

# **INPROX** sensors

## **Distance Laser Sensor**

**MLS9B 15**

**MLS9B 30**

**MLS9BH 15**

**MLS9BH 30**



**Technical Reference Manual**

**V1.06**

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## 1 Introduction

The MLS9 unit is a powerful distance measuring instrument for integration into industrial applications. It allows accurate and contact-less distance measurement over a wide range using the reflection of a laser beam:

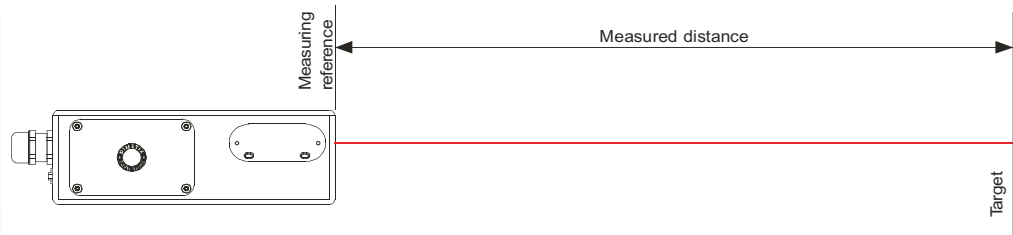


Fig. 1 Standard application

### Key features

- Measurement range 0.2 to 200 m
- Serial interface (RS232 and RS422)
- Connection of up to 10 modules on a single RS422 line
- Wide range power supply (9...30VDC)
- Programmable analog output (0/4...20mA)
- Two programmable digital outputs
- Digital output for error signalization
- D-Sub connector and screw terminal joint for easy connection
- Adapter for telescopic viewer for easy installation
- IP65 (protected against ingress of dust and water)
- 4 LEDs for status signaling
- Complementary configuration software available
- Optional: Internal heater for module operation down to  $-40^{\circ}\text{C}$
- Laser class II ( $<0.95\text{mW}$ )

### CAUTION



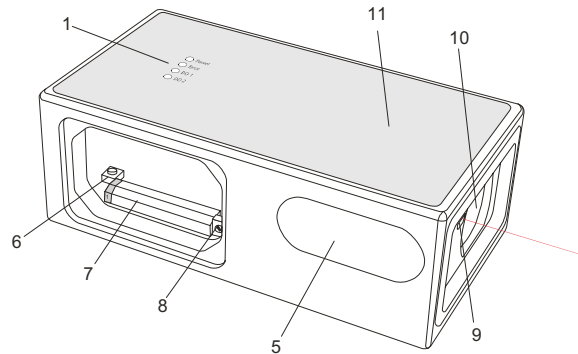
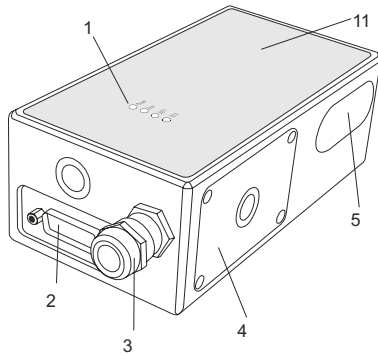
**Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.**

## 1.1 Product identification

The product is identified by the serial label on the top of the enclosure:

Version	Typical Accuracy	
	1.5mm	3.0mm
Standard version	MLS9B 15 Part No.: 700502	MLS9B 30 Part No.: 700501
Extended temperature range	MLS9BH 15 Part No.: 700512	MLS9BH 30 Part No.: 700511

## 1.2 Components



- |  |   |
|--|---|
| <p><b>1 Status LEDs</b><br/>status signaling</p> <p><b>2 15-Pin D-Sub connector</b><br/>RS422, RS232, analog, digital output</p> <p><b>3 Cable gland (M16 x 1.5mm)</b><br/>for connection cable insertion</p> <p><b>4 Cab</b><br/>provides access to electrical components</p> <p><b>5 Mounting area for viewfinder</b><br/>see accessories (Chapter 9 on page 32)</p> | <p><b>6 Reset switch</b><br/>resets theMLS-A(H) to default settings</p> <p><b>7 Screw terminal</b><br/>RS422, RS232, analog, digital output</p> <p><b>8 ID switch</b><br/>defines the module ID for RS422 operation</p> <p><b>9 Laser beam outlet</b></p> <p><b>10 Receiver optics</b></p> <p><b>11 Product label</b></p> |
|--|---|

## 1.3 Validity

This manual is valid for MLS-9 devices with the following software version:

Interface software version: **0117 or later**  
Board software version: **0200**

To get the software version of the MLS9 use the command described in 8.3.9 Get software version (sNN00N) on page 25

## 1.4 Measurement range

The MLS9 is an optical instrument whose operations is influenced by environmental conditions. Therefore, the measurement range achieved in the application can vary. The following conditions may influence the measurement range:

<b>Key</b>	<b>Factors increasing range</b>	<b>Factors reducing range</b>
Target surface	Bright and reflecting surfaces such as the target plates (See 9 Accessories on page 32)	Matt and dark surfaces Green and blue surfaces
Airborne particles	Clean air	Dust, fog, heavy rainfall, heavy snowfall
Sunshine	Darkness	Bright sunshine at target

The MLS9 does not compensate the influence of atmospheric environment, which may be relevant when measuring long distances (e.g. > 150m). This effects are described in:

B.Edlen: "The Refractive Index of Air, Metrologia 2, 71-80 (1966)

## 1.5 Prevention of erroneous measurements

### 1.5.1 Rough surfaces

On a rough surface (e.g. coarse plaster), measure against the center of the illuminated area. To avoid measuring to the bottom of plaster joints use a target plate (see accessories) or board.

### 1.5.2 Transparent surfaces

To avoid measuring errors, do not measure towards transparent surfaces such as colorless liquids (such as water) or (dust free) glass. For unfamiliar materials and liquids, always take a trial measurement.

- ) Erroneous measurements can occur when aiming through panes of glass, or if there are several objects in the line of sight.

### 1.5.3 Wet, smooth, or high-gloss surfaces

- 1 Aiming at an "acute" angle deflects the laserbeam. The MLS9 may receive a signal that is too weak (error message 255) or it may measure the distance targeted by the deflected laser beam.
- 2 If aiming at a right angle, the MLS9 may receive a signal that is too strong (error message 256).

### 1.5.4 Inclined, round surfaces

Measurement is possible as long as there is enough target surface area for the laser spot.

### 1.5.5 Multiple reflections

Erroneous measurements can occur in the case that the laser beam is reflected from other objects than the target. Avoid any reflecting object along the measurement path.

## 2 Device setup

We recommend performing the configuration steps in an office before mounting the device, especially if you are not familiar with the MLS9.

The MLS9 supports two types of operation modes:

- Controlled mode
- Automatic mode

The first decision to be taken is the type of operation mode that will be used to transmit the distance measurement data. While the controlled mode provides maximum flexibility and accuracy, it is often not suitable for integration into existing PLCs or analog environments. In such cases the automatic mode might be preferred.

Key	<i>controlled mode</i>	<i>automatic mode</i> <i>(with analog output and digital outputs)</i>
Accuracy	Maximum measurement accuracy	Accuracy depends on signal scaling (see 8.3.5 Set distance range (sNv) on page 23)
Flexibility	Access to full command set	Limited
Integration	Requires protocol implementation	Wiring of AO and DO signals
Connection	Connection of up to 10 MLS9 is to a single RS-422 line.	Point-to-point connection

The following two sections describe the configuration of the MLS9 for the controlled and automatic modes.

### 2.1 Connection

To be able to configure the MLS9, it must be powered and connected to a PC. Figure shows the necessary connections. On the PC, any terminal program can be used to communicate with the module.

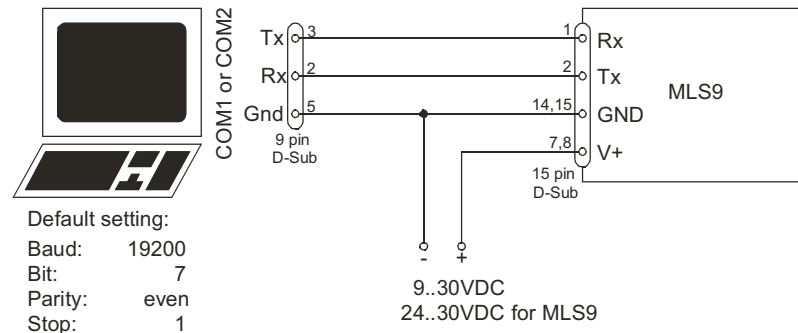


Fig. 2 Connection for MLS9 configuration

## 2.2 Controlled mode

In controlled mode, each operation of a MLS9 is triggered by a command sent from a host system over a serial line. While a single device can be connected to the host system using the RS232 interface, up to 10 devices can be connected to a single serial RS422 line. The related command set is described in Chapter 8 on page 19.

### 2.2.1 Configuration

After connecting the module, the steps below are necessary to configure the MLS9 or the controlled interface mode.

No.	Action	Comment	Command
1	Set ID switch	Changes of the module ID are activated after a power cycle.  Example for module 0: Change the ID Switch to position 0	Set ID switch to position 0 Power OFF; Wait 10s; Power ON
2	Set controlled mode	Set the MLS9 to the controlled mode, if not already in controlled mode.  Example for module 0: Set to controlled mode by the stop command.	s0c<trm> <sup>1)</sup>
3	Set communication parameters	If necessary, change the settings for the serial interface.  Example for module 0: Set serial interface to 19200 Baud, 8 Bit, no Parity	s0br+2<trm> <sup>1)</sup> Power OFF; Wait 10s; Change settings on the host; Power ON

1) Commands are described in 8 Command set on page 19

Remark: If the communication parameters of the module are lost, please reset the configuration to the factory settings (7 Factory settings on page 18) using the reset button (5.2 Reset switch on page 15). Please note that the ID switch must be reset manually.

### 2.2.2 Host software

Host software is required for operation of the MLS9 in controlled mode. When connecting multiple devices to a single serial line (RS422), strict Master-Slave communication must be implemented (MLS9 operates as slave).

Careful testing of the host software together with the devices prior to installation is strongly recommended.

## 2.3 Automatic mode

The automatic mode is provided for host-less operation of the MLS9. The analog and digital outputs are updated according to the configuration described below as soon as the unit is powered up.

### Analog Output

The analog output is configurable and works with two ranges:

- 0..20mA
- 4..20mA

### Digital Outputs

Three digital outputs are included in the MLS9. Two are programmable, while the third is used to signal an error state of the device.

### 2.3.1 Configuration

After connecting the module, the following steps are necessary to configure the MLS9 for the automatic mode.

No.	Action	Comment	Command
1	Set current output range	Defines if the current output range from 0 to 20mA respectively from 4 to 20mA.  Example for module 0: Set current output range from 4mA to 20mA.	s0vm+1<trm> <sup>1)</sup>
2	Set distance range	Defines minimum distance (D <sub>min</sub> ) and the maximum distance (D <sub>max</sub> ) for the distance range of the analog output.  Example for module 0: Set distance range from 0m to 10m	s0v+00000000+00100000<trm> <sup>1)</sup>
3	Set analog output in error case	Sets the current, that should be applied in case of an error.  Example for module 0: Set current to 0mA in case of an error.	s0ve+000<trm> <sup>1)</sup>
4	Configure digital output	Set the ON and OFF level for the digital outputs.  Example for module 0: DO 1: off=2000mm on=2005mm DO 2: off=4000mm on=4005mm	s01+00020000+00020050<trm> <sup>1)</sup> s02+00040000+00040050<trm> <sup>1)</sup>

<b>No.</b>	<b>Action</b>	<b>Comment</b>	<b>Command</b>
5	Save settings	The changed configuration must be saved to make it permanent.  Example for module 0: Save settings for module 0	s0s<trm> <sup>1)</sup>
6	Set automatic mode	Set the MLS9 to the automatic mode with the desired update rate.  Example for module 0: Set measurement rate to fastest possible speed.	s0A+0<trm> <sup>1)</sup>

1) Commands are described in 8 Command set on page 19

Remark: If the serial line settings of the module have been lost, please reset the configuration to the factory settings (7 Factory settings on page 18) using the reset button (5.2 Reset switch on page 15). Please note that the ID switch must be reset manually.

### 3 Installation

#### 3.1 Mounting

Three M4 threaded holes in the bottom of the MLS9 make it easy to mount the device.

Always obey all applicable safety regulations and never use the device outside the specifications stated under 4 Technical data on page 13

#### 3.2 Device wiring

##### 3.2.1 Cable connection

A ferrite must be mounted to the connecting cable. Use a ferrite with a impedance of 150Ω to 260 Ω at 25MHz and 640 Ω to 730 Ω at 100MHz. As example you can use SFC10 from KE Kitagawa.

##### 3.2.2 Shield and Ground

The MLS9 contains two electrical isolated grounds, the general ground (GND) and the analog ground (AGND). GND and AGND is connected to the housing by a RC element. Please see figure 3

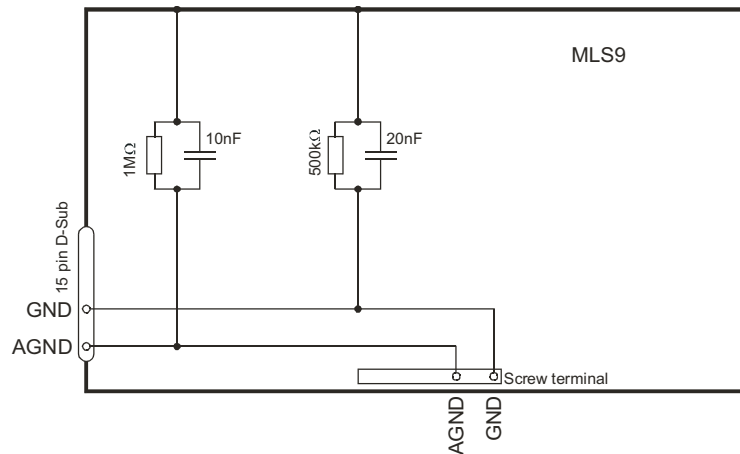


Fig. 3 Connection between shield and ground

### 3.2.3 Controlled mode

#### RS232

When using the RS232 interface only point-to-point communication is possible.

! Never connect multiple MLS9 on a RS232 serial line

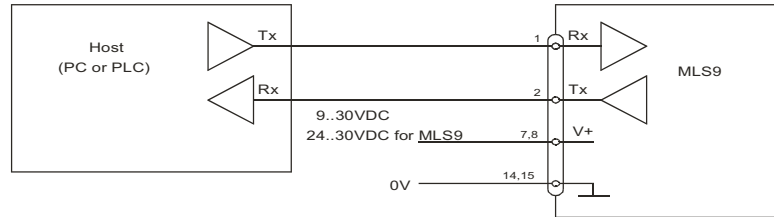


Fig. 4 Point-to-point connection with RS232

#### RS422

It is possible to connect multiple devices on a single RS422 line. To ensure proper operation, strict Master-Slave communication must be used. It is important, that the Master has full control of the communication and never initiates a new communication before termination of the previous communication (answer from the MLS9 or timeout).

! Ensure, that all MLS9's are set to different ID numbers

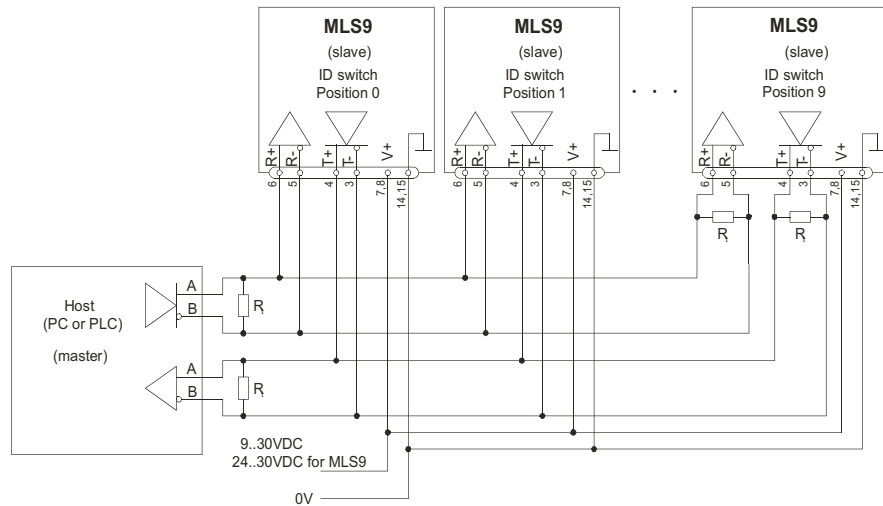


Fig. 5 Connecting multiple devices with RS422

### 3.2.4 Automatic mode

The analog interface of the MLS9 is isolated from the rest of the device. When using the analog interface, connect the analog ground (AGND).

Make sure, that the total resistance in the analog path is smaller than 500Ω.

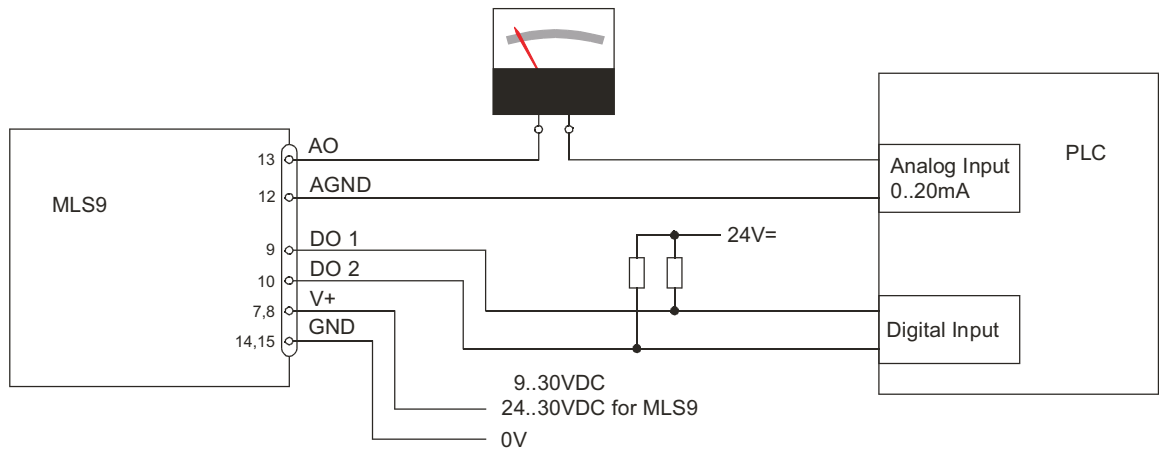


Fig. 6 Connection of an instrument and a PLC

### 3.3 Alignment of the laser beam

Alignment of the laser beam is often difficult when the target is far away, as the laser spot is not visible. The MLS9 has an adapter for mounting a telescopic viewfinder that simplifies alignment significantly. Please refer to chapter 9 Accessories on page 32 for a description of the viewfinder.

## 4 Technical data

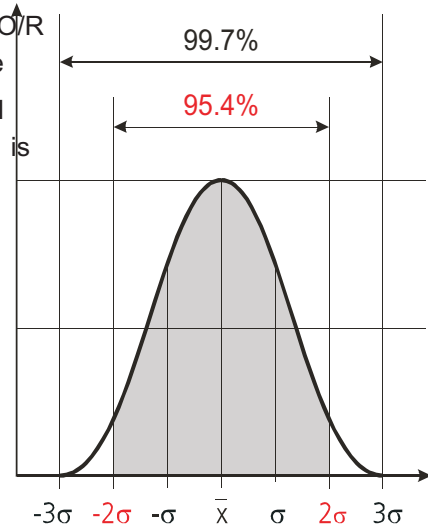
### 4.1 Measuring accuracy

The measuring accuracy corresponds to the ISO-recommendation ISO/R 1938-1971 with a statistical confidence level of 95.4% (i.e.  $\pm$  twice the standard deviation  $\sigma$ , refer to diagram on the right). The typical measuring accuracy relates to average conditions for measuring. It is  $\pm 1.5\text{mm}$  for the MLS9B15 and  $\pm 3.0\text{mm}$  for the MLS9B30 valid in the tracking mode

The maximum measuring error relates to unfavorable conditions such as:

- Highly reflecting surfaces (e.g. reflector tapes)
- Operation at the limits of the permitted temperature range, adaptation to ambient temperature interrupted
- Very bright ambient conditions, strong heat shimmer

and can be up to  $\pm 2\text{ mm}$  for MLS9B15 and  $\pm 5\text{ mm}$  for MLS9B30.



## 4.2 Specifications

Typical measuring accuracy for MLS9B 15 / MLS9BH <sup>1)</sup> 15 MLS9B 30 / MLS9BH <sup>1)</sup> 30	± 1.5 mm @ 2σ ± 3.0 mm @ 2σ
Smallest unit displayed	0.1 mm
Measuring range on natural surfaces	0.05 to approx. 65 m
Measuring range on orange (reflecting) target plate. See chapter 9.2 Target plates on page 35.	0.05 to 500 m
Measuring reference	from front edge (See 6 Physical dimensions)
Diameter of laser spot at target at a distance of	4mm @ 5 m 8mm @ 10m approx. 28mm*14mm @ 50m approx. 40mm*25mm @ 100 m
Time for a measurement Single measurement Tracking	0.04 to approx. 3 sec 0.04 to approx. 3 sec
Light source	Laser diode 620-690 nm (red) IEC 60825-1:2001; Class 2 FDA 21CFR 1040.10 and 1040.11 Beam divergence:0.16 x 0.6 mrad Pulse duration: 0.45x10 <sup>-9</sup> s Maximum radiant power: 0.95 mW
ESD	IEC 61000-4-2 : 1995 +A1 +A2
EMC	EN 61000-6-4 EN 61000-6-2
Power supply	9 ... 30V DC 0.5A for MLS9B 24 ... 30V DC 2.5A for MLS9BH (Heating option)
Dimensions	150 x 80 x 55 mm
Temperature range during operation <sup>2)</sup> MLS9B 15 / MLS9B 30 MLS9BH 15 / MLS9BH 30	-10 °C to +50 °C -40 °C to +50 °C
Temperature range during storage	-40 °C to +70 °C
Degree of Protection	IP65; IEC60529 (protected against ingress of dust and water)
WeightM	MLS9B(H): 665 g MLS9BH(H): 690 g
Interface	1 serial asynchronous interface (RS232/RS422) 1 programmable analog output 0/4 .. 20mA 2 programmable digital outputs 1 programmable digital input 1 digital output for error status

<sup>1)</sup> See 4.1 Measuring accuracy on page 14.

<sup>2)</sup> In case of permanent measurement (tracking mode) the max. temperature is reduced to 45°C

<sup>1)</sup> See 4.1 Measuring accuracy on page 13.

<sup>2)</sup> In case of permanent measurement (tracking mode) the max. temperature is reduced to 45°C

<sup>3)</sup> 500 – 1000h at 50°C.

## 5 Electrical components

### 5.1 ID switch

This switch is used to set the module ID and can be set from 0 to 9.

### 5.2 Reset switch

To reset the module to factory settings do the following:

- Switch OFF the power for the module
- Press the reset button and keep it pressed
- Switch on the power for the module
- Keep the reset button pressed until all LEDs on the module are illuminated
- Release the reset button and wait until the green power LED is on

### 5.3 Digital output

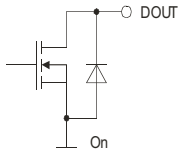


Fig. 7 Open drain output

The MLS9 contains two digital outputs for level monitoring (DO 1 and DO 2) and one digital output for error signalization (DO E). These outputs are open drain outputs as shown in figure 7 and can drive up to 200mA. In the ON state, the FET transistor is electroconductive.

### 5.4 Analog output

The analog output of the MLS9 is a current source (0..20mA or 4..20mA). It is capable of driving loads up to 500Ω.

The analog output has an accuracy of +/- 1% Full scale.

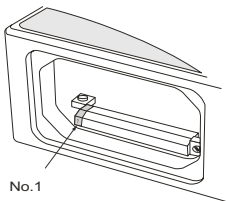
## 5.5 Connector

### 5.5.1 D-Sub connector



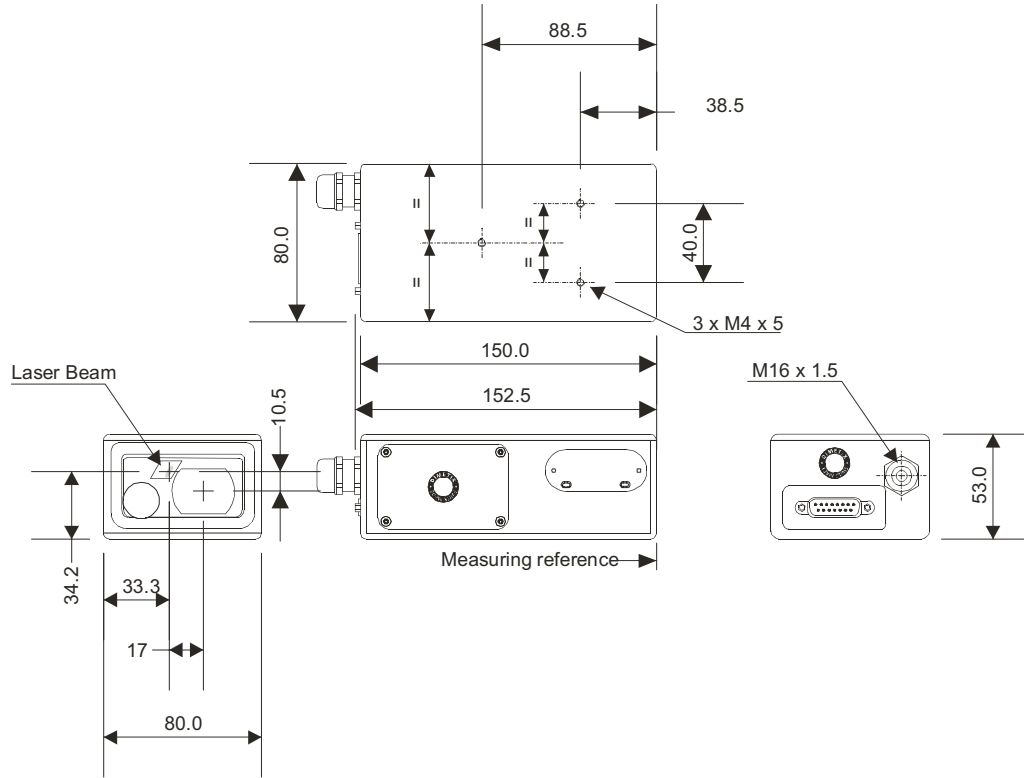
Pin	Designator	Description
1	Rx	RS232 receive line
2	Tx	RS232 send line
3	T-	RS422 send line negative
4	T+	RS422 send line positive
5	R-	RS422 receive line negative
6	R+	RS422 receive line positive
7	PWR	DC Power
8	PWR	+ 9V...+30V for MLS9 +24V...+30V for MLS9 (Heating option)
9	DO 1	Digital output 1 (Open Drain)
10	DO 2	Digital output 2 (Open Drain)
11	DO E	Digital output for error signalization (Open Drain)
12	AGND	Analog ground
13	AO	Analog output (0/4..20mA)
14	GND	Ground line
15	GND	Ground line

### 5.5.2 Screw terminal



Pin	Designator	Description
1	R+	RS422 Receive line positive
2	R-	RS422 Receive line negative
3	T+	RS422 Send line positive
4	T-	RS422 Send line negative
5	Tx	RS232 Transmit line
6	Rx	RS232 Receive line
7	AGND	Analog ground
8	AO	Analog output (0/4..20mA)
9	DO E	Digital output for error signalization (Open Drain)
10	DO 2	Digital output 2 (Open Drain)
11	DO 1	Digital output 1 (Open Drain)
12	GND	Ground line
13	PWR	Power DC +9V...+30V MLS9 +24...+30V MLS9H (Heating option)

## 6 Physical dimensions



All dimension in mm

## 7 Factory settings

### 7.1 Operation

Mode:           Controlled

### 7.2 Communication parameters

Baud:           19200  
Data bit:       7  
Parity:         Even  
Stop bit:       1

### 7.3 Analog outputs

Min output:    4mA  
Range min:     0m  
Range max:     10m  
Error output:  0mA

### 7.4 Module ID

ID Number:    0

### 7.5 Digital output 1 (DOUT1)

ON:            2m + 5mm = 2005mm  
OFF:           2m - 5mm = 1995mm

### 7.6 Digital output 2 (DOUT2)

ON:            1m - 5mm = 995mm  
OFF:           1m + 5mm = 1005mm

## 8 Command set

### 8.1 General

#### 8.1.1 Command termination <trm>

All commands for the MLS9(H) are ASCII based and terminated <trm> with <cr><lf>.

#### 8.1.2 Module identification *N*

Since the module can be addressed with the ID switch, the ID is represented in the commands by *N*. On the location of the *N* insert the Module ID.

#### 8.1.3 Startup sequence

After power on the MLS9 does all the initializations and sends a start sequence *gN?*. On these sequence, the *N* stands for the Module ID. After sending this start sequence, the MLS9 is ready to measure.

## 8.2 Operation commands

### 8.2.1 STOP/CLEAR command (*sNc*)

Stops the current execution and resets the status LEDs as well as the digital outputs.

Command input: *sNc*<trm>  
*N*: Module number (0..9)

Return data  
Successful: *gN?*<trm>  
Error: *gN@Ezzz*<trm>  
*zzz*: Error code

### 8.2.2 Distance measurement (*sNg*)

Triggers simple measurement of distance. Each new command cancels an active measurement.

Command input: *sNg*<trm>  
*N*: Module number (0..9)

Return data  
Successful: *gNg+xxxxxxxx*<trm>  
*xxxxxxxx*: Distance in 1/10 mm  
Error: *gN@Ezzz*<trm>  
*zzz*: Error code

### 8.2.3 Temperature measurement (sNt)

Triggers measurement of temperature.

Command input: sNt<trm>  
                   N:     Module number (0..9)

Return data

Successful: gNt +xxxxxxxx<trm>  
                   +xxxxxxxx: temperature in 1/10°C

Error: gN@Ezzz<trm>  
                   zzz    Error code

### 8.2.4 Laser ON (sNo)

Switches laser ON.

Command input: sNo<trm>  
                   N:     Module number (0..9)

Return data

Successful: gN?<trm>

Error: gN@Ezzz<trm>  
                   zzz:   Error code

### 8.2.5 Laser OFF (sNp)

Switches laser OFF.

Command input: sNp<trm>  
                   N:     Module number (0..9)

Return data

Successful: gN?<trm>

Error: gN@Ezzz<trm>  
                   zzz:   Error code

### 8.2.6 Tracking with buffering – Start (sNf)

Triggers continuous measurement of the distance with internal buffering in the module (buffer for one measurement). The rate of measurements is defined with the sampling time. If the sampling time is set to zero, the measurements are executed as fast as possible. The last measurement can be read out from the module with the command sNq. The measurements are continued until the 'sNc' command is issued.

Command input: sNf+xxxxxxxx<trm>  
 N: Module number (0..9)  
 xxxxxxxx: Sampling time in 10 ms (if 0 -> max possible rate)

Return data

Successful: gNf?<trm>  
 Error: gN@Ezzz<trm>  
 zzz: Error code

### 8.2.7 Tracking with buffering - Read out (sNq)

After starting “tracking with buffering” with the command sNf, the last measurement can be read out from the module with the command sNq.

Command input: sNq<trm>  
 N: Module number (0..9)

Return data

Successful: gNq+xxxxxxxx+c<trm>  
 xxxxxxxx: Distance in 1/10 mm  
 c: 0 = no new measurement since last sNq command  
 1 = new measurement since last sNq command, not overwritten  
 2 = new measurement since last sNq command, overwritten

Error: gN@Ezzz+c<trm>  
 zzz: Error code  
 c: see above

### 8.3 Configuration commands

#### 8.3.1 Set communication parameter (sNbr)

Sets the communication parameters for the serial interface.

- ) The new parameters are immediately saved to the Flash Memory and activated after the power ON.

**Bold** = default parameters (first use or after reset)

Command input: `sNbr+y<trm>`  
*N*: Module number (0..9)  
*y*: Defines the new settings

% Baud rate	Data bit	Parity	% Baud Rate	Data bit	Parity
0 1200	8	N	5 4800	7	E
1 9600	8	N	6 9600	7	E
2 19200	8	N	<b>7 19200</b>	<b>7</b>	<b>E</b>
3 1200	7	E	8 38400	8	N
4 2400	7	E	9 38400	7	E

Return data

Successful: `gN?<trm>`  
 Error: `gN@Ezzz<trm>`  
*zzz*: Error code

#### 8.3.2 Set automatic mode (sNA)

This command activates the automatic mode of the MLS9. It triggers continuous measurement of the distance and sets the analog and digital outputs according to the measured distance values. The rate of measurements is defined with the sampling time. If the sampling time is set to zero, the measurements are executed as fast as possible.

The automatic mode is active until the 'sNc' command is issued.

- ) The operation mode is stored in the MLS9 and activated immediately. This mode is also activated after next power ON.
- ) Internally "tracking with buffering" is started (command `sNf`). Therefore the last measurement can also be read out from the module with the commands `sNq`.

Command input: `sNA+xxxxxxxx<trm>`  
*N*: Module number (0..9)  
*xxxxxxxx*: Sampling time in 10 ms (if 0 -> max possible rate)

Return data

Successful: `gNA?<trm>`  
 Error: `gN@Ezzz<trm>`  
*zzz*: Error code

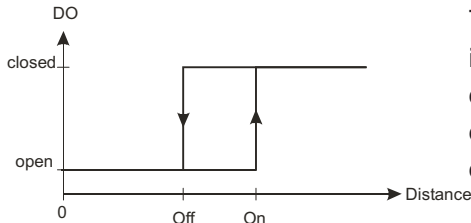


### 8.3.6 Set digital output levels (sNn)

Sets the distance levels at which the digital outputs are switched ON and OFF with a hysteresis.

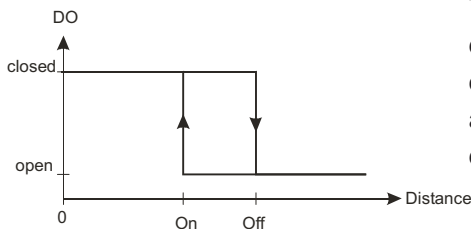
Two different situations are possible:

ON level > OFF level



The ON level of the hysteresis is larger than the OFF level. With an increasing distance, the digital output is switched on (open drain output is closed) when the distance exceeds the ON level. With a decreasing distance, the digital output is switched off (open drain output is open) when the distance falls below the OFF level.

ON level < OFF level



The ON level of the hysteresis is smaller than the OFF level. With a decreasing distance, the digital output is switched on (open drain output is closed) when the distance falls below the ON level. With an increasing distance, the digital output is switched off (open drain output is open) when the distance exceeds the OFF level.

Command input: `sNn+xxxxxxxx+yyyyyyyy<trm>`

`N`: Module number (0..9)

`n`: Digital output port (1 or 2)

`xxxxxxxx`: Distance ON level in 1/10 mm for switching digital output ON

`yyyyyyyy`: Distance OFF level in 1/10 mm for switching digital output OFF

Return data:

Successful: `gNn?<trm>`

Error: `gN@Ezzz`

`zzz`: Error code

### 8.3.7 Save configuration parameters (sNs)

This command saves all configuration parameters, which are set by the commands above. The parameters are written to the Flash Memory.

Command input: `sNs<trm>`  
                   `N:`     Module number (0..9)

Return data:  
   Successful:    `gNs?<trm>`  
   Error:         `gN@Ezzz`  
                   `zzz:`         Error code

### 8.3.8 Set configuration parameters to factory default (sNd)

This command restores all configuration parameters to their factory default values. The parameters are written to the Flash Memory.

)         The communication parameters are also reset to factory settings.

Command input: `sNd<trm>`  
                   `N:`     Module number (0..9)

Return data:  
   Successful:    `gN?<trm>`  
   Error:         `gN@Ezzz`  
                   `zzz:`         Error code

### 8.3.9 Get software version (sNN00N)

Retrieves the software version of the MLS-9.

Command input: `sNN00N<trm>`  
                   `N:`     Module number (0..9)

Return data  
   Successful:    `gNN00N+vvvvxxxxxyyyy<trm>`  
                   `vvvv:`         Interface software version  
                   `xxxx:`         Board version number  
                   `yyyy:`         SW version number

  Error:         `gN@Ezzz<trm>`  
                   `zzz:`         Error code

### 8.3.10 Get hardware version (sNN01N)

Retrieves the hardware version of the MLS9.

Command input: sNN01N<trm>  
                   N:     Module number (0..9)

Return data

Successful: gNN01N+xxxxxyy<trm>  
                   xxxxxx:     Board number  
                   yy:     Revision index

Error: gN@Ezzz<trm>  
           zzz:   Error code

### 8.3.11 Get serial number (sNN02N)

Retrieves the serial number of the MLS9.

Command input: sNN02N<trm>  
                   N:     Module number (0..9)

Return data

Successful: gNN02N+xxxxxxxx<trm>  
                   xxxxxx:     Serial number of the device

Error: gN@Ezzz<trm>  
           zzz:   Error code

### 8.3.12 Get date of manufacture (sNN03N)

Retrieves the date of manufacture of the MLS9.

Command input: sNN03N<trm>  
                   N:     Module number (0..9)

Return data

Successful: gNN03N+YYYYMMDD<trm>  
                   YYYY:     year  
                   MM:     month  
                   DD:     day

Error: gN@Ezzz<trm>  
           zzz:   Error code

## 8.4 Command set for single module operation (Compatibility)

The commands described in this chapter are compatible with commands from the DIST OEM Module 3.0. These commands only work properly for point-to-point connections of the serial interface from the module to the PC or any other controller.

! **Never use these commands if more than one module is connected to the RS422 line**

### 8.4.1 RESET command (a)

Resets the module, the status LEDs and the digital outputs.

```

Command input:  a<trm>

Return data
Successful:    ?<trm>
Error:        @Ezzz<trm>
              zzz:  Error code
    
```

### 8.4.2 OFF command (b)

Switches the module Off. To switch the module On, use the “a” command.

```

Command input:  b<trm>

Return data
Successful:    ?<trm>
Error:        @Ezzz<trm>
              zzz:  Error code
    
```

### 8.4.3 STOP/CLEAR command (c)

Stops the current execution and resets the status LEDs as well as the digital outputs.

```

Command input:  c<trm>

Return data
Successful:    ?<trm>
Error:        @Ezzz<trm>
              zzz:  Error code
    
```

### 8.4.4 Distance measurement (g)

Triggers simple measurement of the distance. Each new command cancels an active measurement. The status LEDs and the digital outputs are updated corresponding to the new measured distance.

```

Command input:  g<trm>

Return data
Successful:    31..06+xxxxxxxx  51....+00000000<trm>
              xxxxxxxx:  Distance in 1/10 mm
Error:        @Ezzz<trm>
              zzz:  Error code
    
```

## 8.4.5 Tracking (h)

Triggers continuous measurement of the distance. The measurements are continued until the next command is issued or until a fault arises. The status LEDs and the digital outputs are updated corresponding to the new measured distance.

Command input: h<trm>

Return data

Successful: 31..06+xxxxxxxx 51....+00000000<trm>

xxxxxxxx: Distance in 1/10 mm

Error: @Ezzz<trm>

zzz: Error code

## 8.4.6 Signal measurement (k)

Triggers continuous measurement of the signal strength. The measurements are continued until the next command is received or until a fault arises.

Command input: k<trm>

Return data

Successful: 53....+xxxxxxxx<trm>

xxxxxxxx: Signal strength of the returned light in mV

Error: @Ezzz<trm>

zzz: Error code

## 8.4.7 Temperature measurement (t)

Triggers measurement of temperature.

Command input: t<trm>

Return data

Successful: 40....+xxxxxxxx<trm>

xxxxxxxx: temperature in 1/10°C

Error: @Ezzz<trm>

zzz: Error code

## 8.4.8 Laser ON (o)

Switches laser ON.

Command input: o<trm>

Return data

Successful: ?<trm>

Error: @Ezzz<trm>

zzz: Error code

## 8.4.9 Laser OFF (p)

Switches laser OFF.

Command input: p<trm>

Return data

Successful: ?<trm>

Error: @Ezzz<trm>

zzz: Error code

## 8.4.10 Software version (N00N)

Outputs software version at interface.

Command input: N00N<trm>

Return data

Successful: 13...+xxxxxyyy<trm>

xxxx: Board version number

yyy: SW version number

Error: @Ezzz<trm>

zzz: Error code

## 8.4.11 Hardware version (N01N)

Outputs the hardware version at the interface.

Command input: N01N<trm>

Return data

Successful: 14...+xxxxxyy<trm>

xxxxx: Board number

yy: Revision index

Error: @Ezzz<trm>

zzz: Error code

## 8.4.12 Serial number (N02N)

Outputs serial number at interface.

Command input: N02N<trm>

Return data

Successful: 12...+xxxxxxxx<trm>

xxxxx: Serial number of the device

Error: @Ezzz<trm>

zzz: Error code

### 8.4.13 Date of manufacture (N03N)

Outputs the date of manufacture at the interface.

Command input: N03N<trm>

Return data

Successful: 15...+YYYYMMDD<trm>

YYYY: year

MM: month

DD: day

Error: @Ezzz<trm>

zzz: Error code

### 8.4.14 Set communication parameter (N70N)

Sets the communication parameters for the serial interface.

) The new parameters are immediately saved to the Flash Memory and activated after the next startup.

**Bold** = default parameters (first use or after reset)

Command input: N70NyN<trm>

y: Defined the new settings

% Baud rate	Data bit	Parity	% Baud Rate	Data bit	Parity
0 1200	8	N	5 4800	7	E
1 9600	8	N	6 9600	7	E
2 19200	8	N	<b>7 19200</b>	<b>7</b>	<b>E</b>
3 1200	7	E	8 38400	8	N
4 2400	7	E	9 38400	7	E

Return data

Successful: ?<trm>

Error: @Ezzz<trm>

zzz: Error code

**8.5 Error codes**

No.	Format	Meaning
203	@E203	wrong syntax in command, or prohibited command, or prohibited parameter in command entry, or non-valid result
204	@E204	Dimension error
210	@E210	Not in tracking mode, use command sNf to start tracking mode first.
211	@E211	Sampling too fast, set the sampling time to a larger value using sNf (also for command sNA)
212	@E212	Command cannot be executed, because in tracking mode, first use command sNc to stop tracking mode.
213	@E213	Baud rate could not be set. (Contact INPROX Sensors)
217	@E217	Parameter set-up incorrect (Contact INPROX Sensors)
221	@E221	Parity error (Prior to contacting INPROX please check the Terminal settings)
222	@E222	Interface buffer overflow (Contact INPROX if error occurs when sending less than 24 characters)
223	@E223	Interface framing error (Contact INPROX Sensors)
224	@E224	Command buffer overflow (Contact INPROX Sensors if error occurs when sending less than 24 characters)
252	@E252	Temperature too high (contact INPROX Sensors if error occurs at room temperature)
253	@E253	Temperature too low (contact INPROX Sensors if error occurs at room temperature)
255	@E255	Received signal too weak, distance < 200mm (Use different target and distances, if the problem persists, please contact us)
256	@E256	Received signal too strong (Use different target and distances, if the problem persists, please contact us)
257	@E257	Too much background light (Use different target and distances, if the problem persists, please contact us)
260 to 299	@E260 to @E299	Hardware failure (Contact INPROX Sensors)
not listed		Hardware failure (Contact INPROX Sensors)

## 9 Accessories

### 9.1 Viewfinder



The telescopic viewfinder can be used for easy alignment of the MLS9 for long distances.

<i>Part Number</i>	<i>Description</i>
25P100	Telescopic viewfinder

### 9.2 Target plates



The target plates provide a defined measuring target. Please use the different sides for the distances as stated below:

- Front color brown, for measuring distances from 20 m to 200 m
- Back color white, for measuring distances from 0.2 m to 30 m

<i>Part Number</i>	<i>Description</i>
25P110	Target plate small, 105 x 147 mm
25P111	Target plate large, 210 x 297 mm

### 9.3 Laser Glasses



The red lens glasses improve visibility of the laser dot at bright environment conditions. It can be use for distances up to 10-15m.

<i>Part Number</i>	<i>Description</i>
25P120	Laser Glass

### 9.4 Cables

<i>Part Number</i>	<i>Description</i>
500200	PC-Connection cable: MLS9 to - 9 pin D-Sub for PC (RS232) - 2 wires for power supply
500201	RS422-Connection cable: MLS9 to - 5 wires for RS422 - 2 wires for power supply
500202	Connection cable for automatic mode: MLS9 to - 2 wires for current output - 5 wires for digital outputs and power supply

### 9.5 Connector cover IP65

If the MLS9 is connected via the cable gland and the 15 pin D-Sub connector is not used, this cover protects the 15 pin D-Sub connector of the MLS9.



<i>Part Number</i>	<i>Description</i>
500251	Connector Cover IP65

### 9.6 Connector with 90° cable exit IP65



The connector allows the connection of the MLS9 with IP65 protection.

<i>Part Number</i>	<i>Description</i>
500253	Connector 90° IP65

## 10 Safety instructions

The following directions should enable the person responsible for the MLS9, and the user of the instrument, to anticipate and avoid operational hazards.

The MLS9 is made to be integrated into technical systems. A basic technical education is therefore essential. This device may only be operated by trained persons.

The person responsible for the instrument must ensure that all users understand these directions and adhere to them.

If the MLS9 is part of a system, the manufacturer of such a system is responsible for all safety-relevant issues, such as the manual, labeling and instruction.

### 10.1 Use of the instrument

#### Permitted use:

The permitted use of the MLS9 is: measuring distances.

#### Prohibited use:

- 1) Using the instrument without instruction
- 2) Using outside the stated limits
- 3) Deactivation of safety systems and removal of explanatory and hazard labels
- 4) Opening of the equipment, except to open the cover for access to the screw terminal
- 5) Carrying out modification or conversion of the product
- 6) Operation after failure in operation
- 7) Use of accessories from other manufacturers without the express approval of INPROX.
- 8) Aiming directly into the sun
- 9) Deliberate dazzling of third parties; also in the dark
- 10) Inadequate safeguards at the surveying site (e.g. when measuring on roads, etc.)

#### WARNING

Prohibited use can lead to injury, malfunction, and material damage. It is the duty of the person responsible for the instrument to inform the user about hazards and how to counteract them. The MLS9 must not be operated until the user has been adequately instructed.

## 10.2 Limits to use

) See section "Technical Data"

### Environment:

Suitable for use in an atmosphere appropriate for permanent human habitation. Cannot be used in an aggressive or explosive environment.

## 10.3 Areas of responsibility

### Responsibilities of the manufacturer of the original equipment INPROX Sensors (INPROX):

INPROX is responsible for supplying the product, including the Technical Reference Manual and original accessories, in a completely safe condition.

### Responsibilities of the manufacturer of non-INPROX accessories:

The manufacturers of non-INPROX accessories for the MLS9 are responsible for developing, implementing and communicating safety concepts for their products. They are also responsible for the effectiveness of these safety concepts in combination with the INPROX equipment.

### Responsibilities of the person in charge of the instrument:

#### WARNING:

The person responsible for the instrument must ensure that the equipment is used in accordance with the instructions. This person is also accountable for the deployment of personnel and for their training and for the safety of the equipment when in use.

The person in charge of the instrument has the following duties:

- 1) To understand the safety instructions of the product and the instructions in the Technical Reference Manual
- 2) To be familiar with local safety regulations relating to accident prevention.
- 3) To inform INPROX immediately if the equipment becomes unsafe.

## 10.4 Hazards in use

Important hazards in use

### **WARNING:**

The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or prohibited use, and can give rise to accidents with far-reaching human, material and environmental consequences.

### **Precautions**

All users must follow the safety instructions given by the manufacturer and the directions of the person responsible for the instrument.

### **CAUTION:**

Watch out for erroneous distance measurements if the instrument is defective or if it has been dropped or has been misused or modified.

### **Precautions:**

Carry out periodic test measurements, partially after the instrument has been subject to abnormal use, and before, during and after important measurements. Make sure the MLS9 optics are kept clean.

### **WARNING:**

Hidden labels of the MLS9 when mounted could cause a dangerous situation.

### **Precautions:**

Always ensure the visibility of MLS9 labels at all times or add labels corresponding to the local safety regulation.

### **CAUTION:**

When using the instrument for distance measurements or for positioning moving objects (e.g. cranes, building equipment, platforms, etc.) unforeseen events (e.g. breaking the laser beam) may cause erroneous measurements.

### **Precautions:**

Only use this product as a measuring sensor, not as a control device. The system must be configured and operated in such a way that no damage will occur in case of an erroneous measurement, malfunction of the device or power failure due to installed safety measures (e.g. safety limit switch).

**WARNING:**

Operate the equipment appropriately in accordance with the regulations in force. Always prevent access to the equipment by unauthorized personnel.

**CAUTION:**

Be careful when pointing a telescope towards the sun, because the telescope functions as a magnifying glass and can injure eyes and/or cause damage inside the MLS9.

**Precautions**

Do not point the telescope directly at the sun.

## 10.5 Laser classification

The MLS9 produces a visible laser beam, which emerges from the front of the instrument.

It is a Class 2 laser product in accordance with:

- 1) IEC60825-1 (2001) "Radiation safety of laser products"
- 2) EN60825-1 (2001) "Radiation safety of laser products"

It is a Class II laser product in accordance with:

- 1) FDA 21CFR 1040.10 1004.11 (US Department of Health and Human Service, Code of Federal Regulations)

**Laser Class 2/II products:**

Do not stare into the laser beam or direct it towards other people unnecessarily. Eye protection is normally afforded by aversion responses including the blink reflex.

**WARNING:**

Looking directly into the beam with optical aids (binoculars, telescopes) can be hazardous.

**Precautions:**

Do not look into the laser beam. Make sure the laser is aimed above or below eye level. (particularly with fixed installations, in machines, etc.).

**CAUTION:**

Looking into the laser beam may be hazardous to the eyes.

**Precautions:**

Do not look into the laser beam. Make sure the laser is aimed above or below eye level (particularly with fixed installations, in machines, etc.).

## 10.6 Electromagnetic compatibility (EMC)

The term "electromagnetic compatibility" is taken to mean the capability of the MLS9 to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic interference to other equipment.

**WARNING:**

Electromagnetic radiation can cause interference in other equipment. Although the MLS9 meets the strict regulations and standards that are in force in this respect INPROX cannot completely exclude the possibility that interference may be caused to other equipment.

## 10.7 Maintenance

The MLS9 is almost maintenance free. The only thing you have to do is cleaning the optical surfaces.

### CAUTION:

Look after the optical surfaces with same care that you would apply to spectacles, cameras and field glasses.

## 10.8 Service

If you need to service the device, please contact INPROX for instructions.

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