (IEC 825)
Lifetime: ..... 50 000 h

Opto-receiver: ..... Photodiode

*** Resolution:** ..... ≥ 0,001 mm

Updating / refresh cycle: ..... 1000 values / s

Reproducibility ..... ± 2 mm (at 5 sigma for sigma = 0,4 mm)

Integration time ..... < 2 ms

Programming via RS485: ..... PC IBM-compatible (OMS1 PCA)

SSI-Interface
* Output code: ..... Binary, Gray
Clock input: ..... Optocoupler
Clock frequency: ..... 80 kHz - 820 kHz
Data transfer length: ..... Depending on cable cross-section, shielding
Data output RS422 (2-wire)
* Output format: ..... Multiple transmission, manual

Inputs
* Preset: ..... Electronic adjustment,
"0" < + 2 V DC, "1" > + 8 V DC, max. 30 V DC

* Programmable parameter

4.1.2 Environmental conditions

EMC:	EN 61000-4-2 (IEC-801-2) / EN 61000-4-4 (IEC-801-4)
Operating temperature range:	0-50°C
Device with heating:	-30 to +50°C
Thermal drift:	1 ppm / °C
Storage temperature range:	-20 to +75°C
Relative air humidity:	98 % (no moisture condensation)
***** **Degree of protection: .....**	IP 65 (DIN 40 050)

***** The degree of protection is based on the assumption that the Laser Measuring Device cables are correctly screwed in and connected.

4.2 Ordering information

4.2.1 Laser devices

Art.-No.:	Type	Description
500 32810	OMS1 / 100 SSI	Laser device SSI-Interface 100 m
500 34153	OMS1 / 100 SSI-H	Laser device SSI-Interface 100 m with heating
500 34152	OMS1 / 100 SSI-L	Laser device SSI-Interface 100 m with linearization

4.2.2 Accessories

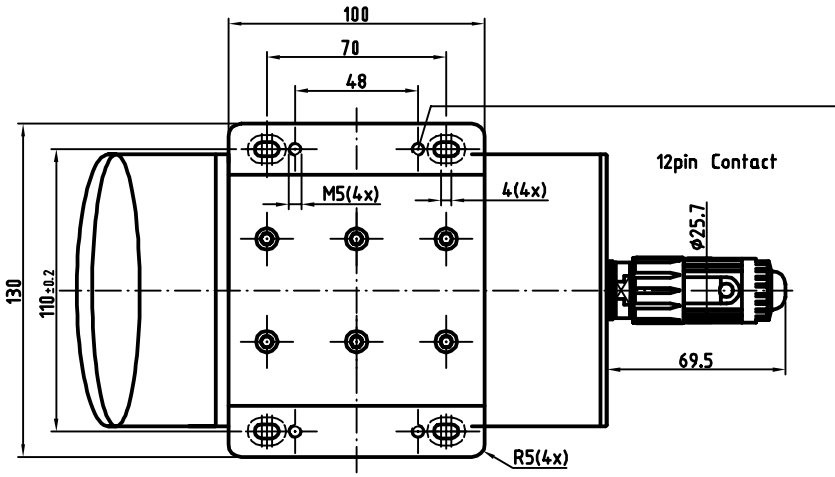
Art.-No.:	Type	Description
500 32812	MA OMS1 PCA	PC adapter (RS232/RS485)
500 32826	OMS1 PCA	PC program, 3½" disk (Component of the PC adapter)
500 33189	Technical documentation	Operating manual PC program, english
500 32813	MA OMS1 PCAS	Switch cabinet for PC adapter
500 32816	RF1 200x200	Reflector 200 x 200 mm (Component of the laser device)
500 32814	MA OMS1 IS	INTERBUS-S connecting unit

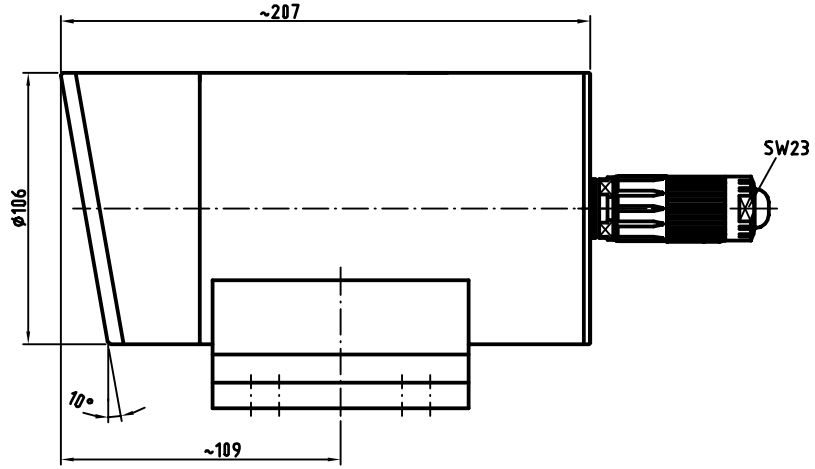
Pin assignment: 12 pole CONTACT
Laser Measuring Devices OMS1/100 SSI

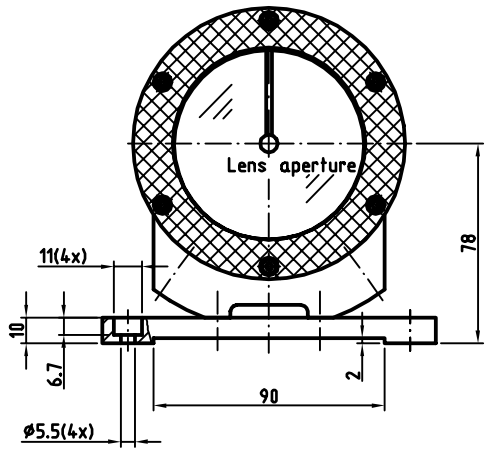
Pin	Name	Description	Level	Driver
1	SSI_Clock-_IN	Clock input -	RS 422	RS 422
2	SSI_Clock+_IN	Clock input +	RS 422	RS 422
3	SSI_Data+_OUT	Data output +	RS 422	RS 422
4	SSI_Data-_OUT	Data output -	RS 422	RS 422
5	Ser.Program+_IN/OUT	Ser. programming interface RS 485	RS 485	RS 485
6	Ser.Program-_IN/OUT	Ser. programming interface RS 485	RS 485	RS 485
7	*IN			
8	Error output_OUT			
9	Preset1_IN	Preset value 1	Supply voltage	
10	Acknowledge error_IN		Supply voltage	
11	Supply Voltage IN	Supply voltage	1)	
12	Ground IN	Ground	0 V	

[1)] Standard device: 18 – 27 V DC
Device with heating: 24 V DC

* optional input







TYPE NAME:	**OMS1/100 SSI**
MEASURING RANGE	100m
INTERFACE	SSI
OUTPUT CONFIGURATION	RS422
CODE	GRAY/BINARY
RESOLUTION	0.5mm
INPUT POWER SUPPLY VOLTAGE	18-27V
TEMERATURE RATINGS	0-50°C
PROTECTION RATINGS	IP65
LASER CLASS	2
CONNECTOR TYPE	12pin Contact with MATING CONNECTOR
REFLECTOR	yes
OPTION ENC	PROGRAMMABLE
OPTIONS	

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Zust.	Änderung	Datum	Name
1	Text ergänzt	26.04.00	Flaig

	Datum	Name
Erstellt	20.09.99	Habetler
Bearb.		
Gepr.		
Norm		

Pin connections:
LZ-ELE-TI-GB-0001
EDV-NR.:

Maßstab 1:2 DIN A3 Projekt-Nr.:
Article-No.: 500 32810
Order-No.:

OMS1/100 SSI

Drawing-No.: E4-885-001

Blatt 1
BL

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