

Distance Laser Sensor

DLS-C 15 / DLS-C 30
DLS-CH 15 / DLS-CH 30

FLS-C 10 / FLS-C 30
FLS-CH 10 / FLS-CH 30

Technical Reference Manual

V2.04

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1 Introduction

The DLS-C(H) and FLS-C(H) are powerful distance-measuring instruments for integration into industrial applications. They allow accurate and contactless distance measurement over a wide range using the reflection of a laser beam:

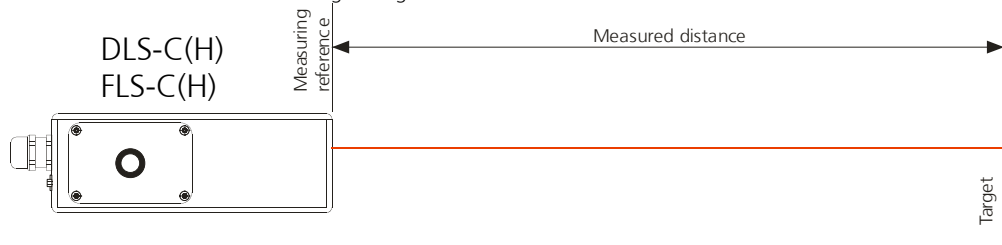


Fig. 1 Standard application

Key features

- Compatible with DIMETIX DLS-C(H) Laser Distance Sensor
- Measurement range 0.05 to 500 m
- Serial interface (RS232 and RS422)
- SSI interface (FLS-C(H) only)
- Connection of up to 10 modules on a single RS422 line
- Wide range power supply (9...30VDC), heating option (24...30VDC)
- Programmable analog output (0/4...20mA)
- Two programmable digital outputs (DO1 and DO2)
- Digital output for error signalization (DOE)
- One programmable digital input (DI1)
- ASCII protocol to control external displays
- D-Sub connector and screw terminal joint for easy connection of DLS-C(H) / FLS-C(H)
- IP65 (protected against ingress of dust and water)
- 4 LEDs for status signaling
- Complementary configuration software available at Dimetix web site (www.dimetix.com)
- Optional: Internal heater for module operation down to -40°C
- Laser class II (<0.95mW)
- Accessories for easy use of the sensor

CAUTION



Use of controls or adjustments or performance of procedures other than those specified in this Technical Reference Manual may result in hazardous radiation exposure.



For easy startup with the DLS / FLS sensor, please use our free configuration software from our web-page: www.dimetix.com/UtilitySW

1.1 Product identification

The product is identified by the label on the top of the sensor:

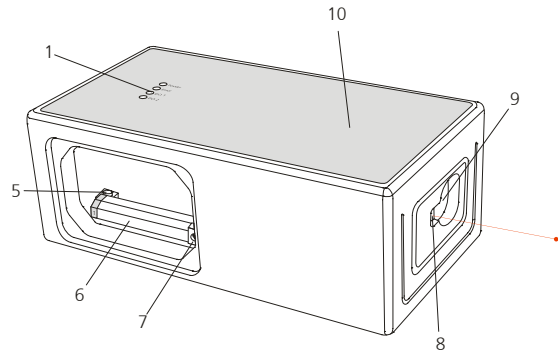
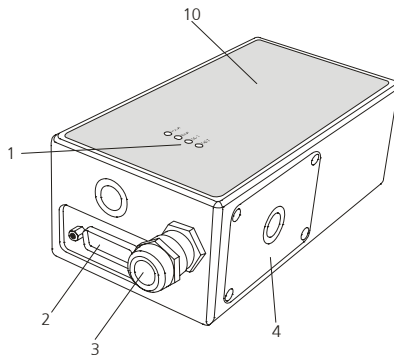
DLS-C Version with a measurement rate of up to 6 Hz

	Typical Accuracy	
	1.5mm	3.0mm
Standard version	DLS-C 15 Part No.: 500622	DLS-C 30 Part No.: 500621
Extended temperature range	DLS-CH 15 Part No.: 500624	DLS-CH 30 Part No.: 500623

FLS-C Version with a measurement rate of up to 20 Hz

	Typical Accuracy	
	1.0mm	3.0mm
Standard version	FLS-C 10 Part No.: 600502	FLS-C 30 Part No.: 600501
Extended temperature range	FLS-CH 10 Part No.: 600504	FLS-CH 30 Part No.: 600503

1.2 Components



- | | |
|---|---|
| <p>1 Status LEDs
status signaling</p> <p>2 15-Pin D-Sub connector
RS422, RS232, SSI, analog, digital output</p> <p>3 Cable gland (M16 x 1.5mm)
for connection cable insertion</p> <p>4 Cover
provides access to the screw terminal</p> <p>5 Reset switch
resets the DLS-C(H) to default settings</p> | <p>6 Screw terminal
RS422, RS232, SSI, analog, digital output</p> <p>7 ID switch
defines the module ID for RS422 operation</p> <p>8 Laser beam outlet</p> <p>9 Receiver optics</p> <p>10 Product label
see 9.9 Labeling on page 40</p> |
|---|---|

1.3 Validity

This manual is valid for DLS-C(H) and FLS-C(H) devices with the following software version:

Interface software version: **0300 or later**
Module software version: **0300 or later**

To get the software version use the command described in 8.3.10 *Get Software Version (sNsv)* on page 29

1.4 Measuring range

The DLS-C(H)/FLS-C(H) is an optical instrument, whose operation is influenced by environmental conditions. Therefore, the measuring range achieved in use may vary. The following conditions may influence the measuring range:

Key	Factors increasing range	Factors reducing range
Target surface	Bright and reflective surfaces such as the target plates (See Accessories)	Matt and dark surfaces Green and blue surfaces
Airborne particles	Clean air	Dust, fog, heavy rainfall, heavy snowfall
Sunshine	Darkness	Bright sunshine on the target

The measurement range may be influenced by configuring different measurement modes. See 8.3.2 Enhanced measuring Modes (sNuc) on page 25.

The DLS-C(H)/FLS-C(H) does not compensate the influence of the atmospheric environment, which may be relevant when measuring long distances (e.g. > 150m). These 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 gaps in the surface use a target plate (see accessories) or board.

1.5.2 Transparent surfaces

To avoid measuring errors, do not measure against transparent surfaces such as colorless liquids (such as water) or (dust-free) glass. In case of unfamiliar materials and liquids, always carry out a trial measurement.



Erroneous measurements can occur when aiming through glass panes 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 laser beam. The DLS-C(H)/FLS-C(H) 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 DLS-C(H)/FLS-C(H) 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. On irregular and round surfaces the arithmetic average of the illuminated surfaces will be measured.

1.5.5 Multiple reflections

Erroneous measurements may occur if the laser beam is reflected by other objects than the target. Avoid any reflective object along the measurement path.

2 Device setup

We recommend that you carry out the configuration steps in an office before mounting the device, especially if you are not familiar with the DLS-C(H)/FLS-C(H).

The DLS-C(H)/FLS-C(H) supports two types of operating modes:

- Controlled mode (Host controlled)
- Automatic mode (for use in stand-alone operation)

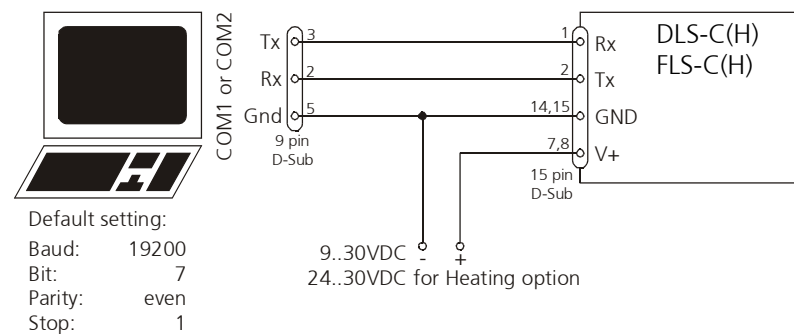
The first decision to be taken is the type of operating mode that will be used to transmit the distance measurement data. While the controlled mode provides maximum flexibility and accuracy, it is often not suitable for integration into existing PLCs or analog environments. In such cases the automatic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

Influence factors	controlled mode	automatic mode (with analog and/or digital outputs)
Accuracy	Maximum measurement accuracy	Accuracy depends on signal scaling (see 8.3.6 Set/Get distance range (sNv) on page 27)
Flexibility	Access to full command set	Limited
Integration	Requires protocol implementation	Wiring of AO and/or DO signals
Connection	Connection of up to 10 DLS-C(H)/FLS-C(H)s to a single RS-422 line.	Point-to-point connection

The following two sections describe the configuration of the DLS-C(H)/FLS-C(H) for the controlled and automatic modes.

2.1 Connection

To be able to configure the DLS-C(H)/FLS-C(H), it must be powered and connected to a PC. Figure 2 shows the necessary connections. On the PC, any terminal program can be used to communicate with the module. A configuration utility is also available on the web page www.dimetix.com.



2.2 Controlled mode

In controlled mode, each operation of a DLS-C(H)/FLS-C(H) 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 20.

2.2.1 Configuration

After connecting the module, the steps below are necessary to configure the DLS-C(H)/FLS-C(H) for the controlled interface mode.

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

1) Commands are described in 8 Command set on page 20

Note: If the communication parameters of the module are lost, please reset the configuration to the factory settings (7 Factory settings on page 19) using the reset button (5.2 Reset switch on page 16). Please note that the ID switch must be reset manually.

2.2.2 Host software

Host software is required for operation of the DLS-C(H)/FLS-C(H) in controlled mode. When connecting multiple devices to a single serial line (RS422), strict Master-Slave communication must be implemented (DLS-C(H)/FLS-C(H) operates as slave). For software sample-code or application-notes please consult our web site www.dimetix.com.

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

2.3 Automatic mode

An automatic mode is provided for host-less operation of the DLS-C(H)/FLS-C(H). The analog and digital outputs are updated according to the configuration described below as soon as the unit is powered off and on. Furthermore the value to output on the SSI interfaces is updated.

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 DLS-C(H)/FLS-C(H). Two are programmable, while the third is used to signal an error state of the device.

2.3.1 Configuration

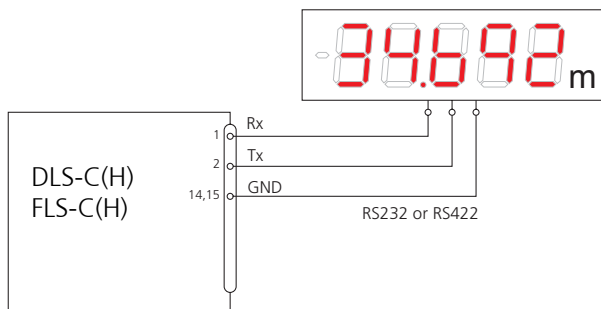
After connecting the module, the following steps are necessary to configure the DLS-C(H)/FLS-C(H) for automatic mode.

No.	Action	Comment	Command
1	Set current output range	Defines the current output range from 0 to 20mA or from 4 to 20mA. <i>Example for module 0:</i> Set current output range from 4mA to 20mA.	s0vm+1<trm> ¹⁾
2	Set distance range	Defines the minimum distance (D _{min}) and the maximum distance (D _{max}) for the current range of the analog output. <i>Example for module 0:</i> Set distance range from 0m to 10m	s0v+00000000+00100000<trm> ¹⁾
3	Set analog output in case of an error	Sets the current that should be applied in case of an error. <i>Example for module 0:</i> Set current to 0mA in case of an error.	s0ve+000<trm> ¹⁾
4	Configure digital output	Set the ON and OFF level for the digital outputs. <i>Example for module 0:</i> DO 1: off=2000mm on=2005mm DO 2: off=4000mm on=4005mm	s01+00020000+00020050<trm> ¹⁾ s02+00040000+00040050<trm> ¹⁾
5	Save settings	The changed configuration must be saved to make it permanent. <i>Example for module 0:</i> Save settings for module 0	s0s<trm> ¹⁾
6	Set automatic mode	Set the DLS-C(H)/FLS-C(H) to the automatic mode with the desired sample rate. <i>Example for module 0:</i> Set sample rate to fastest possible speed.	s0A+0<trm> ¹⁾

1) Commands are described in 8 Command set on page 20

Note: If the serial line settings of the module have been lost, please reset the configuration to the factory settings (7 Factory settings on page 19) using the reset button (5.2 Reset switch on page 16). Please note that the ID switch must be reset manually.

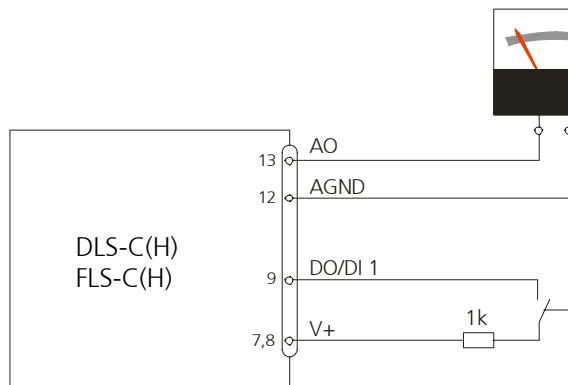
2.4 Display Mode



If Display Mode is enabled, the DLS-C(H)/FLS-C(H) formats the measured distance as ASCII string, which is understood by External Displays with a serial interface. Since the DLS-C(H)/FLS-C(H) outputs this formatted string automatically on the serial interface after completing a measurement. Measurement results can be displayed on an external display without an additional controller.

For a detailed description of this mode, please contact Dimetix or your dealer.

2.5 External Trigger



The DLS-C(H)/FLS-C(H) includes the option of triggering measurements with an external switch or push button on Digital Input 1 (DI 1). Using the Digital Input DI 1 disables the Digital Output DO 1.

The command to activate the external trigger option is described in 8.4 Digital Input on page 30.

2.5.1 Configuration

After connecting the DLS-C(H)/FLS-C(H), the following steps are necessary to activate the external trigger. The example shows the configuration for triggering a single distance measurement.

No.	Action	Comment	Command
1	Activate digital input DI1	Defines the action for a trigger event on DI1. <i>Example for module 0:</i> Configure DI1 to trigger a single distance measurement.	<code>s0DI1+2<trm></code> ¹⁾
5	Save settings	The changed configuration must be saved to make it permanent. <i>Example for module 0:</i> Save settings for module 0	<code>s0s<trm></code> ¹⁾

1) Commands are described in 8 Command set on page 20

3 Installation

3.1 Mounting

Three M4 threaded holes in the bottom of the DLS-C(H)/FLS-C(H) 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 14.

3.2 Device wiring

3.2.1 Power Supply

For trouble-free operation use a separate power supply for the DLS-C(H)/FLS-C(H).

FLS-C, DLS-C:	9...30V, 0.5A DC
FLS-CH, DLS-CH:	24...30V, 2.5A DC

3.2.2 Cable connection

A ferrite core must be fitted to the connecting cable. Use a ferrite core with an impedance of 150 Ω to 260 Ω at 25MHz and 640 Ω to 730 Ω at 100MHz. For example you can use KCF-65 from KE Kitagawa.

3.2.3 Shield and Ground

The DLS-C(H)/FLS-C(H) contains two electrically isolated grounds, the general ground (GND) and the analog ground (AGND). GND and AGND are connected to the housing by a RC element. Please see figure 3

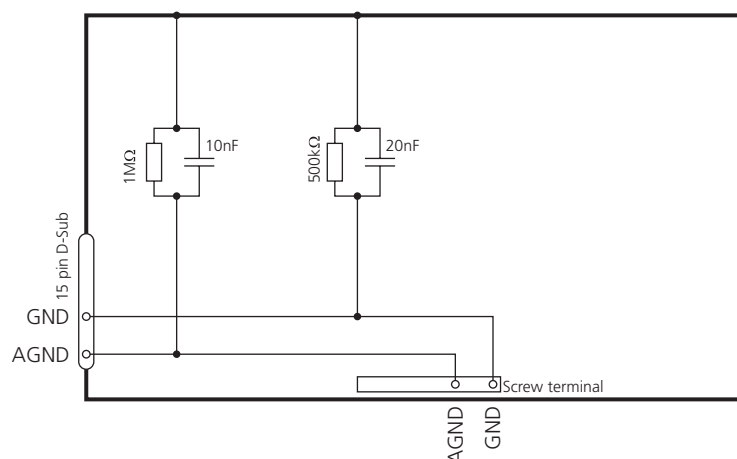


Fig. 3 Connection between shield and ground

3.2.4 Controlled mode

RS232

Only point-to-point communication is possible when using the RS232 interface.

Never connect multiple DLS-C(H)/FLS-C(H)s on a RS232 serial line

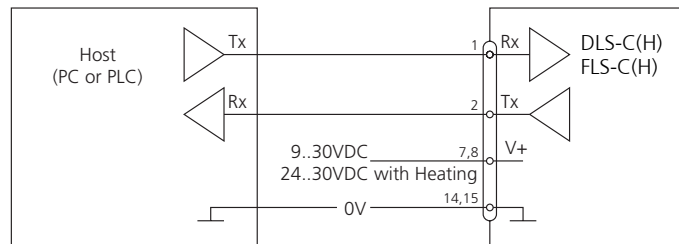


Fig. 4 Point-to-point connection with RS232

RS422

It is possible to connect multiple devices on a single RS422 line. To ensure proper operation, strict Master-Slave communication must be applied. 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 DLS-C(H)/FLS-C(H) or timeout).

Ensure, that all DLS-C(H)/FLS-C(H)s are set to different ID numbers

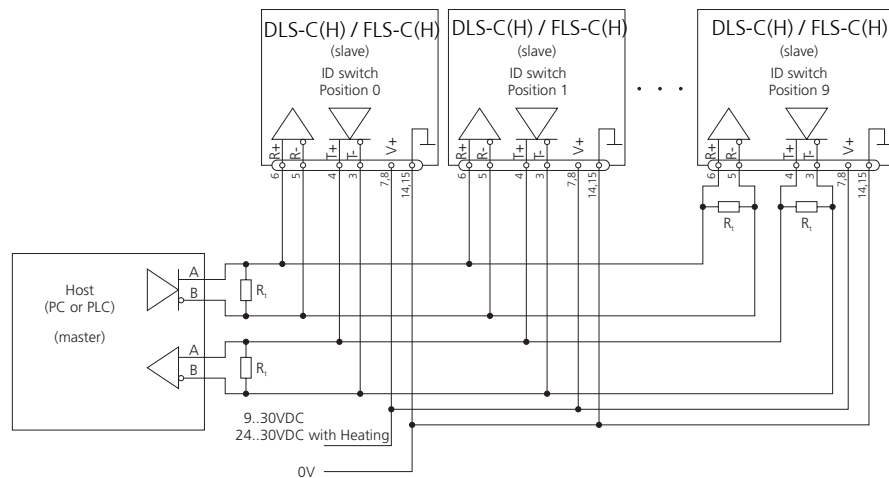


Fig. 5 Connecting multiple devices with RS422

3.2.5 Automatic mode

The analog interface of the DLS-C(H)/FLS-C(H) 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 lower than 500

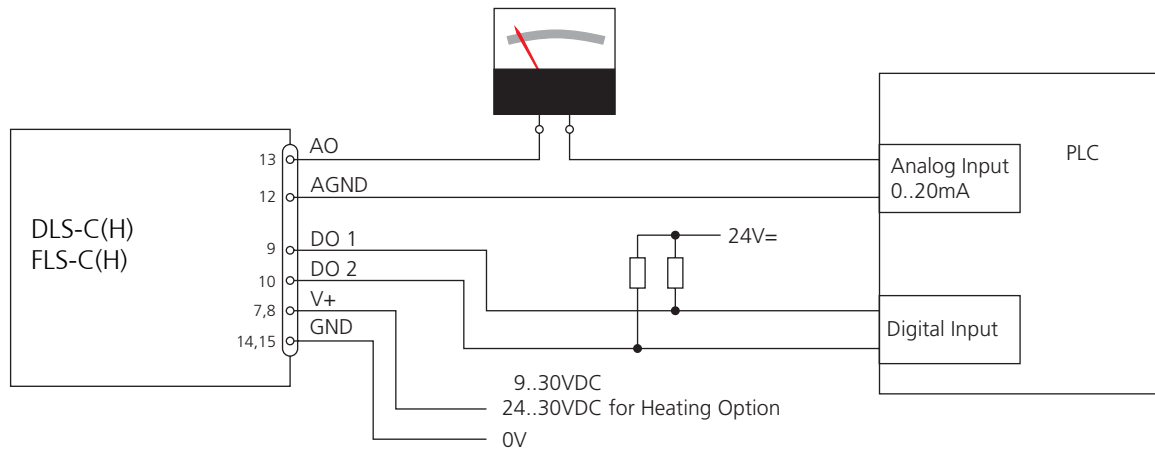


Fig. 6 Connection of an instrument and a PLC

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. An optional telescopic viewfinder is available which simplifies the alignment significantly.

4 Technical data

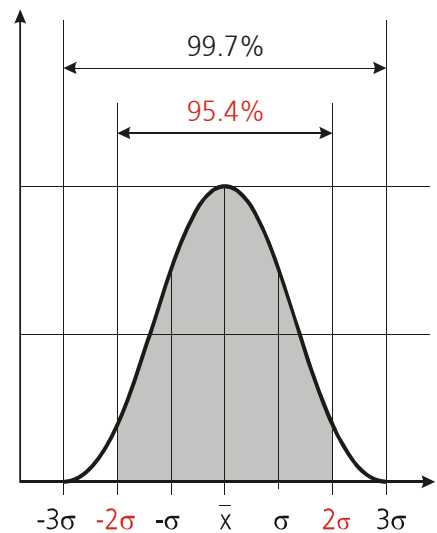
4.1 Measuring accuracy

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 σ , refer to diagram on the right). The typical measuring accuracy relates to average conditions for measuring. It is $\pm 1.0\text{mm}$ for the FLS-C(H) 10, $\pm 1.5\text{mm}$ for the DLS-C(H) 15 and $\pm 3.0\text{mm}$ for the DLS-C(H)/FLS-C(H) 30 valid in the tracking mode.

Maximum deviation may occur under unfavorable conditions such as bright sunlight or when measuring to poorly reflecting or very rough surfaces. Measuring accuracy may deteriorate by approximately $\pm 0.02\text{mm/m}$ for distances above 30m.

The DLS-C(H)/FLS-C(H) does not compensate changes of atmospheric environment. These changes can influence the accuracy if measuring long distances ($>150\text{m}$) under conditions very different from 20°C , 60% relative humidity and 953 mbar air pressure. The influences of the atmospheric environment are described in

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



4.2 Specifications

Typical measuring accuracy for DLS-C 15 / DLS-CH 15 ¹⁾ DLS-C 30 / DLS-CH 30 ¹⁾ FLS-C 10 / FLS-CH 10 ^{1,3,4)} FLS-C 30 / FLS-CH 30 ^{1,3)}	$\pm 1.5 \text{ mm @ } 2\sigma$ $\pm 3.0 \text{ mm @ } 2\sigma$ $\pm 1.0 \text{ mm @ } 2\sigma$ $\pm 3.0 \text{ mm @ } 2\sigma$
Accuracy of the analog output DLS-C(H) FLS-C(H)	0.2% programmed span (8.3.6 Set/Get distance range (sNv) on page 27) 0.1% programmed span (8.3.6 Set/Get distance range (sNv) on page 27)
Typical Repeatability for DLS-C 15 / DLS-CH 15 ¹⁾ DLS-C 30 / DLS-CH 30 ¹⁾ FLS-C 10 / FLS-CH 10 ¹⁾ FLS-C 30 / FLS-CH 30 ¹⁾	$\pm 0.4 \text{ mm @ } 2\sigma$ $\pm 0.5 \text{ mm @ } 2\sigma$ $\pm 0.3 \text{ mm @ } 2\sigma$ $\pm 0.5 \text{ mm @ } 2\sigma$
Smallest unit displayed	0.1 mm
Measuring range on natural surfaces	0.05 m to approx. 65 m
Measuring range on orange (reflective) target plate	DLS-C(H) Approx. 25 m to 150 m FLS-C(H) Approx. 0.5 m to 500 m
Measuring reference	from front edge (See 6 Physical dimensions)
Diameter of laser spot at target at a distance of	4mm @ 5m 8mm @ 10m 15mm @ 30m
Time for a measurement Single measurement: DLS-C(H) / FLS-C(H) ³⁾ Tracking: DLS-C(H) ³⁾ FLS-C(H) ³⁾	Typical: 0.3 s to 4 s Typical: 0.15 s to 4 s Typical: 50 ms to 4 s
Light source	Laser diode 620-690 nm (red) IEC 60825-1:2007; Class 2 FDA 21CFR 1040.10 and 1040.11 Beam divergence: 0.16 x 0.6 mrad Pulse duration: $0.45 \times 10^{-9} \text{ s}$ Maximum radiant power: 0.95 mW
Laser Life Time	typical 50'000h @ 20°C
ESD	IEC 61000-4-2
EMC	EN 61000-6-4 EN 61000-6-2
Power supply	9 ... 30V DC 0.6A for DLS-C / FLS-C 24 ... 30V DC 2.5A for DLS-CH / FLS-CH(Heating option)
Dimensions	150 x 80 x 55 mm
Temperature range during operation ²⁾ DLS-C 15 / DLS-C 30 DLS-CH 15 / DLS-CH 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)
Weight	DLS-C, FLS-C: 690 g DLS-CH, FLS-CH: 720 g
Standard interface	1 serial asynchronous interface RS232 1 serial asynchronous interface RS422 1 SSI (only FLS-C(H)) 1 programmable analog output 0/4 .. 20mA 2 programmable digital outputs 1 programmable digital input 1 digital output for error status

1) See 4.1 Measuring accuracy on page 14.

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

3) Accuracy and measurement speed depend on configuration (See 8.3.2 Enhanced measuring Modes (sNuc) on page 25)

4) By measuring on the orange reflecting target plate the accuracy may be reduced to $\pm 1.5 \text{ mm @ } 2\sigma$

5 Electrical components

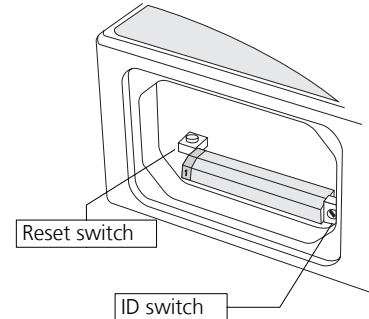
5.1 ID switch

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

5.2 Reset switch

To reset the module to factory settings do the following:

- Change ID Switch to position 0
- 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
- Switch the power OFF and wait 5 seconds
- Switch on the power and wait until the green power LED is on



5.3 Digital output

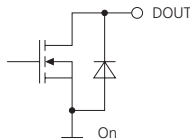


Fig. 7 Open drain output

The DLS-C(H)/FLS-C(H) contain 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. Maximum switching voltage is 30V DC. In the ON state, the FET transistor is electro conductive.

5.4 Digital Input

The Digital Output (DO 1) can be configured as a Digital Input (DI 1). This is useful for triggering measurements by means of an external switch or push button. Please refer to chapter 8.4 Digital Input on page 30.

- Low Level is: $U_{DI1} < 2VDC$
- High Level is: $U_{DI1} > 9VDC$ and $U_{DI1} < 30VDC$

5.5 Analog output

The analog output of the DLS-C(H)/FLS-C(H) is a current source (0..20mA or 4..20mA). It is capable of driving loads up to 500 Ω.

$$e_{Dist} = Accuracy_{Device} + \frac{(MaxDist_{Conf} - MinDist_{Conf}) * Accuracy_{AO}}{100}$$

- e_{Dist} Total error in mm
- $Accuracy_{Gerät}$ Device accuracy in mm
- $Accuracy_{AO}$ Accuracy of the analog output in %
- $MaxDist_{Conf}$ Configured max Distance in mm
- $MinDist_{Conf}$ Configured min Distance in mm

Example:	DLS-C(H) 30
Device accuracy	±3 mm
Min. Distance	0 mm
Max. Distance	10'000 mm
Accuracy analog output FLS	±0.1%
Total error	$3mm + \frac{(10000-0) * 0.1}{100} = \pm 13mm$



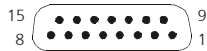
The stated errors include all possible errors as Temperature drift, linearity, surface color and measurement distance.



The best accuracy of ±1.5 mm for the DLS-C(H) 15 and ±1 mm for the FLS-C(H) 10 can only be achieved by using the digital interfaces (RS-232, RS-422 or SSI)

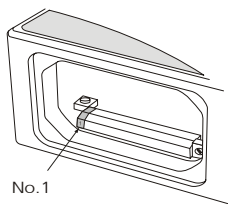
5.6 Connector

5.6.1 D-Sub connector



Pin	Designator	Description
1	Rx	RS232 receive line
2	Tx	RS232 send line
3	T-	RS422 send line negative SSI data output negative (Only for FLS-C and if configured for SSI)
4	T+	RS422 send line positive SSI data output positive (Only for FLS-C and if configured for SSI)
5	R-	RS422 receive line negative SSI clock input negative (Only for FLS-C and if configured for SSI)
6	R+	RS422 receive line positive SSI clock input positive (Only for FLS-C and if configured for SSI)
7	V+	DC Power
8	V+	+ 9V...+30V for DLS-C / FLS-C +24V...+30V for DLS-CH / FLS-CH (Heating option)
9	DO 1	Digital output 1 (Open Drain) or Digital input 1
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

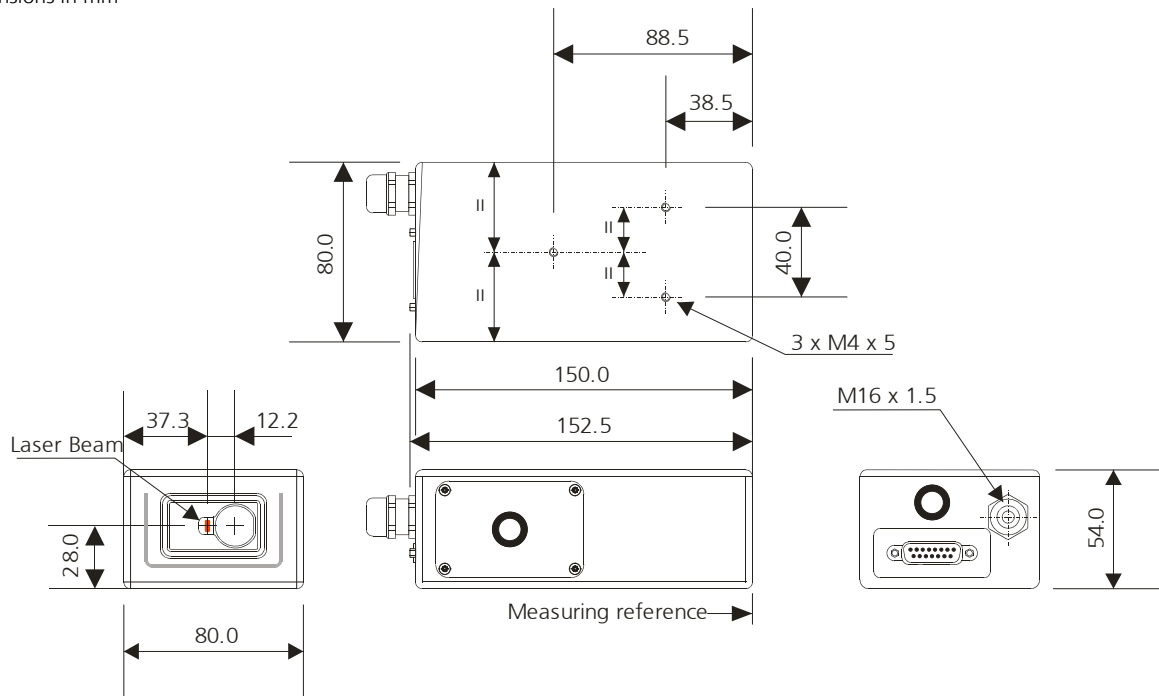
5.6.2 Screw terminal



Designator	Description
R+	RS422 Receive line positive SSI clock input positive (Only for FLS-C and if configured for SSI)
R-	RS422 Receive line negative SSI clock input negative (Only for FLS-C and if configured for SSI)
T+	RS422 Send line positive SSI data output positive (Only for FLS-C and if configured for SSI)
T-	RS422 Send line negative SSI data output negative (Only for FLS-C and if configured for SSI)
Tx	RS232 Transmit line
Rx	RS232 Receive line
AGND	Analog ground
AO	Analog output (0/4..20mA)
DO E	Digital output for error signalization (Open Drain)
DO 2	Digital output 2 (Open Drain)
DO 1	Digital output 1 (Open Drain) or Digital input 1
GND	Ground line
V+	Power DC +9V...+30V DLS-C / FLS-C +24...+30V DLS-CH / FLS-CH (Heating option)

6 Physical dimensions

All dimensions in mm



7 Factory settings

7.1 Operation

Mode: Controlled Mode

7.2 Communication parameters

Baud: 19200
 Data bit: 7
 Parity: Even
 Stop bit: 1
(Setting 7)

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

7.7 Digital input 1 (DI1)

Inactive, configured as output

7.8 User distance offset

User distance offset = 0mm

8 Command set

8.1 General

8.1.1 Command termination <trm>

All commands for the DLS-C(H)/FLS-C(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*. At the location of the *N* insert the Module ID.

8.1.3 Parameter separator

The command syntax uses the '+' sign as parameter separator. The '+' sign can be replaced by the minus '-' sign if applicable by the command.

8.1.4 Set/Get Commands

All configuration commands that are used to set configuration values can also be used to read the currently set value by omitting the parameter. The command syntax is described as follows:

	Set Command	Get Command
Command	sNuof+xxxxxxxx<trm>	sNuof<trm>
Return successful	gNuof?<trm>	gNuof+xxxxxxxx<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	<p><i>N</i> Module ID</p> <p>xxxxxxxx Offset in 1/10 mm; + positive / - negative</p> <p>zzz Error code</p>	

8.1.5 Startup sequence

After power on, the DLS-C(H)/FLS-C(H) does all the initializations and sends a start sequence gN?. On this sequence, the *N* stands for the Module ID. After sending this start sequence, the DLS-C(H)/FLS-C(H) is ready to use.

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	
Command	sNc<trm>	
Return successful	gN?<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	N	Module ID
	zzz	Error code

8.2.2 Distance measurement (sNg)

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

	Command	
Command	sNg<trm>	
Return successful	gNg+xxxxxxxx<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	N	Module number (0..9)
	xxxxxxxx	Distance in 1/10 mm
	zzz	Error code

8.2.3 Signal measurement (sNm)

Signal measurement can be done continuously or with a single measurement. The signal strength is returned as a relative number in the range of 0 to 8 millions.

The value for the signal strength is just an approximate value, it differs from device to device and also depends on environment conditions.

	Command	
Command	sNm+c<trm>	
Return successful	gNm+xxxxxxxx<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	N	Module number (0..9)
	c	0: single measurement 1: repetitive measurements ! attention, use only with one sensor
	xxxxxxxx	Signal strength (range 0.. 8 millions)
	zzz	Error code

8.2.4 Temperature measurement (sNt)

Triggers measurement of the temperature inside the sensor.

	Command	
Command	sNt<trm>	
Return successful	gNt+xxxxxxxx<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	N	Module ID
	xxxxxxxx	Temperature in 0.1°C
	zzz	Error code

8.2.5 Laser ON (sNo)

Switches laser the beam ON for easy adjustment.

	Command	
Command	sNo<trm>	
Return successful	gN?<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	N zzz	Module ID Error code

8.2.6 Laser OFF (sNp)

Switches the laser OFF.

	Command	
Command	sNp<trm>	
Return successful	gN?<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	N zzz	Module ID Error code

8.2.7 Single sensor Tracking (sNh)

Triggers continuous measurement of the distance. The measurements are made as fast as possible (Measurement speed depends on target conditions) This command is not to be used with more than one DLS-C(H)/FLS-C(H) on a RS-232/RS-422 line. The measurements are continued until the STOP/CLEAR command is issued. The status LEDs and the digital outputs are updated corresponding to the new measured distance.



Never use this command if more than one module is connected to the RS232/RS422 line

	Command	
Command	sNh<trm>	
Return successful	gNh+xxxxxxxx<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	N Module ID xxxxxxxx Distance in 0.1mm zzz Error code	

8.2.8 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 (Measuring speed depends on target conditions). The last measurement can be read out from the module with the command sNq. The measurements are continued until the 'sNc' command is issued.

	Set Command	Get Command
Command	sNf+xxxxxxxx<trm>	sNf<trm>
Return successful	gNf?<trm>	gNf+xxxxxxxx<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	N Module ID xxxxxxx Sampling rate in 10ms (if 0 -> max possible rate) zzz Error code	

8.2.9 Read out - Tracking with buffering(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	
Command	sNq<trm>	
Return successful	gNq+xxxxxxxx+c<trm>	
Return Error	gN@Ezzz+c<trm>	
Parameters	N Module ID xxxxxxxx Distance in 0.1mm c 0 = no new measurement since last sNq command 1 = one new measurement since last sNq command, not overwritten 2 = more than one measurement since last sNq command, overwritten zzz Error code	

8.3 Configuration commands

8.3.1 Set/Get communication parameter (sNbr)

Sets the communication parameters for the serial interface.



**This command saves all configuration parameters to Flash.
The changed baud rate is activated after the next power on.**

Bold = default parameters (first use or after reset)

Command																																																									
Command	sNbr+y<trm>																																																								
Return successful	gN?<trm>																																																								
Return Error	gN@Ezzz<trm>																																																								
Parameters	<p><i>N</i> Module ID</p> <p><i>y</i> Defines the new settings</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>%</th> <th>Baud rate</th> <th>Data bit</th> <th>Parity</th> <th>%</th> <th>Baud Rate</th> <th>Data bit</th> <th>Parity</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1200</td> <td>8</td> <td>N</td> <td>6</td> <td>9600</td> <td>7</td> <td>E</td> </tr> <tr> <td>1</td> <td>9600</td> <td>8</td> <td>N</td> <td>7</td> <td>19200</td> <td>7</td> <td>E</td> </tr> <tr> <td>2</td> <td>19200</td> <td>8</td> <td>N</td> <td>8</td> <td>38400</td> <td>8</td> <td>N</td> </tr> <tr> <td>3</td> <td>1200</td> <td>7</td> <td>E</td> <td>9</td> <td>38400</td> <td>7</td> <td>E</td> </tr> <tr> <td>4</td> <td>2400</td> <td>7</td> <td>E</td> <td>10</td> <td>115200</td> <td>8</td> <td>N</td> </tr> <tr> <td>5</td> <td>4800</td> <td>7</td> <td>E</td> <td>11</td> <td>115200</td> <td>7</td> <td>E</td> </tr> </tbody> </table>	%	Baud rate	Data bit	Parity	%	Baud Rate	Data bit	Parity	0	1200	8	N	6	9600	7	E	1	9600	8	N	7	19200	7	E	2	19200	8	N	8	38400	8	N	3	1200	7	E	9	38400	7	E	4	2400	7	E	10	115200	8	N	5	4800	7	E	11	115200	7	E
%	Baud rate	Data bit	Parity	%	Baud Rate	Data bit	Parity																																																		
0	1200	8	N	6	9600	7	E																																																		
1	9600	8	N	7	19200	7	E																																																		
2	19200	8	N	8	38400	8	N																																																		
3	1200	7	E	9	38400	7	E																																																		
4	2400	7	E	10	115200	8	N																																																		
5	4800	7	E	11	115200	7	E																																																		

8.3.2 Enhanced measuring Modes (sNuc)

Multiple measuring modes available in the FLS-C measuring devices meet different requirements for various applications. With these measuring modes measuring rate and accuracy can be optimized for special requirements.

The FLS-C measuring device has with factory settings an accuracy of ± 1 mm (FLS-C(H) 10) respectively ± 3 mm (FLS-C(H) 30) at 2σ . Measuring rate depends on environmental conditions such as target surface, distance, background light (e.g. sun light), etc. Good environmental condition increase measuring rate (e.g. white target surface or orange reflective target plate and dark environment).

Measuring Mode overview

Mode	Measuring rate	Typical accuracy @ 2σ		Characteristics	Application examples
		FLS-C(H) 10	FLS-C(H) 30		
Normal (factory settings)	max. 10 Hz ¹⁾	± 1 mm	± 3 mm	Measuring range on natural surface: typical 65 m	Various
Fast	max. 20 Hz ¹⁾	± 2 mm	± 6 mm	Increased measuring rate up to 20 Hz.	Positioning applications: Warehouse, Crane, etc.
Precise	max. 6 Hz ¹⁾	$\sim \pm 0.8$ mm	$\sim \pm 2.4$ mm	Increased accuracy of ± 0.8 mm	Surveying applications, short range applications etc.
Natural surface	~ 0.3 Hz @ up to approx. 80m	$\sim \pm 5$ mm @ up to approx. 80m	$\sim \pm 15$ mm @ up to approx. 80m	Increased measuring range on natural surfaces: typical 80 meters	Measuring against far away natural surfaces or bad reflective surfaces such as black synthetic granules, etc.

1) Good environmental conditions (e.g. white target surface or orange reflective target plate and dark environment).

Configuration command



The configuration command sNuc is applied to the special user commands as well to the standard commands.

	Command	Get Command
Command	sNuc+0+x<trm>	sNuc
Return successful	gNuc+0000000+xxxxxxxx<trm>	gNuc+xxxxxxxx+yyyyyyy<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	<p><i>N</i> Module number (0..9)</p> <p><i>x</i> measuring mode</p> <p style="margin-left: 100px;">0: Normal 1: Fast 2: Precise 3: Natural surface</p> <p><i>zzz</i> Error code</p>	

Configuration parameters need to be saved (See 8.3.8 Save configuration parameters (sNs) on page 28)

8.3.3 Set automatic mode (sNA)

This command activates the automatic mode of the DLS-C(H)/FLS-C(H). It triggers continuous measurement of the distance. The analog, digital and SSI outputs are updated according to the measured distance values. The sampling time defines the measurement rate. If the sampling time is set to zero, the measurements are executed as fast as possible (depending on target conditions).

The automatic mode is active until the STOP/CLEAR command (sNc') is issued.



The operating mode is stored in the DLS-C(H)/FLS-C(H) and activated immediately. This mode is also activated after next power ON.



Internally, "tracking with buffering" is started (command sN£). Therefore, the last measurement can also be read out from the module with the command sN£.

	Command	
Command	sNA+xxxxxxxx<trm>	
Return successful	gNA?<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	N Module number (0..9) xxxxxxxx Sampling time in 10 ms (if 0 -> max. possible rate) zzz Error code	

8.3.4 Set/Get analog output min level (sNvm)

This command sets the minimum analog output current level (0 or 4 mA).

	Set Command	Get Command
Command	sNvm+x<trm>	sNvm<trm>
Return successful	gNvm?<trm>	gNvm+x<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	N Module number (0..9) x Minimum output for analog out 0: Minimum current is 0 mA 1: Minimum current is 4 mA zzz Error code	

Configuration parameters need to be saved (See 8.3.8 Save configuration parameters (sNs) on page 28)

8.3.5 Set/Get analog output value in error case (sNve)

This command sets the analog output current level in mA in case of an error. This level can be lower than the minimum level set in 8.3.4 Set/Get analog output min level (sNvm).

	Set Command	Get Command
Command	sNve+xxx<trm>	sNve<trm>
Return successful	gNve?<trm>	sNve+xxx<<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	N Module number (0..9) xxx Value in case of an error in 0.1mA zzz Error code	

Configuration parameters need to be saved (See 8.3.8 Save configuration parameters (sNs) on page 28)

8.3.6 Set/Get distance range (sNv)

Sets the minimum and maximum distances corresponding to the minimum and maximum analog output current levels.

$$A_{out} = \frac{DIST - D_{min}}{D_{max} - D_{min}} * 20mA$$

$$A_{out} = \frac{DIST - D_{min}}{D_{max} - D_{min}} * 16mA + 4mA$$

Aout Analog current output
DIST Actual measured distance
Dmin Distance programmed for the minimum output current
Dmax Distance programmed for the maximum output current

	Set Command	Get Command
Command	sNv+xxxxxxxx+yyyyyyy<trm>	sNv<trm>
Return successful	gNv?<trm>	gNv+xxxxxxxx+yyyyyyy<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	N Module number (0..9) xxxxxx Minimum distance in 1/10 mm corresponding to 0mA / 4mA yyyyyyy Maximum distance in 1/10 mm corresponding to 20mA zzz Error code	

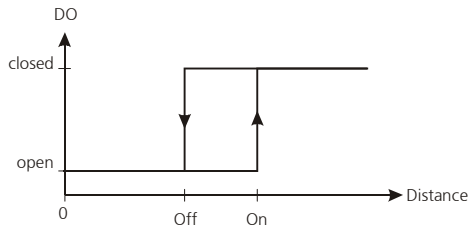
Configuration parameters need to be saved (See 8.3.8 Save configuration parameters (sNs) on page 28)

8.3.7 Set/Get digital output levels (sNn)

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

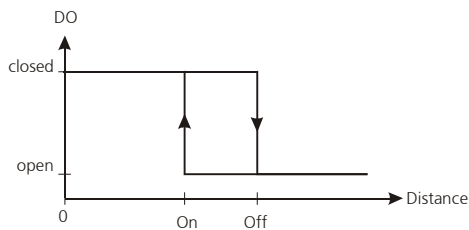
Two different situations are possible:

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.

	Set Command	Get Command
Command	sNn+xxxxxxxx+yyyyyyy<trm>	sNn<trm>
Return successful	gNn?<trm>	gNn+xxxxxxxx+yyyyyyy<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	<i>N</i> Module number (0..9) <i>n</i> 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 zzz Error code	

Configuration parameters need to be saved (See 8.3.8 Save configuration parameters (sNs) on page 28)

8.3.8 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	
Command	sNs<trm>	
Return successful	gNs?<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	<i>N</i> Module number (0..9) zzz Error code	

8.3.9 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 and therefore permanently saved.



The communication parameters are also reset to factory settings.

	Command	
Command	sNd<trm>	
Return successful	gN?<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	<i>N</i>	Module number (0..9)
	<i>zzz</i>	Error code

8.3.10 Get Software Version (sNsv)

Retrieves the software version of the DLS-C(H)/FLS-C(H).

	Command	
Command	sNsv<trm>	
Return successful	gNsv+xxxxyyyy<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	<i>N</i>	Module number (0..9)
	<i>xxxx</i>	Internal measuring module software version number
	<i>yyyy</i>	Interface software version
	<i>zzz</i>	Error code

8.3.11 Get Serial Number (sNsn)

Retrieves the serial number of the DLS-C(H)/FLS-C(H).

	Command	
Command	sNsn<trm>	
Return successful	gNsn+xxxxxxxx<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	<i>N</i>	Module number (0..9)
	<i>xxxxxxxx</i>	Serial number of the device
	<i>zzz</i>	Error code

8.3.12 Get device generation and type (dg)

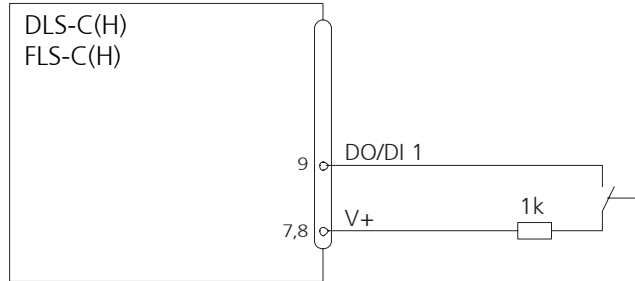
This command returns the device type, generation and current communication settings.

Works only from device generation C on.

	Command	
Command	dg	
Return successful	gNdg+xxx+yz?<trm>	
Return Error	gN@Ezzz	
Parameters	<i>N</i>	Module number (0..9)
	<i>xxx</i>	Bit coded number to identify the device: 0x53 (83) DLS-C / FLS-C
	<i>y</i>	(additional internal information)
	<i>z</i>	Communication settings (see command sNbr+C)
	<i>zzz</i>	Error code

8.4 Digital Input

The following commands configure the terminal DO1. This port can also be used as digital input. For safety reasons, always use a resistor to protect the connection terminal.



8.4.1 Configure digital input (sNDI1)

The digital output 1 of the DLS-C can also be used as digital input. Its state can be read or trigger a configurable action. Use the following command to configure the behavior of the digital input.



On active digital input, the digital output function of DO1 is deactivated

	Set Command	Get Command
Command	sNDI1+xxxxxxxx<trm>	sNDI1<trm>
Return successful	gNDI1?<trm>	sNDI1+xxxxxxxx<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	<i>N</i> Module number (0..9) xxxxxxxx 0: Digital input inactive (DO1 active) 1: activate the digital input to read out its state with the command 8.4.2 Read digital input (sNRI). 2: Trigger Distance measurement (sNg) 3: Start/Stop Single sensor Tracking (sNh) 4: Start/Stop Tracking with buffering (sNf) zzz Error code	

Configuration parameters need to be saved (See 8.3.8 Save configuration parameters (sNs) on page 28)

8.4.2 Read digital input (sNRI)

Displays the state of the digital input, if the input is not inactive. (Necessary configuration of the digital input: sNDI1+1)

	Command	
Command	sNRI<trm>	
Return successful	gNRI+x<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	<i>N</i> Module number (0..9) x 0: Input Off (Signal Low) 1: Input On (Signal High) zzz Error code	

8.5 SSI (Synchronous serial interface)

The SSI Interface is only implemented in the FLS type. Connect the device by RS232 to do the configuration and use the following commands to activate the SSI interface. The application note "SSI Interface" contains all detailed information to operate the SSI Interface.



Use the automatic mode to automatically update the SSI output value.
(8.3.3 Set automatic mode (sNA) page 26)

8.5.1 Change from RS422 to SSI output and back

If the SSI interface should be used at the same port where normally the RS422 resides, it can be switched.

	Set Command	Get Command
Command	sNSSI+c<trm>	sNSSI<trm>
Return successful	gNSSI?<trm>	gNSSI+c<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	<i>N</i> Module ID <i>c</i> 0: switch to (or stay in) RS 422 mode 1: switch to (or stay in) SSI mode <i>zzz</i> Error code	

Configuration parameters need to be saved (See 8.3.8 Save configuration parameters (sNs) on page 28)

8.5.2 Set/Get error value on SSI output

In measuring error case, the SSI output will have the value, which is stored as the SSI error value. To change it, the sNSSIe command can be used: The value can be in the range [0;16777215]. This value will only be available until the next power OFF. To keep it, use the sNs command.

	Set Command	Get Command
Command	sNSSIe+xxxxxxxx<trm>	sNSSIe<trm>
Return successful	gNSSIe?<trm>	gNSSIe+xxxxxxxx<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	<i>N</i> Module ID <i>xxxxxxxx</i> A value within 0 and 16777215. <i>zzz</i> Error code	

Configuration parameters need to be saved (See 8.3.8 Save configuration parameters (sNs) on page 28)

8.6 Special User Commands

The special user commands are user configurable and are an extension to the standard commands. Use these commands carefully and only if you really understand their impact.

The syntax of the user commands differ to the standard commands as follows:

Standard Commands: sNx
 User Commands: sNuxx

The user configuration parameters influence the result of the user commands. A gain and offset may be applied to the measurement result and the output format may be configured.

8.6.1 Set/Get user distance offset (sNuof)

The user can set an individual overall offset correction for all distance measurement commands in this 'Special User Command' section. The standard distances measurement commands are not involved.

	Set Command	Get Command
Command	sNuof+xxxxxxxx<trm>	sNuof<trm>
Return successful	gNof?<trm>	gNuof+xxxxxxxx<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	<i>N</i> Module ID xxxxxxxx Offset in 1/10 mm; + positive / - negative zzz Error code	

8.6.2 User configured distance measurement (sNug)

Triggers simple distance measurement, similar to the command 8.2.2 *Distance measurement (sNg)* on page 21. This command returns the distance corrected with the user offset as set with the command 8.6.1 *Set/Get user distance offset (sNuof)*. Each new command cancels an active measurement.



This command takes the user distance offset into account

	Command	
Command	sNug<trm>	
Return successful	gNug+xxxxxxxx<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	<i>N</i> Module number (0..9) xxxxxxxx Distance in 0.1mm zzz Error code	

8.6.3 User-configured single sensor tracking (sNuh)

Triggers continuous measurement of the distance and outputs the result immediately to the serial interface. The distance measurement is executed as fast as possible (depending on target conditions). The measured distance is corrected with the user offset as set with the command 8.6.1 *Set/Get user distance offset (sNuof)*. The measurements are continued until the stop/clear command (sNc) is issued. Each measurement updates the status LED's and all outputs.



This command takes the user distance offset into account



Never use these commands if more than one module is connected to the RS232/RS422 line

	Command	
Command	sNuh<trm>	
Return successful	gNuh+xxxxxxxx<trm>	
Return Error	gN@Ezzz<trm>	
Parameters	<i>N</i>	Module number (0..9)
	<i>xxxxxxxx</i>	Distance in 0.1mm
	<i>zzz</i>	Error code

8.6.4 User-configured tracking with buffering – Start (sNuf)

Triggers continuous measurement of the distance with internal buffering in the module (buffer for one measurement). The measured distance is corrected with the user offset as set with the command 8.6.1 *Set/Get user distance offset (sNuof)*. Define the rate of measurements 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 sNug. The measurements are continued until the stop/clear command (sNc) is issued.



This command takes the user distance offset into account

	Set Command	Get Command
Command	sNuf+xxxxxxxx<trm>	sNuf<trm>
Return successful	gNuf<trm>	gNuf+xxxxxxxx<trm>
Return Error	gN@Ezzz<trm>	gN@Ezzz<trm>
Parameters	<i>N</i>	Module number (0..9)
	<i>xxxxxxxx</i>	Sampling time in 10ms (if 0 -> use max. possible sample rate)
	<i>zzz</i>	Error code

8.6.5 Read out – User-configured tracking with buffering (sNuq)

After starting “User-configured fast tracking with buffering” with the command `sNuF`, the last measurement can be read out from the DLS-C(H)/FLS-C(H).



This command takes the user distance offset into account

	Command	
Command	<code>sNuq<trm></code>	
Return successful	<code>gNuq+xxxxxxxx+c<trm></code>	
Return Error	<code>gN@Ezzz+c<trm></code>	
Parameters	<i>N</i>	Module ID
	<i>xxxxxxxx</i>	Distance in 0.1 mm
	<i>c</i>	0 = no new measurement since last sNuq command 1 = one new measurement since last sNuq command, not overwritten 2 = more than one measurement since last sNuq command, overwritten
	<i>zzz</i>	Error code

8.7 Error codes

No.	Format	Meaning
203	@E203	Wrong syntax in command, prohibited parameter in command entry or non-valid result
210	@E210	Not in tracking mode, start tracking mode first
211	@E211	Sampling too fast, set the sampling time to a larger value
212	@E212	Command cannot be executed, because tracking mode is active, first use command sNc to stop tracking mode
220	@E220	Communication error
230	@E230	Distance value overflow caused by wrong user configuration. Change user offset (and/or user gain)
231	@E231	Wrong mode for digital input status read
232	@E232	Digital output 1 cannot be set if configured as digital input
233	@E233	Number cannot be displayed. (Check output format)
234	@E234	Distance out of range
236	@E236	Digital output manual mode (DOM) cannot be activated when configured as digital input
252	@E252	Temperature too high (contact Dimetix if error occurs at room temperature)
253	@E253	Temperature too low (contact Dimetix if error occurs at room temperature)
254	@E254	Bad signal from target It takes too long to measure according distance
255	@E255	Received signal too weak (Use different target and distances, if the problem persists, please contact Dimetix)
256	@E256	Received signal too strong (Use different target and distances, if the problem persists, please contact Dimetix)
257	@E257	Too much background light (Use different target and distances, if the problem persists, please contact Dimetix)
258	@E258	Power supply voltage is too high
260	@E260	Distance cannot be calculated because of ambiguous targets. Use clearly defined targets to measure the distance.
360	@E360	Configured measuring time is too short
361	@E361	Configured measuring time is too long
not listed		Hardware failure (Contact Dimetix)

Before contacting Dimetix, please collect as much information as possible.

9 Safety instructions

The following instructions are to enable the person responsible for the DLS-C(H)/FLS-C(H), and the user of the instrument, to anticipate and avoid operational hazards.

The DLS-C(H)/FLS-C(H) is made to be integrated into technical systems. Basic technical training is therefore essential. This device may only be operated by trained personnel.

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

If the DLS-C(H)/FLS-C(H) is part of a system, the manufacturer of such a system is responsible for all safety-related issues, such as the manual, labeling and instruction.

9.1 Use of the instrument

Permitted use:

The permitted use of the DLS-C(H)/FLS-C(H) is: measuring distances.

Prohibited use:

- 1) Use of the instrument without instruction
- 2) Use 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 Dimetix
- 8) Aiming directly into the sun
- 9) Deliberate dazzling of third parties; also in the dark
- 10) Inadequate safeguards at the surveying location (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 DLS-C(H)/FLS-C(H) must not be operated until the user has been adequately instructed.

9.2 Limits to use

☞ See 4 Technical data on page 14.

Environment:

Suitable for use in an atmosphere appropriate for permanent human habitation. The device must not be used in environments such as but not limited to:

- aggressive vapor or liquids
- snow and rain
- radiation (radioactive, heat, etc)
- explosive atmosphere

9.3 Areas of responsibility

Responsibilities of the manufacturer of the original equipment Dimetix AG, CH-9100 Herisau (Dimetix):

Dimetix 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-Dimetix accessories:

The manufacturers of non-Dimetix accessories for the DLS-C(H)/FLS-C(H) 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 Dimetix 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 for 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 Dimetix immediately if the equipment becomes unsafe.

9.4 Hazards in use

WARNING: The absence of instruction, or the inadequate provision of instruction, can lead to incorrect or prohibited use, and can give rise to accidents with far-reaching personal, 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: Beware of 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, particularly after the instrument has been subject to abnormal use, and before, during and after important measurements. Make sure the DLS-C(H)/FLS-C(H) optics are kept clean.

WARNING: If labels are hidden when the DLS-C(H)/FLS-C(H) is installed, this could lead to dangerous situations.

Precautions:

Always ensure the visibility of DLS-C(H)/FLS-C(H) labels at all times or add labels in accordance with the local safety regulations.

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 the event 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.

Precautions:

Do not point the telescope directly at the sun.

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 DLS-C(H)/FLS-C(H).

9.5 Laser classification

The DLS-C(H)/FLS-C(H) produces a visible laser beam, which emerges from the front of the instrument.

It is a Class 2 laser product in accordance with:

- IEC60825-1 (2007) "Radiation safety of laser products"
- EN60825-1 (2007) "Radiation safety of laser products"

It is a Class II laser product in accordance with:

- FDA 21CFR 1040.10 and 1040.11 (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.).

9.6 Electromagnetic compatibility (EMC)

The term "electromagnetic compatibility" is taken to mean the capability of the DLS-C(H)/FLS-C(H) 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 DLS-C(H)/FLS-C(H) meets the strict regulations and standards that are in force in this respect, Dimetix cannot completely exclude the possibility that interference may be caused to other equipment.

9.7 Producer Standards

Dimetix hereby certifies that the product has been tested and complies with the specifications as stated in this 'Technical Reference Manual'. The test equipment used is in compliance with national and international standards. This is established by our Quality Management System. Further, the DLS-C(H)/FLS-C(H) devices are produced in compliance with 2002/95/EG «RoHS».

9.8 Disposal



This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of the equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or the dealer where you purchased the product.

In countries in which Dimetix has no subsidiaries, Dimetix delegates the duty for the disposal in compliance with 2002/96/EG «WEEE» to the local dealer or to the customer, if no dealer is present.

9.9 Labeling

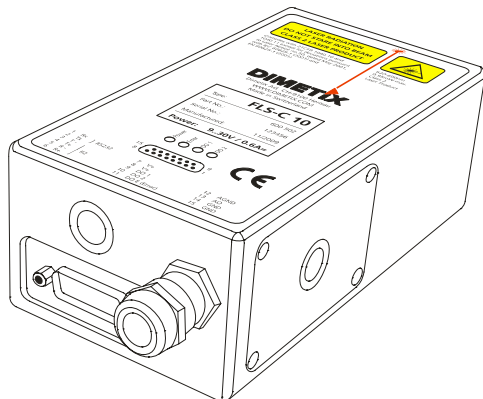


Fig. 8: Location of the label

Type: FLS-C 10 Part No.: 600 502 Serial No.: 123456 Manufactured: 11/2009 Power: 9..30V / 0.6A=	Type: FLS-C 30 Part No.: 600 501 Serial No.: 123456 Manufactured: 11/2009 Power: 9..30V / 0.6A=	Type: DLS-C 15 Part No.: 500 622 Serial No.: 123456 Manufactured: 11/2009 Power: 9..30V / 0.6A=	Type: DLS-C 30 Part No.: 500 621 Serial No.: 123456 Manufactured: 11/2009 Power: 9..30V / 0.6A=
Type: FLS-CH 10 Part No.: 600 504 Serial No.: 123456 Manufactured: 11/2009 Power: 9..30V / 2.5A=	Type: FLS-CH 30 Part No.: 600 503 Serial No.: 123456 Manufactured: 11/2009 Power: 9..30V / 2.5A=	Type: DLS-CH 15 Part No.: 500 624 Serial No.: 123456 Manufactured: 11/2009 Power: 9..30V / 2.5A=	Type: DLS-CH 30 Part No.: 500 623 Serial No.: 123456 Manufactured: 11/2009 Power: 9..30V / 2.5A=

Fig. 10: all existing type labels

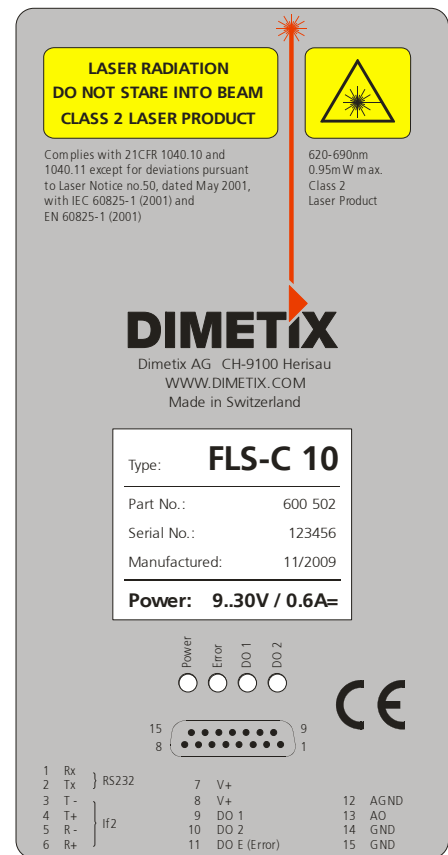


Fig. 9: DLS-C / FLS-C label inclusive type label

9.10 Laser Specification

Standard applied	EN60825-1:2007 IEC60825-1:2007
Emitted wavelength	620-690nm
Beam divergence	0.16 x 0.6 mrad
Pulse duration	0.45×10^{-9} s
Max. radiant power	0.95 mW

9.11 Maintenance

The DLS-C(H)/FLS-C(H) is almost maintenance free. The only thing you have to do is to clean the surfaces of the lenses.

CAUTION: Look after the surfaces of the lenses with same care that you would apply to spectacles, cameras and field glasses. Clean the optical parts only with a clean soft glasses cleaning cloth and avoid scratching of the optical parts.

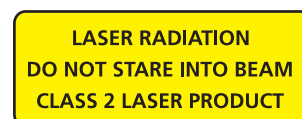
9.12 Service

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

CAUTION: The warranty is void if the device is opened except the cover of the screw terminal. Removing the label is also understood as opening.

Important Notice

Dimetix reserves the right to make corrections, modifications, enhancements, improvements and other changes to its products, documentation and services at any time and to discontinue any product or service without notice. We try to give our best possible effort to provide you with perfect documents, but we can not guarantee for incorrect information. Customers should obtain the latest relevant information before placing orders and should verify that such information is up to date and complete. All products are sold subject to Dimetix terms and conditions of sale supplied at the time of order acknowledgment.



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