

ZOL1150

Inline Glossmeter Instruction Manual



Firmware as from V.2.1

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1 Introduction

The ZOL 1150 is a tailored gloss-measuring system for industrial areas for contactless online measurement of all gloss ranges from matt to high gloss up to 2'000 GU.

1.1 Application areas

- Measuring instrument for several industries such as paint, plastics, paper, foil and metal industry
- For all gloss measurements
- Gloss measurement at manufacturing of sheet metal and floor coverings
- Finishing processes such as application of coating of all types, e.g. coil coating
- Combinable with other quality monitoring systems, e.g. humidity, thickness etc.

1.2 Key features

This apparatus has the following features:

- Multi angle device, up to three angles in the same device
- Pathbreaking with various types of digital communication interfaces (Ethernet) and analog outputs
- Unique automatic in-situ calibration simplifies handling and minimizes holding times significantly
- Automatic measuring distance correction
- Online monitoring of gloss during the production with up to 1'000 measurements per second
- Integrated Z-axis
- Powerful stray light compensation allows exact measurements of transparent objects
- Analog output of measuring value: 0-10 V, 0-20 mA or 4-20 mA
- Possibility to control the unit over digital inputs, this means the possibility of (signal input for calibration and moving measuring head)
- Signal outputs for alerts
- Reliable results

1.3 Versions

The ZOL1150 is available in two versions:

ZOL1150.268 Triple Angle device, 20°/60°/85°

ZOL1150.26 Triple Angle device, 20°/60°

1.4 Scope of this document

This document is an instruction manual for the ZOL1150 Inline Glossmeter.

It describes in technical details, the mounting and explains the connection setup, the protocol format, the command set and their parameters, the answer-strings of the device as well as possible error reports.



2 Safety information

2.1 Symbols used

-  This note comprises instructions needed to follow directions, specifications, proper working procedure and to avoid data loss, damage or destruction of the instrument.
-  This note signifies a warning about dangers to life and limb if the apparatus is handled improperly. Observe these notes and be particularly careful in these cases. Also inform other users on all safety notes. Besides the notes in this instruction manual the generally applicable safety instructions and regulations for prevention of accidents must be observed.

2.2 Safety notes and hints

-  It is strictly forbidden to open the housing of the ZOL 1150. If not observed, all the guarantee and liability claims will be void.
-  The ZOL 1150 is a high quality, state of the art instrument and is safe to operate. However, there is always risk when the instrument is handled improperly or otherwise as intended by the manufacturer.
-  Always turn off the unit and unplug the power cable before any maintenance.
-  The ZOL 1150 is exclusively intended for contactless online measurement of all gloss ranges from matt to high gloss up to 2'000 GU. Any other use is considered as being not in accordance with the intentions of the manufacturer and is conducted at the user's own risk. The manufacturer is not liable for any resulting damages.
-  Every person operating or maintaining the ZOL 1150 must have read and understood this instruction manual in its entirety, in particular the safety precautions and warnings.
-  Avoid any mode of operation that could affect the safe working with the ZOL 1150. The determination of the gloss must take place as described in this operating manual.
-  Unauthorized modifications and changes of the ZOL 1150 are not permitted.
-  All maintenance and repair not explicitly allowed and described in this manual (see chapter 11.1 "Maintenance and cleaning work that can be carried out by the user" on page 35), shall only be carried out by Proceq or authorized Proceq service center, failure to comply voids warranty.
-  **Proceq SA** refuses all warranty and liability claims for damages caused by usage of the ZOL 1150 in combination with **non-original accessories**, or accessories from third party suppliers.
-  All local safety regulations apply for the operation of the ZOL 1150.



3 Scope of Delivery

The following parts are included in the delivery:

1	single, dual or triple angle measuring head with calibration plate	
1	Microfiber cleaning cloth	
2	Mounting brackets	
4	Screws with washers and nuts	
1	Mating Connector J1 (Binder 680 Series 3 Way, M16)	
1	Mating Connector J2(Binder 680 Series 8 Way, M16)	
1	Mating Connector J3 (Binder 680 Series 4 Way, M16) Type: 09 0309 00 04 (male)	
1	Mating Connector J4 (Binder 680 Series 4 Way, M16) Type: 09 0310 00 04	
1	Certificate of manufacturer	
1	Certificate of calibration	
1	Instruction manual	

! **Proceq SA** refuses all warranty and liability claims for damages caused by usage of the ZOL 1150 in combination with **non-original accessories**, or accessories from third party suppliers.



4 Device Overview



- (1) Measuring head
- (2) Connector panel
- (3) Optical lenses
- (4) Calibration plate
- (5) Z-axis
- (6) Z-axis motor
- (7) Red status LED
- (8) Orange status LED
- (9) Green status LED
- (10) Green power LED

4.1 Connection technology

The measuring head can be connected in the following ways:

- **Ethernet / TCP/IP/UDP**

By using Ethernet connection, the measuring head can be accessed over a web based interface. Over the web interface, it is possible to modify settings on the measuring head. Furthermore all functions of the measuring head software, such as calibration can be accessed.

- **PLC Signals**

The measuring head can be controlled by hardware signals coming from a command unit, for example a PLC. Commands such as calibration can be engaged.

- **Analog output**

The measured values are available as analog output signals. Three analog output modes are possible: 0-10V, 0-20mA and 4-20mA. The modes can be chosen over the web interface.

4.2 Measuring head technology

The measuring head is equipped with precision monobloc optics. This optical block assures best precision of the optical apertures and light beams. The illumination unit is a regulated white LED, which produces modulated light. Possible light source instability due to temperature changes or lifetime degradation of the LED is compensated with a special compensation circuit that has been developed for this device.

The sensor is $V(\lambda)$ adapted (adapted to the spectral sensitivity of the human eye). The gloss measuring circuit compensates any offset produced by stray light or other influences.

This leads to extremely stable and precise measuring results.



5 Setting up

5.1 Connections and Signals



5.1.1 Connector Overview

Connector	Description	Type	Recommended mating connector
J1	POWER 24 VDC 1.5A	Binder 680 Series 3 Way, M16 09 0307 00 03	Binder 680 Series 3 Way, M16 09 0306 00 03
J2	SIGNAL Used for interfacing with hardware commands.	Binder 680 Series 8 Way, M16 09 0474 00 08	Binder 680 Series 8 Way, M16 09 0571 02 08 or 09 0571 00 08
J3	ANALOG OUT Analog output of measured gloss value.	Binder 680 Series 4 Way, M16 09 0312 00 04	Binder 680 Series 4 Way, M16 09 0309 00 04
J4	STATUS LAMPS Switched outputs for status lights	Binder 680 Series 4 Way, M16 09 0311 00 04	Binder 680 Series 4 Way, M16 09 0310 00 04
J5	RJ45 Jack Terminal for Ethernet connection	Neutrik NE8FDX-P6-B	NE8MC or NE8MX

Switch & Fuse	Description	Type	Recommended mating connector
S1	Main switch	-	-
F1	Main fuse	-	-

5.2 Connector pin assignment and signals

5.2.1 J1 – POWER Connector

Connector	Pin	Name	Description
J1	1	Power negative (ground)	Negative power potential, usually ground
J1	2	Power positive	Positive power potential, 24 VDC, $\pm 10\%$, Power consumption: - Measuring max 10 W - For movement of the Z-axis max 18 W polarity protected
J1	3	Housing	Connected to the housing of the instrument. Usually, this pin needs to be connected to power negative (ground). In some cases it might be necessary to connect this pin to a separate earth potential.
J1		Shield	Connected to the housing of the instrument.

5.2.2 J2 – SIGNAL Connector

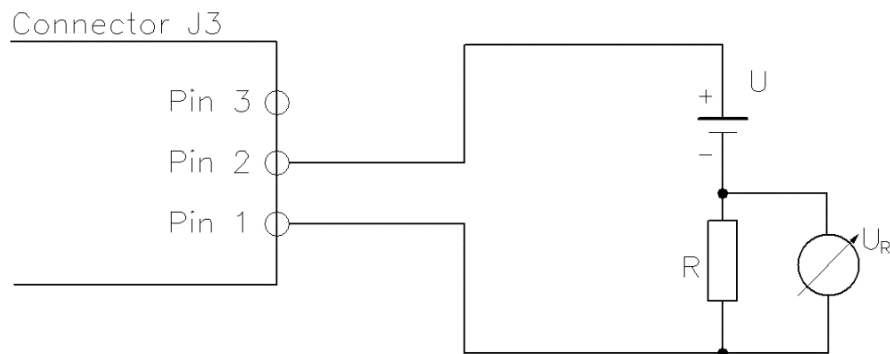
Connector	Pin	Name	Description
J2	1	CALIBRATE (Isolated Input)	Active Low Input Active: "0" ($\leq 0.8V$) or tie to COMMON (Signal Ground) Not active: "1" ($\geq 1.4V$) or leave unconnected Impedance 20k Ω , max. 30V
J2	2	MOVE TO MEASURING POSITION (Isolated Input)	Active Low Input Active: "0" ($\leq 0.8V$) or tie to COMMON (Signal Ground) Not active: "1" ($\geq 1.4V$) or leave unconnected Impedance 20k Ω , max. 30V When active, measuring head will move to the calibration position, but will not calibrate.
J2	3	MOVE TO CALIBRATION POSITION (Isolated Input)	Active Low Input Active: "0" ($\leq 0.8V$) or tie to COMMON (Signal Ground) Not active: "1" ($\geq 1.4V$) or leave unconnected Impedance 20k Ω , max. 30V When active, measuring head will move to the measuring position.
J2	4	RESET (Device) (Isolated Input)	Active Low Input Active: "0" ($\leq 0.8V$) or tie to COMMON (Signal Ground) Not active: "1" ($\geq 1.4V$) or leave unconnected Impedance 160k Ω , max. 30V
J2	5	GROSS VALUE ALARM (Isolated Output)	Active Low Output (Type: Open Collector -> current-sourcing) Protected (Short Circuit, ESD) max. 20mA (Load), max 30V
J2	6, 7	Not connected	
J2	8	COMMON Ground Signal	Isolated from Power Ground
J2		Shield	Connected to the housing of the instrument



5.2.3 J3 - ANALOG OUT Connector

Connector	Pin	Name	Description
J3	1	COMMON-Ground (Analog output)	Isolated from Power Ground
J3	2	Current-Loop Output (Isolated Output)	Current range: 0-20mA or 4-20mA Protected (Short Circuit, ESD) Supply Voltage for current loop $U = 5$ to 30 V.
J3	3	Voltage Output (Isolated Output)	Voltage range: 0-10V Protected (Short Circuit, ESD) Max. 65mA
J3		Shield	Connected to the housing of the instrument.

Connection diagram of the analog output:

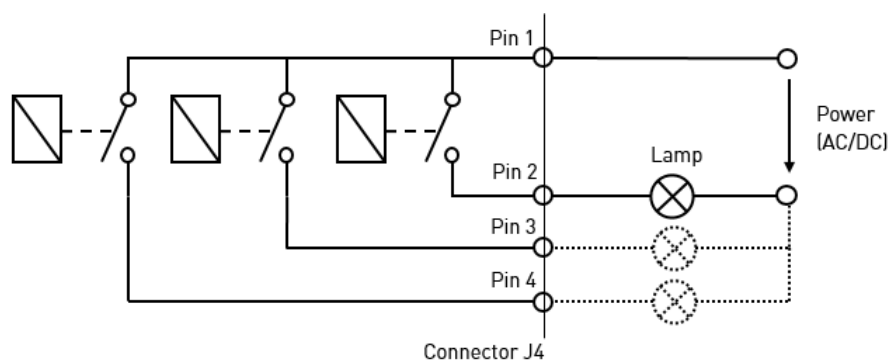


5.2.4 J4 – STATUS LAMPS Connector

Connector	Pin	Name	Description
J4	1	COMMON (Power)	Max. switching voltage 30 VDC Max. switching current: 2.5A
J4	2	System lamp (green)	Active closed contactor which indicates that the system is running. It has always the same status as the green status LED (9) on the measuring head.
J3	3	Action lamp (yellow)	Active closed contactor which indicates that action is going on (such as motor moving) or that a user interaction is required. It has always the same status as the orange status LED (8) on the measuring head.
J4	4	Error lamp (red)	Active closed contactor which indicates an error. It has always the same status as the red status LED (7) on the measuring head.
J4		Shield	Connected to the housing of the instrument.

Connection diagram of the lamps:

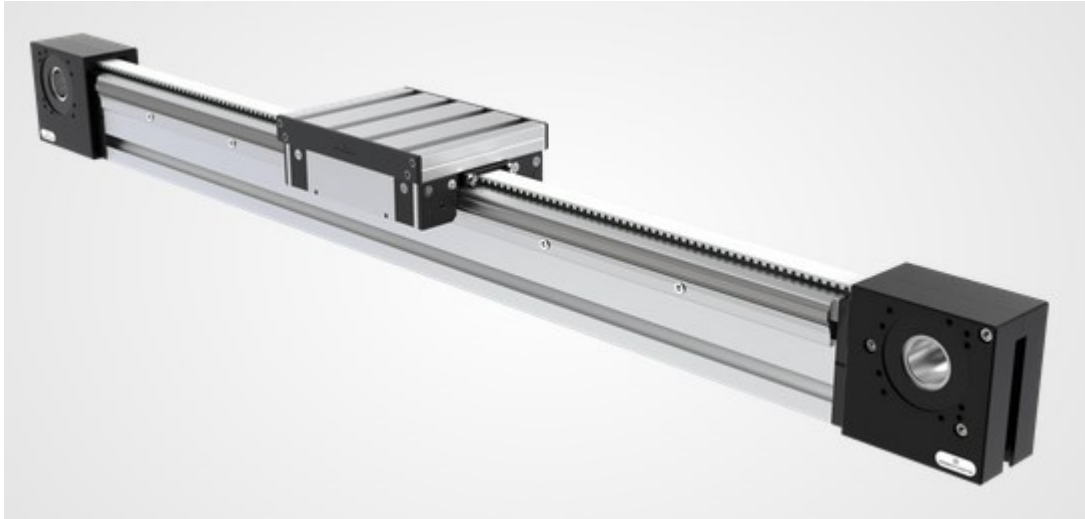




5.3 Mounting of the device

The ZOL1150 allows various mounting configurations, which allows a flexible use of the device.

In an inline production setting the device is often mounted on a traversal unit. (not within the scope of delivery).



Mounting Configurations:



Vertical to the material to be measured.



Horizontal to the material to be measured, version 1.

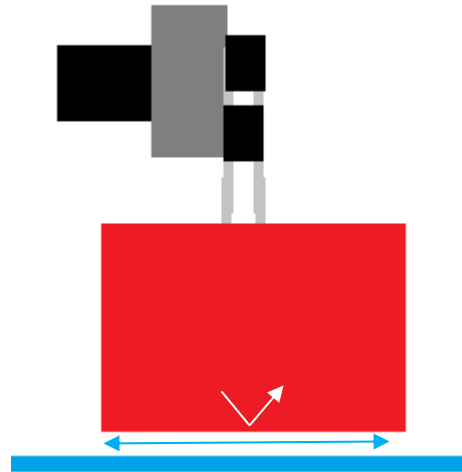




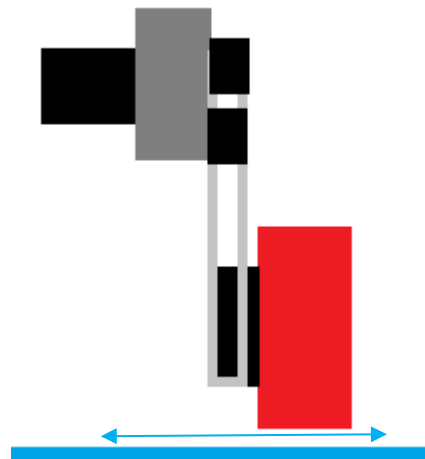
Horizontal to the material to be measured, version 2.

The measurement direction can also be either in the moving direction of the material or perpendicular to it.

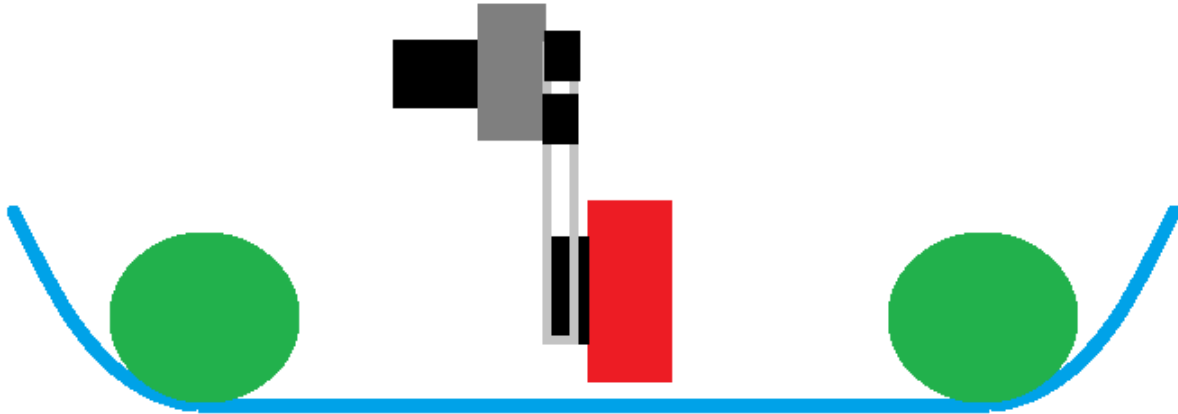
In moving direction



Perpendicular to moving direction



It's important to install the device with the respective measurement distance. In order to guarantee a stable measurement distance in a moving setup, mounting a transmission roll before and after the device is recommended. This will reduce vibrations of the material and help to achieve stable results.

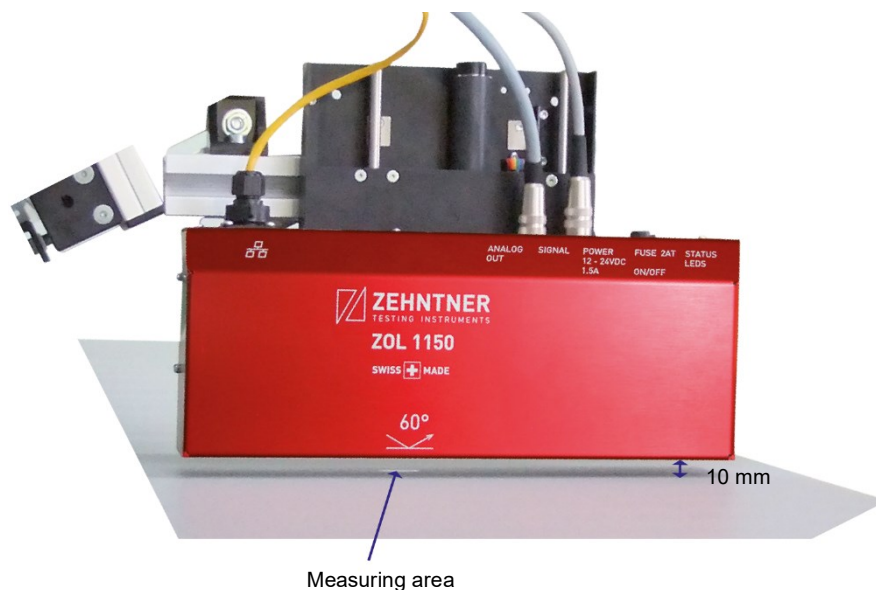


5.3.1 Installation

- ! Only install the measuring head if it is in the measuring position. Otherwise you will risk a crash when the measuring head moves out to the measuring position.
- ! The distance between the material and the measuring head housing should be adjusted to respective measurement distance. You will need to make sure that the measuring head is precisely parallel to the material.

5.3.2 Measuring area

The indication arrow printed on the device indicates the center of the measuring range and the measuring direction.

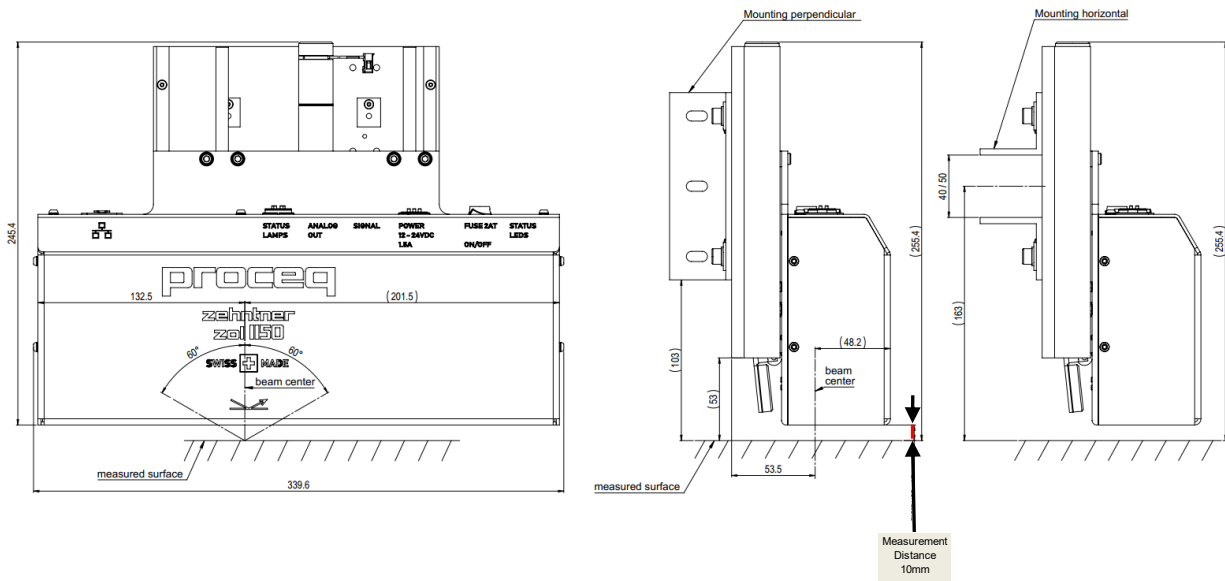


The dimensional drawings show the exact positioning of the measuring area.

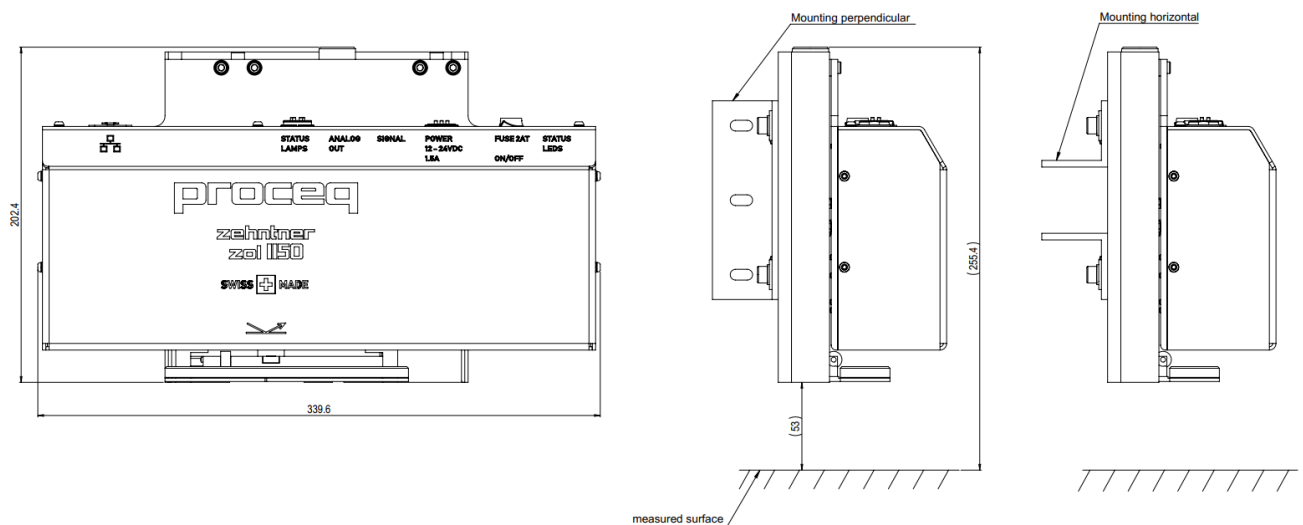
5.4 Dimensional drawings

5.4.1 ZOL1150.26 – Dual Angle

Measurement Position

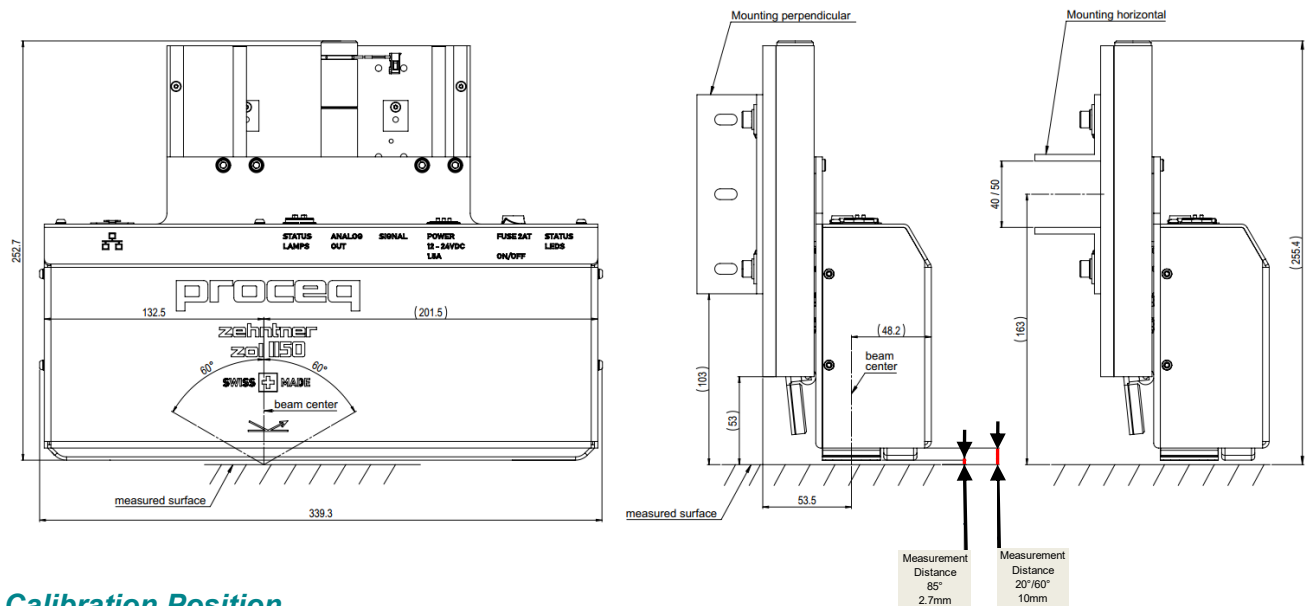


Calibration Position

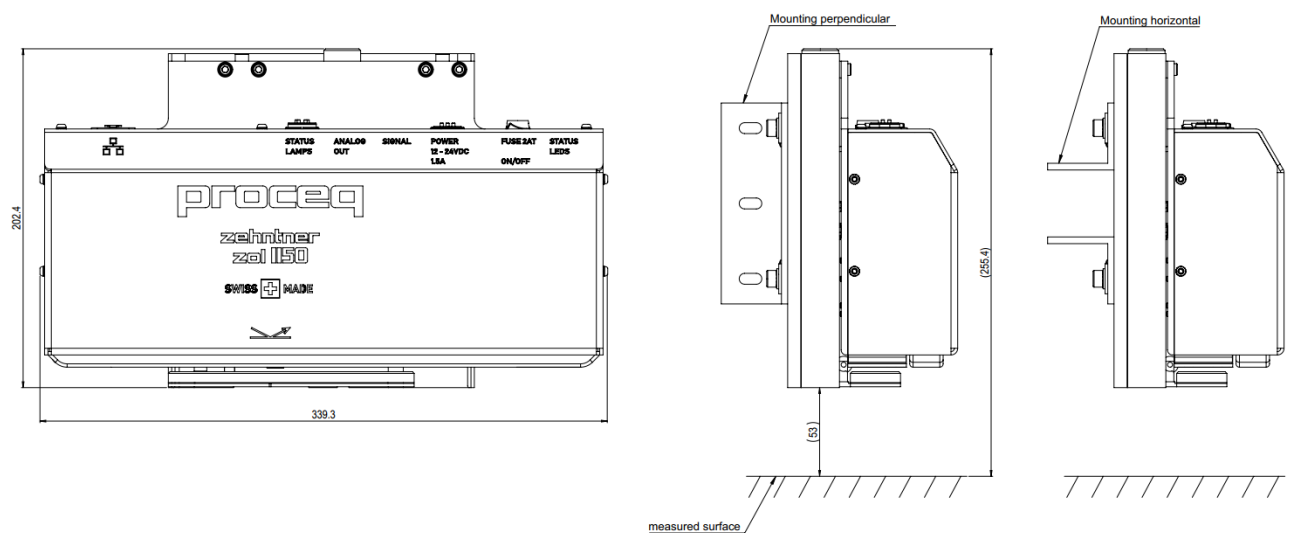


5.4.2 ZOL1150.268 – Triple Angle

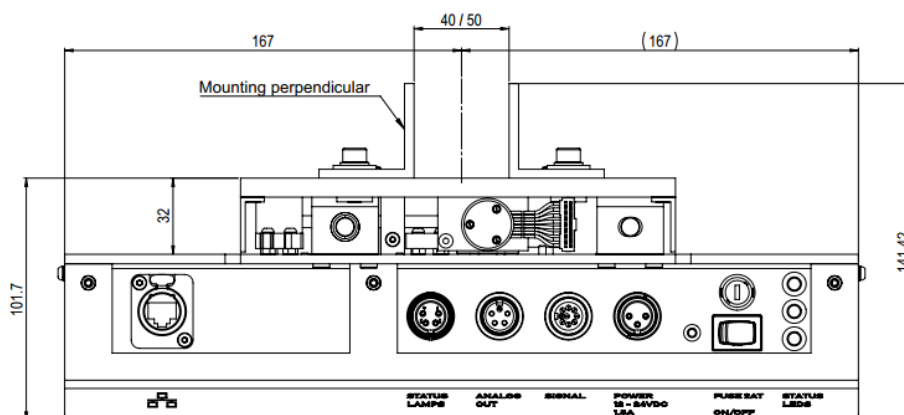
Measurement Position



Calibration Position



5.4.3 Top View



5.5 Starting up

The device is switched on by the main switch S1. After switching on, the power LED (10) will light up and the device will take up to 80 seconds until it has completely booted up. Towards the end of this procedure, the orange status LED (8) starts to blink once per second and then extinguishes. Finally, the green status LED (9) lights up and the device is ready by turning automatically into the measuring mode. It is now providing measured-data on the Ethernet port and on the analog output.

If the Z-axis (5) is not in measuring position, the orange status LED (8) will keeps glowing even after the booting process.

The device can simply be shut off with the main switch S1.



6 Z-Axis Control

The measuring head has an integrated Z-axis (5). It is used for calibration and for moving the measuring head away from the material in case more distance between the measuring head and the material to be measured is needed.

The position of the measuring head is controlled with a motor (6) and has two positions:

Calibration position: In the calibration position, the measuring head (1) is away from the material. The calibration tile (4) is located under the measuring head (1).	Measuring position: In the measuring position, the measuring head (1) is close to the material. The measuring head is ready to measure.
	

A Z-axis movement is caused by two operations:

1) Calibration

When a calibration is initiated, the measuring head will move from the measuring position to the calibration position. After calibration it will move back to measuring position.

2) Position control

The position of the Z-axis (5) can also be controlled manually with the position control function. This function is needed e.g. if you need to move away from the material because of maintenance work in the production line.

Position control can be accessed either by the web interface or the Z-AXIS POSITION input on connector J2 pin 3.

The Z-axis (5) uses a special positioning procedure in order to increase positioning precision.

When moving up, the procedure is as follows:

a) b) c)



a) move up fast

b) move a little bit down

c) move back up slowly in order to find the precise position

When moving down, the procedure is the same but in the opposite way.

If the measuring head is moved to the calibration position with the external command on connector J2 pin 2 and this signal is kept active, the measuring head remains in the calibration position after a calibration has been started.

The following table shows all input combinations (J2, pins 1-3 and the respective result.

Input combination (on connector J2)			Result
J2/Pin 3 „move to calibration position “	J2/Pin 2 „move to measuring position “	J2/Pin 1 „calibrate “	
false	false	false	Motor stop
false	false	true	Calibrate and afterwards move to position "measure".
false	true	false	Move to position "measure".^
false	true	true	Calibrate and afterwards move to position "measure".
true	false	false	Move to position "calibrate", but without calibration.
true	false	true	Calibrate and afterwards stay in calibration position.
true	true	false	Move to position "calibrate", but without calibration.
true	true	true	Calibrate and afterwards stay in calibration position.

! Please note that the logical inputs on the connector J2 are active low (true = 0 Volts)



7 Webinterface

7.1 Getting started

The web interface allows controlling the device over a computer that is connected to the measuring head over Ethernet. To view the web interface, please open a web browser and enter the following address with the IP Address of the device:

`http://[IP Address]:8002/gui`

Example with the default IP Address: <http://192.168.1.10:8002/gui>

7.2 IP address

The default IP address of the instrument is 192.168.1.10.

The IP address can be configured by changing a file on the instrument. The file can be accessed using an FTP client. When you have an unknown IP address you can retrieve the IP address over the MAC address of the network adapter. You will find the MAC address on the serial number label on the device.

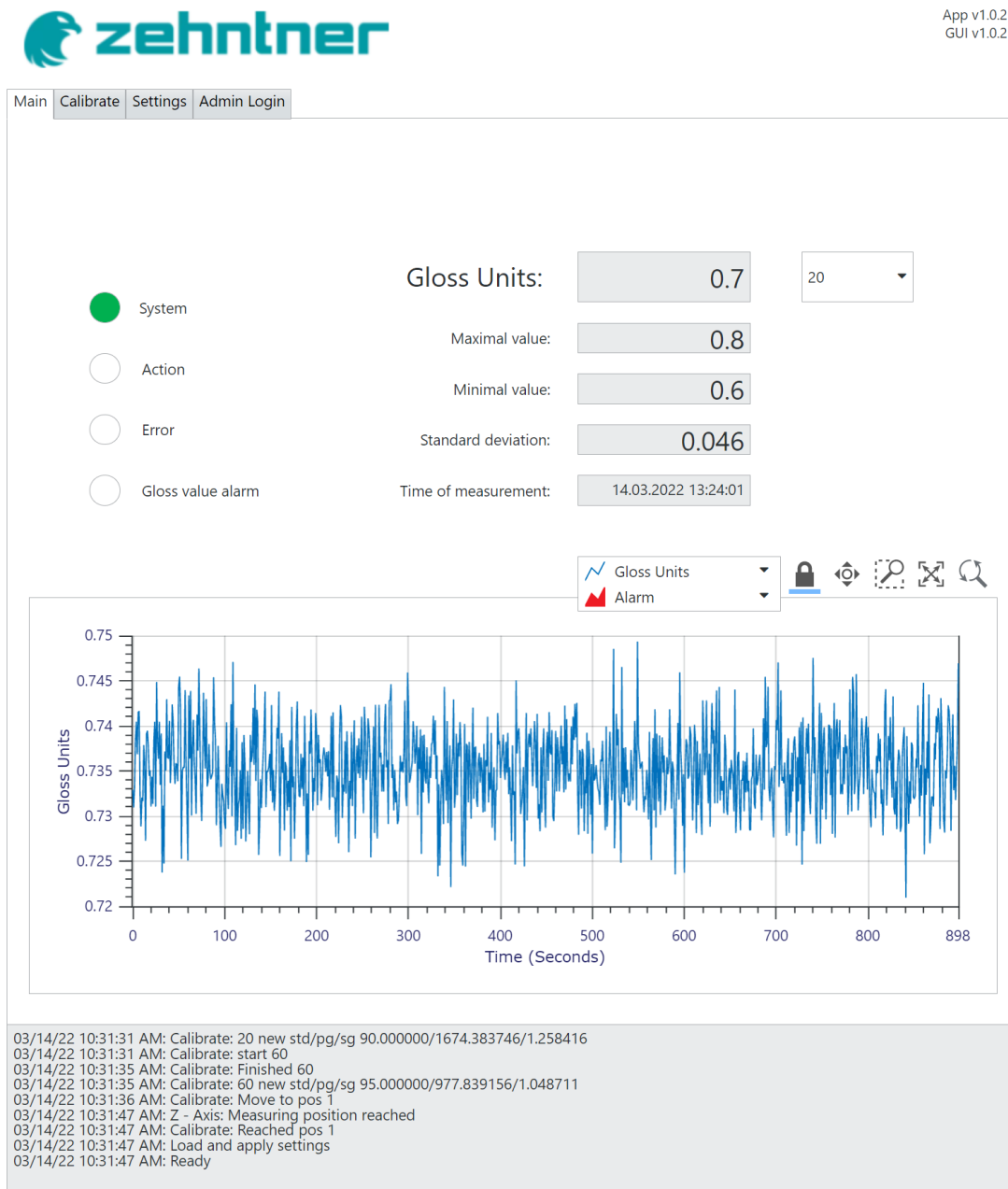
In order to change the IP address, please carry out the following steps:

- Connect a computer to the device using an FTP client (`ftp://192.168.1.10`)
- Download the file `ni-rt.ini` to your computer
- Open the file with a text editor
- Change the IP address by editing the line `"IP Address="192.168.1.10"`
- Save the file on your computer
- Upload the file to the device with FTP
- Restart the device



7.3 Main Page

The main page of the web interface shows the following:



UI Element	Name	Description
W1	System lamp	Indicates that the system is running. This indicator has always the same status as the green status LED (9) on the measuring head.
W2	action lamp	Indicates that action is going on (such as motor moving) or that a user interaction is required. This indicator has always the same status as the orange status LED (8) on the measuring head.
W3	Error lamp	Indicates an error. This indicator has always the same status as the red status LED (7) on the measuring head.
W4	Gloss value alarm	Indicates that the gloss value is out of range. This indicator has the same status as the output "GLOSS VALUE ALARM" on the connector J2 Pin 5 of the measuring head. The gloss range can be set in the Settings page of the web interface tool.
W5	Gloss value	Displays the actual gloss value. This value is updated once a second.
W6	Maximal value	Displays the maximal value of the 100 single measurements that were used to calculate the gloss value.
W7	Minimal value	Displays the minimum value of the 100 single measurements that were used to calculate the gloss value.
W8	Standard deviation	Displays the standard deviation of the 100 single measurements that were used to calculate the gloss value.
W9	Time	Indicates the time of the measurement.
W10	Gloss value graph	The graph shows the gloss value (y axis) over time (x axis).
W11	Graph settings	These adjustment tools can be used to modify the display mode of the graph.
W12	Geometry selection	Selection of the active geometry.



7.4 Calibrate page



App v1.0.2
GUI v1.0.2

Main
Calibrate
Settings
Admin Login

Calibration

W13
20

☒ Calibrate

W14
60

☒ Calibrate

W15

Measuring Head Position

W19

W20

W21

W22

External PLC commands

W16
☐ Off External calibration command

W17
☐ Off Move to calibration position command

W18
☐ Off Move to measuring position command

03/14/22 10:31:31 AM: Calibrate: 20 new std/pg/sg 90.000000/1674.383746/1.258416
03/14/22 10:31:31 AM: Calibrate: start 60
03/14/22 10:31:35 AM: Calibrate: Finished 60
03/14/22 10:31:35 AM: Calibrate: 60 new std/pg/sg 95.000000/977.839156/1.048711
03/14/22 10:31:36 AM: Calibrate: Move to pos 1
03/14/22 10:31:47 AM: Z - Axis: Measuring position reached
03/14/22 10:31:47 AM: Calibrate: Reached pos 1
03/14/22 10:31:47 AM: Load and apply settings
03/14/22 10:31:47 AM: Ready



UI Element	Name	Description
W13	Calibration value	The calibration value used for calibration. It has to be identical with the value written on the calibration plate.
W14	Enable geometry for calibration	Enables the geometry for the calibration process.
W15	Calibrate button	When this button is pressed, the calibration process will be launched.
W16	External calibration command	Indicates the logical status of the external "calibration" command. The external calibration command can be wired to the measuring head on connector J2 pin 1.
W17	External move to calibration position command	Indicates the logical state of the external "move to calibration position" command. The external "move to calibration position" command can be wired to the measuring head on connector J2 pin 2.
W18	External move to measuring position command	Indicates the logical status of the external "move to measuring position" command. The external "move to measuring position" command can be wired to the measuring head on connector J2 pin 3.
W19	Position indicator	Indicates the position of the Z-axis of the measuring head. When the indicator is green the measuring head is either in calibration or in measuring position. When the indicator is orange, the measuring position is not exactly known or the head is moving between the two positions.
W20	Move to calibration position button	When this button is pressed, the measuring head will move to the calibration position.
W21	Move to measuring position button	When this button is pressed, the measuring head will move to the measuring position.
W22	Stop motor button	When this button is pressed, the measuring head movement on the Z-axis will stop immediately.



7.5 Settings page


 App v1.0.2
 GUI v1.0.2

Main
Calibrate
Settings
Admin Login

Pass / Fail Gloss Alarm Levels

PassFailMax
2000
W23

PassFailMin
0
W24

Analog Output Configuration

Offset
0
W25

Ceiling
2000
W26

Analog Output Type:
0 - 20 mA
W27

☐ Hide gloss value when not precisely on measuring position.

☐ Always move to measuring position after calibration.

W31

☐ set system time
Apply

hh
mm
ss

13
29
26

DD
MM
YYYY

14
3
2022

ZolFpgaVersion
2
W32

ZolHostVersion
2.1
W33

SerialNumber
55-0053-1150

IpAddress
192.168.1.10
W34

MacAddress
00:80:2F:31:21:92
W35

W30

Apply changes

03/14/22 10:31:31 AM: Calibrate: 20 new std/pg/sg 90.000000/1674.383746/1.258416
03/14/22 10:31:31 AM: Calibrate: start 60
03/14/22 10:31:35 AM: Calibrate: Finished 60
03/14/22 10:31:35 AM: Calibrate: 60 new std/pg/sg 95.000000/977.839156/1.048711
03/14/22 10:31:36 AM: Calibrate: Move to pos 1
03/14/22 10:31:47 AM: Z - Axis: Measuring position reached
03/14/22 10:31:47 AM: Calibrate: Reached pos 1
03/14/22 10:31:47 AM: Load and apply settings
03/14/22 10:31:47 AM: Ready

UI Element	Name	Description
W23	Pass / Fail maximum value	With this Pass/Fail function a maximum gloss value for the measurements can be specified. Whenever the measured gloss value exceeds the maximum level, the gloss value alarm will be active. The gloss value alarm is indicated on the main page as well as on the logical output on connector J2 pin 5 on the measuring head.
W24	Pass / Fail minimum value	With this Pass/Fail function a minimum gloss value for the measurements can be specified. Whenever the measured gloss value is lower than the minimum level, the gloss value alarm will be active. The gloss value alarm is indicated on the main page as well as on the logical output on connector J2 pin 5 on the measuring head.
W25	Analog Output Offset	Allows having an offset of gloss units on the analog output. The default value is 0. When you give an Offset of e.g. 10, the analog output will stay

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UI Element	Name	Description
		at 0V (in 0-10V mode) or 4 mA (in 4-20mA mode) until 10 gloss units have been reached.
W26	Analog Output Ceiling	Sets the gloss value when the analog output is at 100%. The default value is 100. This means when 100 gloss units are measured, the analog output will give out 10V (in 0-10V mode) or 20 mA (in 4-20mA mode).
W27	Analog Output Type	Three analog output modes are available: 0-10V voltage mode 0-20 mA current loop mode 4-20 mA current loop mode
W28	Hide gloss value when not precisely on measuring position	When this function is enabled, the gloss value on the graph will only be updated while the measuring head is precisely on the measuring position. In all other cases, the measured value will not be updated.
W29	Always move to measuring position after calibration	When this function is enabled, the measuring head moves to the measuring position after the calibration process.
W30	Apply changes button	When some settings have been changed, click on this button in order to save the changes. Otherwise the changes will be lost the next time the measuring head is booted up.
W31	Time and Date Block	Indicates the current time and date of the measuring head. Time and date can be changed by entries into this block.
W32	FPGA Version	Indicates the version of the FPGA.
W33	Host-Version	Indicates the version of the host system.
W34	IP-Address	Indicates the IP address of the measuring head network adapter
W35	MAC-Address	Indicates the MAC address of the measuring head network adapter



8 Measurements

8.1 General

After switching on the device, it takes about 80 Seconds until it has completely booted up and is ready to measure by turning automatically into the measuring mode. It is now providing measured data on the Ethernet port and on the analog output.

When the device has not been used for a period of time, it is recommended to let the device run for about 10 minutes in order to heat it up. Afterwards a calibration should be performed to make sure the measured value is correct, and the Z-axis is in the right position.

8.2 Pass/Fail

With the pass/fail function a valid gloss range for the measurements can be specified. Whenever the measured gloss value exceeds the maximum level or falls below the minimum, the gloss value alarm will activate. This allows for supervising whether the measured gloss value is in its defined range.

The gloss value alarm is visualized in the web interface. It is also available as a digital output on connector J2 Pin 5.

The pass/fail levels can be set over the web interface.



9 Calibration

9.1 Calibration procedure

The measuring head is equipped with an automatic calibration procedure. As soon as a calibration command is sent to the measuring head, it moves along the Z-axis until it is on the calibration plate. Then the calibration is carried out and the measuring head moves back to the measuring position automatically.

The calibration can be initiated in two ways, either over the web panel or a digital I/O.

When using the digital I/O, pin 1 of the connector J2 has to be touched to COMMON for about 1 second.

9.2 Calibration plate

The calibration standard is mounted on a swiveling plate. When the measuring head is in measuring position, the calibration plate is located at the side of the measuring head.

As soon as the measuring head is moved into calibration position, the calibration plate will swivel under the measuring head. It is then automatically positioned correctly for the calibration to be performed (usually automatically).

The calibration standard has been measured by Zehntner. In order to prevent wrong calibration values, protect the calibration standard from dust, moisture and other environmental factors.

- ! After the expiry date a factory calibration of the ZOL 1150 and its corresponding calibration plate is required. Contact either Proceq or your authorized Proceq agent.
- ! The factory calibration is valid for two years.
- ! The calibration plate delivered with the ZOL 1150 is valid only for the delivered instrument. The serial number of the measuring head together with the corresponding calibration plate are shown on the certificate of calibration.

9.3 Cleaning the calibration plate

Should the calibration plate be soiled or covered by dust, it can be cleaned carefully using window cleaner and a soft tissue such as the supplied microfiber cleaning cloth. The following steps explain the cleaning procedure:

- Move the measuring head into the calibration position. This can be done over the web interface with the digital command Z-AXIS POSITION on connector J2 pin 3.
- Fold down the calibration plate carefully.
- Clean the calibration standard with a soft tissue such as the supplied microfiber cleaning cloth.
- Bring the calibration plate back to its default position.
- Move the measuring head back to the measuring position.

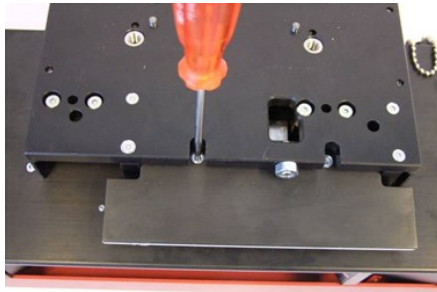
- ! A damaged or polluted calibration plate may cause incorrect calibration and therefore incorrect measuring results.



9.4 Replacing the calibration plate

The calibration plate can be removed for replacement or new certification.

Follow these steps to remove the calibration plate from the measuring head:



Make sure the measuring head is in the measuring position.

Loosen and remove the 2 Allen screws on the backside of the measuring head.



Carefully remove the calibration plate.



10 Protocol Specification

10.1 Introduction

This section describes the proprietary protocol of the Zehntner ZOL 1150 glossmeter. This protocol allows to control the device and read the measurements with a connected computer.

10.2 Protocol

The data protocol of the ZOL 1150 consists of two types of protocols:

Data sentences and commands.

All types of protocols are text based.

The delimiter is the vertical bar character “|” (ASCII code 124).

The terminator is semicolon character “;” (ASCII code 59).

The port for UDP and TCP/IP communication is always 4450.

10.2.1 Data sentences

Data sentences are read only. They are sent out from the measuring head in a broadcast manner. Typically, sentences are sent over UDP.

As soon as the measuring head has started up completely (may take 30 seconds), it will start measuring gloss and send out data sentences. These sentences contain information such as measured gloss value and are pushed out by the measuring head each second (except DSF every 10 ms).

Data sentences always start with a 3-character code, followed by one or more data strings.

DSM - Data Sentence for Main information

The DSM sentence provides measurement information in a 1 Hz interval.

Format:

DSM|TimeOfMeasure|Angle|GlossValue|MaxGlossValue|MinGlossValue|StdDev|GlossValueAlarm|ErrorFlag

Parameter	Native data type	Example
DateTimeOfMeasure	DateTime	03.05.2013 17:35:05.000
Angle	Double	85°
GlossValue	Double	83.61
MaxGlossValue	Double	83.64
MinGlossValue	Double	83.55
StdDev	Double	0.01
PassFailAlarm	Bool (1 / 0)	0
ErrorFlag	Bool (1 / 0)	0

Example of a DSM sentence that has been sent out by the glossmeter:

DSM|03.05.2013 17:35:05.000|85°|83.61|83.64|83.55|0.01|0|0;



DSD - Data Sentence Digital I/O

The DSD sentence represents the state of the boolean inputs/outputs on the device. It is pushed out every second.

Format:

DSD|ExtCalibrateCommand|ExtZAxisPosition0Command|ExtZAxisPosition1Command|
ExtReelChange|ExtAlarmOut|ExtSpareOut|ZAxisPosition0|ZAxisPosition1|
ZAxisPreciseOnPosition0|ZAxisPreciseOnPosition1|SignalLampGreen|
SignalLampOrange|SignalLampRed

Parameter	Native data type	Input/Output	Remarks
ExtCalibrateCommand	Bool (0/1)	Input	These signals represent the levels at the "Signal" connector
ExtZAxisPosition0Command	Bool (0/1)	Input	
ExtZAxisPosition1Command	Bool (0/1)	Input	
ExtReelChange (future use)	Bool (0/1)	Input	
ExtAlarmOut	Bool (0/1)	Output	
ExtSpareOut (future use)	Bool (0/1)	Output	
ZAxisPosition0	Bool (0/1)	Input	
ZAxisPosition1	Bool (0/1)	Input	
ZAxisPreciseOnPosition0	Bool (0/1)	Input	
ZAxisPreciseOnPosition1	Bool (0/1)	Input	
SignalLampGreen	Bool (0/1)	Output	
SignalLampOrange	Bool (0/1)	Output	
SignalLampRed	Bool (0/1)	Output	

Meaning of Position0 and Position1:

Position 0: Measuring head in calibration position

Position 1: Measuring head in measuring position

Example of a DSD sentence that has been sent out by the glossmeter:

DSD|0|0|0|0|0|0|0|0|1|0|1|1|0|0;

DSS – Data Sentence State

The DSS sentence gives information whether the device is in measuring or in calibration state.

Format: DSS|State

Parameter	Native data type
State:	"Measuring" or "Calibrating"

Example of a DSS sentence that has been sent out by the glossmeter:

DSS|Measuring;



DSF – Data Sentence Fast

The DSF sentence is pushed out every 10 milliseconds. It contains only the gloss value of the currently active angle.

Format: DSF|GlossValue

Parameter	Native data type	Example
GlossValue	Double	83.61

Example of a DSF sentence that has been sent out by the glossmeter:

DSF|83.61;

10.2.2 Commands

Commands are used to configure the measuring head and to send commands, such as "calibrate".

They are based on a send-receive topology, where the measuring head is always the client. Typically, commands are sent over TCP.

For the commands, the measuring head acts always as a client. It waits for a command from a host (e.g. a PC) and will answer on that command.

For parameter readouts, the received number format is engineering:
e.g. 22.000000+E0 for the number of 22.

CMD – Movement commands

Movement Commands always start with a "CMD".

Example of sending a calibration command	
Send to measuring head	CMD Calibrate;
Answer from measuring head if command succeeded	OK;
Answer from measuring head if command failed.	NOK;

Available commands:

Calibrate	Launches the calibration procedure, including moving to the calibration position and back. A CLE string will report the calibration success and parameters
MoveToCalibPosition	Moves the measuring head to calibration position (z-axis). When the measuring head has reached the calibration position a CLE string will be sent on the console.
MoveToMeasurePosition	Moves the measuring head to measuring position (z-axis). When the measuring head has reached the calibration position a CLE string will be sent on the console.
StopMotor	Stops the movement on the z-axis.
ClearErrors	Clears all errors in the error buffer.

Example of Move to Calibration Position	
Send out	CMD MoveToMeasurePosition;



Answer on success	OK;
	Measuring head starts movement
	CLE 03/04/22 06:09:38 AM: Z - Axis: Move to pos 0;
	Measuring head reaches position
	CLE 03/04/22 06:09:38 AM: Z - Axis: Reached pos 0;

INF – Parameter Info commands

Info Parameters are read only parameters (settings) on the measuring head. They can be asked with an INF command.

Example of reading an Info Parameter	
Send out	INF ParameterName;
Answer on success	OK ParameterName Value;
Answer on fail	NOK;

List of Info Parameters

Info Parameter name	
Temperature	Temperature in °C
CpuLoad	CPU load in %
GeometryCount	Number of available geometries
SerialNumber	Serial number
MacAddress	Mac address, format: 00:80:41:ae:fd:7e
IpAddress	IP address, format: 192.168.110.245
HostName	Host name of the measuring head
Error	Gives back one or more errors

When the errors are read, (INF|Error;), a list of errors will be sent back. An error always consists of an *ErrorNumber*, *ErrorText* and *NativeErrorNumber*.

Here are some example answers of an error list:

No error	OK Error;
One error	OK Error 104 Error1Text 65006;
Two errors	OK Error 104 Error1Text 65006 105 Error2Text 0;

CFG – Parameter configuration commands

The configurable parameters of the measuring head can be changed over the protocol. After changing these parameters, they are automatically saved and are ready to be used.

To read a configurable parameter the command CFG|GET is used.

To set a configurable parameter the command CFG|SET is used.



Example of reading a configurable parameter	
Send	CFG GET ParameterName ;
Answer on success	OK ParameterName Value ;
Answer on fail	NOK ;

Example of setting a configurable parameter	
Send	CFG SET ParameterName Value ;
Answer on success	OK ;
Answer on fail	NOK ;



Parameter Name	Description	Value range	Comment
Geometry	Index of the current geometry	0,1,2	
SerialNumber	Serial number, read only		
DateTime	Date and time	Format: DD.MM.YYYY HH:MM:SS	
MotorSpeedFastDuty	Inverted duty cycle for the fast speed of the z-axis motor. Default: 0	0..1	Do not change
MotorSpeedSlowDuty	Inverted duty cycle for the slow speed of the z-axis motor. Default: 0.9	0..1	Do not change
AnalogOutFrequency	Modulation frequency of the analog output. Default: 10000	1..100000	Do not change
AnalogOutCeiling	Gloss value at which the maximal analog value is reached. Default: 100	0..10000	
AnalogOutOffset	Offset for the analog output (in Gloss units) Default: 0	0..1000	
AnalogOutMode	Mode of the analog output. 0: 0-10 V 1: 0-20 mA 2: 4-20 mA	0,1,2	
PassFailMin	Lower value for pass / fail	0..100000	
PassFailMax	Upper value for pass / fail	0..100000	
G0Name	Name of Geometry 0	String	
G1Name	Name of Geometry 1	String	
G2Name	Name of Geometry 2	String	
G0Channel	Measuring channel of geometry 0	Always 0	Do not change
G1Channel	Measuring channel of geometry 1	Always 1	Do not change
G2Channel	Measuring channel of geometry 2	Always 2	Do not change
G0MaxValue	0..100000		
G1MaxValue	0..100000		
G2MaxValue	0..100000		
G0StandardValue	1..100000		
G1StandardValue	1..100000		
G2StandardValue	1..100000		
G0PrimaryGain	0..10000	Do not change	
G1PrimaryGain	0..10000	Do not change	
G2PrimaryGain	0..10000	Do not change	
G0RmsOffset	0..10	Do not change	
G1RmsOffset	0..10	Do not change	
G2RmsOffset	0..10	Do not change	
G0SecondaryGain	0..10000		
G1SecondaryGain	0..10000		
G2SecondaryGain	0..10000		
G0DoCalibrate	0 = false > 0 = true		
G1DoCalibrate	0 = false > 0 = true		
G2DoCalibrate	0 = false > 0 = true		



CLE – Console out

The measuring head has a console text, which informs over the activities of the measuring head. The console out can be viewed on the web-frontend of the measuring head and is also stored into a log file.

Furthermore, the console out is pushed to the interface as a CLE. It is only of informative type and may for example be used to display in a console window.

Two examples of console outs:

CLE 05/28/13 01:50:06 PM: Main Startup;

CLE 05/28/13



11 Maintenance and Cleaning

11.1 Maintenance and cleaning work that can be carried out by the user

Only the following maintenance and cleaning work shall be carried out by the user:

- Outer cleaning of the device (see chapter 11.2 on page 35).
 - Cleaning the calibration plate as described in chapter 11.3 on page 35).
 - Replacing the calibration plate (see chapter 9.4 on page 27).
- ! All other maintenance and repair work shall only be carried out by **Proceq SA** or your authorised Proceq agent otherwise all guarantee and liability claims are void.
- ! Always switch off and unplug the ZOL 1150 before any cleaning and maintenance.
- ! The optics housing **may not be opened under any circumstances** since the measuring geometry would be misaligned. The measuring geometry can only be adjusted by means of special testing equipment in our factory.
- ! The instrument consists of delicate optical and electronic precision parts. Do not drop it and protect it from shocks, moisture and dust.

11.2 Cleaning

It is recommended that the instrument is checked and certified by Zehntner every two years.

- Clean the instrument periodically using a soft tissue.
- Wipe the optical lenses (3) on the bottom of the measuring head (1) with the supplied microfiber cleaning cloth or with a lens cleaning tissue.

11.3 Fault/Error diagnosis

If the green LED (10) is not glowing, check the following parts:

- Switch (S1) is in position “On”?
- Power is connected (J1) and voltage is in the range 12V to 24V?
- Fuse (F1) is ok and is the right type?

If there are still problems, contact the support of the manufacturer.



12 Technical Specification

Geometry	ZOL1150.268: Triple Angle 20°, 60°, 85° ZOL1150.26: Dual Angle 20°, 60°
Measuring accuracy	0 - 199.9 GU: ≈0.2 GU, 0 - 1999 GU: ≈2 GU*
Measuring sensor adaption	V(λ)
Measuring area	20°: 22 mm x 20 mm (0.87" x 0.79") 60°: 29 mm x 14 mm (1.14" x 0.55") 85°: 114 mm x 11 mm (4.49" x 0.43")
Interfaces	Ethernet
Analog output	0-10 V, 0-20 mA or 4-20 mA
Light source	LED
Power supply	24 VDC, $\pm 10\%$
Power consumption	max. 18 W
Operating Temperature	-10°C to + 50°C (12 °F to 122 °F)
Storage Temperature	- 20° C to + 60° C (-4°F to 140°F)
Relative Humidity	10 % to 95 % rF, non condensing
Fuse type	2AT
Calibration	traceable to an ISO 17025 accredited laboratory
Measuring distance to material	20°/60°: 10 mm (0.39") 85°: 2.7 mm (0.11"), 2 mm (0.08") with slide shoe
Calibration position	20°/60°/85°: 50 mm (1.97")
Tolerance of measuring distance to material	20°/60°: ± 3 mm (0.12"), 85°: ± 0.5 mm (0.02")
Dimensions measuring head in measuring position	20°/60°: 339 mm x 142 mm x 243 mm 20°/60°: 13.35" x 5.59" x 9.57" 85°: 339 mm x 142 mm x 250 mm 85°: 13.35" x 5.59" x 9.84"
Dimensions measuring head in calibration position	20°/60°/85°: 339 mm x 142 mm x 203 mm 20°/60°/85°: 13.35" x 5.59" x 7.99"
Weight	20°: 3.9 kg, (8.6 lbs), 20° / 60°: 4 kg (8.8 lbs)
Standards	ASTM D823, ASTM D2457, BS 3900-D6, DIN EN ISO 2813, JIS Z 8741

*depending on the chosen specifications and under perfectly ideal conditions in a clean environment.





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