ZGM1120

Glossmeter

Technical Manual

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Revision History

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Content

1 Safety notes

1.1 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.

1.2 Safety notes and hints

ⓘ It is strictly forbidden to open the housing of the product! If not observed, all the guarantee and liability claims to Proceq SA will be void.

ⓘ The glossmeter is exclusively intended for the determination of gloss ranges of surfaces. Any other use is considered as not being in accordance with the intentions of the manufacturer. The manufacturer is not liable for damage resulting from inappropriate application. The user bears the full responsibility.

ⓘ Unauthorized modifications and changes of the product are not permitted.

ⓘ Reproduction without permission is not allowed.

ⓘ All maintenance and repair work which is not explicitly permitted and described in the present instruction manual shall only be carried out by **Proceq SA** or your authorized Zehntner agent, failure to comply voids warranty. Always disconnect the glossmeter from the USB port of the computer before the permitted maintenance.

ⓘ **Proceq SA** refuses all warranty and liability claims for damages caused by usage of the product in combination with **non-original accessories**, or accessories from 3rd party suppliers.

ⓘ Never unplug the USB-cable during a measurement or while the green data transfer indication light LED (2) is on.

ⓘ Never immerse the device in water or other liquids: **Danger of short circuit!**

ⓘ Never leave the product under direct sun exposure. Always store the product in its carrying case.

▪

For the operation of the product all local safety regulations apply.

2   Introduction

The ZGM 1120 glossmeters are for measurement of all gloss ranges on all surfaces, including small parts and curved surfaces.

The entire operation and control of the ZGM 1120 is done via the USB interface of your PC by using the GlossTools measuring and examination software.

This instrument has the following features:

- Sturdy aluminum design and high quality

- Smallest dimensions and ultra-light weight

- Extremely small measuring spot

- Available as 1-, 2- or 3-angle version

- User friendly, multilingual user interface

- Easy control, operation and display with a computer using the GlossTools software.

- Powerful stray light compensation allows exact measurement of transparent objects.

- Automatic, adjustable prompt for calibration

- Automatic standard recognition

- Long-lasting LED illumination system

- Power is supplied via the USB-interface.

2.1   Scope of this document

This document is an instruction manual for the ZGM1120 Glossmeter family.

This instruction manual covers all models of the ZGM 1120 series which includes the USB version ZGM 1120 and the RS232 version ZGM 1120-RS232 with all 1-, 2- or also 3-angle models.

Therefore, some pictures or functional descriptions (e.g. selection of measuring geometry) may differ from your model.

2.2   Product versions

2.2.1   ZGM 1120-RS232

The ZGM 1120 is also available in a RS232 version (ZGM 1120-RS232), which connects to an RS232 port of a PC.

This version requires an additional USB-2-RS232 cable, which needs to be ordered separately.

2.2.2   ZGM 1120-RS232 with special measuring distance

There is a special version of the ZGM 1120-RS232, which is designed for contactless measurements. Due to stray light compensation and a different measurement head, these instruments can measure with a measuring distance of 0,5 mm or 1 mm, depending on the ordered version.

ZGM 1120 with adjusted measuring distance

!   To ensure reliable measuring results the measuring distance of your glossmeter to the sample has to be maintained within a tolerance of ± 0.1mm.

For calibration a special standard is required. This standard is included in the product.

3 Scope of Delivery

3.1 Standard delivery

The following parts are included in the delivery:

ZGM 1120	ZGM1120-RS232	Content	
1	1	ZGM 1120 glossmeter	
1	1	calibration standard	
1	1	microfiber cleaning cloth	
1		USB-cable	
1	1	certificate of manufacturer	
1	1	certificate of calibration	
1	1	carrying case	

3.2 Software

A software for windows PCs is available to connect to the device.

This software allows to read data from the device.

The GlossTools software is available for download on the Proceq website.

Part of this package are also two APIs, which allow automized measurement:

Labview programming interface	
„GlossTools" programming interface (.NET API)	

> 🛈 **Proceq** refuses all warranty and liability claims for damages caused by usage of the ZGM 1120 in combination with **non-original accessories**, or accessories from 3rd party suppliers.

4 Device Overview
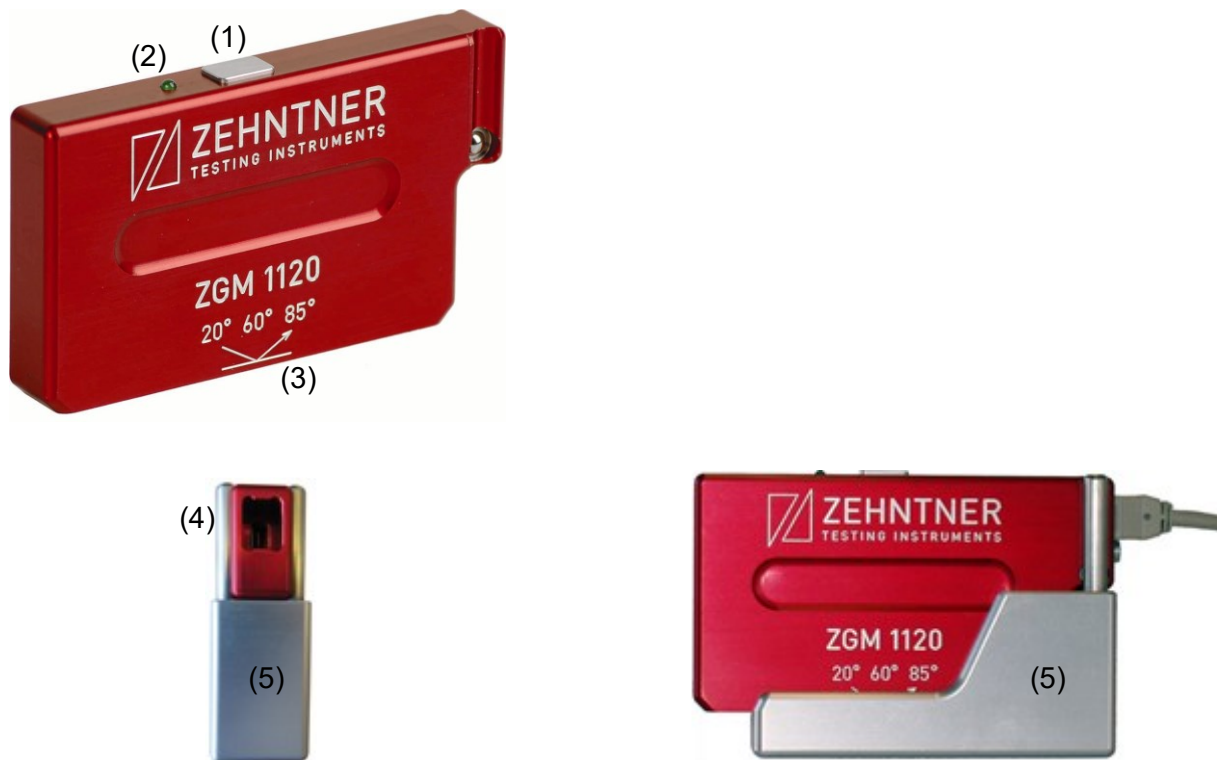
(1) Measuring button

(2) Data transfer indication light

(3) Measurement opening, indication of light beam direction

(4) USB interface

(5) Zehntner calibration standard

5 Operation and handling ZGM 1120

Operation and control of the ZGM 1120 is done by using the included GlossTools measuring and examination software.

ⓘ Do not connect the glossmeter to your PC unless all installation steps of the "GlossTools" software package have been performed.

5.1 Calibration

▪ Start GlossTools software.

▪ Insert the ZGM 1120 from the top into the supplied calibration standard until it locks audibly.

▪ Carry out the calibration according to the instructions of the „GlossTools" manual.

ⓘ To ensure precise and valid results the ZGM 1120 must be calibrated by the user on the calibration standard in regular intervals (recommended interval: every 2 days).

ⓘ The standard has been measured in the factory and marked with the serial number of the instrument.

5.2 Measuring procedure

▪ Position the unit on the surface to be measured so that it bears evenly.

■ With the ZGM 1120 is also possible to measure upside down. Insert the unit upside-down into the holder of the calibration standard. Small parts can be measured easier in this position. Due to the stray light compensation, you receive correct gloss values even though the measurement opening (3) is not completely covered by the sample.

Measuring upside down

Version with measuring distance for

contactless gloss measuring

Measurement on uneven surfaces

❗ The ZGM 1120 consists of sensitive precision optical and electronic parts. Do not drop it and avoid shocks.

❗ Protect the measurement opening of the ZGM 1120 from foreign particles and dust.

6 Operation ZGM 1120-RS232

The ZGM 1120-RS232 version is intended to be used on the RS323 port of a PC. This allows a simple serial communication via a string-based ASCII protocol.

This section contains the technical details concerning the communication with the RS232 version of ZGM 1120 Glossmeter and explains the connection setup, the protocol format, the command set and their parameters, the answer-strings of the unit as well as possible error reports.

6.1 RS232 connection

The ZGM 1120-RS232 is connected to a RS232 port using the included USB-2-RS232 cable.

This cable is a special Y-cable, which is designed for exclusive use with ZGM 1120-RS232.

Connect the cable according to the scheme below:

Labelling	Connector	Application
1	9-pin D-sub	Connection to COM port at PC / Laptop or at an RS-232 to USB converter.
2	Mini USB	Connection to ZGM 1120.
3	USB Type A	Connection to the PC / Laptop for power supply.

The glossmeter is powered with 5V over the USB A connector, plugged into a USB port on the PC side.

6.1.1 D-Sub 9 pin assignment

Pin assignment on D-Sub 9 pin connector, device cable side (male)

Pin No.	Signal	Description
2	RX	Receive
3	TX	Transmit
5	GND	Ground
1,4,6,7,8,9	NC	Not connected
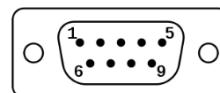
The following connection settings have to be set on the serial port of the PC:

	Setting
Baudrate	115200
Databits	8
Stop Bits	1
Parity	None
Flow control	None

After opening the corresponding COM ports, the ZGM 1120 Glossmeter is immediately ready for use.

6.2 Communication protocol

6.2.1 Command string

The communication with the ZGM 1120 Glossmeter is completely string based. That means all commands are composed of ASCII-character strings. This enables a simple control of the device, for example with a commercial terminal program such as „HyperTerminal".

A command consists in each case of:

- an operation code (OP-Code)

- the serial number of the corresponding ZGM 1120 Glossmeter

- a transaction-ID (TID)

- optionally one or more parameters

The components of the command string are separated from each other by „|" character (ASCII 0x7C).

Every command string is completed with a „:" (ASCII 0x3A).

Example: `1| 401120999|xy|1|0:`

6.2.2 Return string

The answer of the ZGM 1120 Glossmeter to a command string consists of the following parts:

- the operation code of the command performed (OP-Code)

- the serial number of the corresponding ZGM 1120 Glossmeter

- a transaction ID (TID) of the performed command

- optionally one or more return values

The components of the return string are separated from each other by a "|" character (ASCII 0x7C).

In contrast to the command string, the return string is not finished with a ":" character (ASCII 0x3A)!

In case there is an error at carrying out the command, an error string will be sent back instead of a return string (see section 6.5).

6.2.3   Operation code (OP-Code)

The first transmitted component, the so called operation code or OP-code, describes the command which has to be performed.

The following table shows the assignment of the OP-codes to the corresponding commands:

Command	OP-Code
MeasureValue(SerialNo, TID, AngleBinary, Count, isTemp)	01
GetIsOnStandard(SerialNo, TID)	28
MeasureTemp(SerialNo, TID)	36
ControlLEDOn(SerialNo, TID, LED)	48
ControlLEDOff(SerialNo, TID, LED)	52
Error(SerialNo, TID, ErrorCode) -> Error-String from client to host	56
Reset_Device(SerialNo, TID)	64
Calibrate(SerialNo, TID, Angle, Cal2Standard, Cal2StandValue)	72
AutoSend(SerialNo, TID, AutoSendCluster)	6

Attention:

The listed commands are not the entire set of OP-Codes which the ZGM 1120 Glossmeter can understand and process. Certain OP-Codes are only used for using the ZGM 1120 with the Zehntner „GlossTools" software or for factory configuration / calibration.

🛈   Only use the operation codes which are listed here. Using unlisted operation codes could lead to serious manipulations in the device memory, which damages its function and consequently it has to be sent in for maintenance and calibration to the company Zehntner.

6.2.4   Overview of the commands

OP-Code:	2 characters	max. two-digit operation code (range: 1-99)
SerialNo:	10 characters	9-digit serial number + preceding blank
TID:	2 characters	Transactional-ID 2 ASCII character, which serves the allocation of the command and answer string, respectively, the error string. Apart from the following exception, all digits of the ASCII-character set can be used: „NULL" (ASCII 0x00) „:" (ASCII 0x3A) „A" (ASCII 0x41) „|" (ASCII 0x7C)
Count:	1 character	Defines the number of measurements which have to be accomplished as parameter. This value must always be 1 (single measurement). In the return string, „Count" indicates the number of the actual measurements (has to be 1 too).
isTemp:	1 character	Flag, which indicates whether the temperature has to be measured additionally. 1 = gloss measurement with temperature 0 = gloss measurement without temperature
AngleBinary:	1 character	Indication of the angle to which the command has to be applied. binary coded decimal number: {A1 = 2^0, A2 = 2^1, A3 = 2^2}
ErrorCode:	2 characters	Error code of the occurred error

Cal2Standard	1 character	Indicates whether the ZGM 1120 shall be calibrated on the provided working standard or on an alternative 2nd calibration standard. 0 = working standard 1 = 2nd standard
Cal2StandValue		Calibration value for the 2nd standard, in case the Flag „Cal2Standard" has been set on 1. This value is indicated in decimal gloss units (dGU).
Delimiter „|":	1 character	Separator between single parameters in a command, respectively, return string.

6.2.5   Serial number (serial No.)

Every ZGM 1120 has a unique 9-digit serial number for identification. The serial number has to be indicated for the addressing of the requested device in every command-string.

In the additional answer or possible error string this serial number is always mirrored.

❗   **NOTE:** The serial number has always to be transmitted with a leading space character.

6.2.6   Transactional number (TID)

The TID is a two digit number, which serves the allocation of the command and answer-string. It can be generated of two arbitrary ASCII-character (for example xy).

Excluded are only the following 4 ASCII-characters:

- „NULL" (ASCII 0x00)

- „:" (ASCII 0x3A) -> End of command characters

- „A" (ASCII 0x41)

- „\|" (ASCII 0x7C) -> Parameter delimiter characters

At every command strings, such a TID has to be added. In the additional answer or possible error string, this TID is always mirrored.

In general, it is not necessary to generate a new TID for every command string. The same TID can be used all the time.

6.2.7 Parameter „AngleBinary"

This parameter includes information for which geometry or geometries actions are accomplished. The parameter corresponds to a binary coded integer number and is codified as follows:

A3	A2	A1	Integer value
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

A1, A2, A3 = angle

A1 always denotes the smallest angle looked at from the perpendicular to the measuring plane.

Considering a three angle glossmeter device with geometries of 20° / 60 ° / 85°, **A1 would be 20°, A2 = 60° and A3 = 85°.**

If the command MeasureValue() only measures, for example, the angles 1 and 3, the value of the parameter is AngleBinary = 5!

6.3 Commands

6.3.1 Command MeasureValue()

This command initiates a gloss measurement in the measuring head.

MeasureValue(SerialNo, TID, AngleBinary, Count, isTemp)

OP-Code: 01

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 character transaction number of the host
AngleBinary	Indication of the angle(s) that has to be measured Binary coded integer number: {A1 = 2^0, A2 = 2^1, A3 = 2^2}
Count	This value is always 1!

isTemp	Flag indicates if the temperature is measured while measuring 0 = without temperature 1 = with temperature

Return string:

SerialNo	9-digit serial number with preceding blank
TID	Transactional number [2 characters]
Measuring value	Measurements in „deci gloss units" (dGU). (900 dGU would mean 90 gloss units) If an angle is not measured, a „-1" is returned [max. 3 x 5 characters]
Offset	Offset respectively value of the zero current measurement (raw value of the A/D-modifier). In case an angle is not being measured, „-1" is returned for the corresponding offset value. If an „Overflow"occurs during a measurement, a „-2" is returned. [max. 3 x 5 characters] **Sequence: MW1|Offset1|MW2|Offset2|MW3|Offset3**
Count	This value is always 1!
Temperature	Temperature in °C [max. 3 characters] (characters + 2 digits, without decimal place) In case isTemp=0, a „0" is returned.

Example:

If you want to measure for example 20° and 85° angle without temperature with a three angle gloss meter (20°/60°/85°), the following command string has to be used:

```
1| 401120999|xy|5|1|0:
```

Operation code:	1 (MeasureValue)
Serial-No:	401120999 (with preceding blank)
TID:	xy (can freely be chosen)
AngleBinary:	5 (angle A1 and A3)
Count:	1 (this parameter is always 1!)
isTemp:	1 (additional temperature measurement)

The corresponding return-string could be as follows:

```
1| 401120999|xy|958|94|−1|−1|993|78|1|25
```

Operation code: 1 (MeasureValue)

Serial-No: `401120999` (with preceding blank)

TID: `xy` (mirrored TID of the command string)

Value1:   `958` dGU for the angle 20° (corresponds to 95.8 GU)

Offset1:   `94` (raw value of the A/D-converter)

Value 2:   `-1` (angle2 not measured)

Offset2:   `-1` (angle2 not measured)

Value 3:   `993` dGU for the angle 85° (corresponds to 99.3 GU)

Offset3:   `78` (raw value of the A/D-converter)

Count: `1` (this parameter is always 1!)

isTemp: `25` (measured temperature in °C)

6.3.2 Command GetIsOnStandard

This command verifies if the measuring head is on the calibration standard.

GetIsOnStandard(SerialNo, TID)

OP-Code: 28

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number of the host

Return string:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number
Flag IsOnStandard	1 = is in the standard 0 = is not in the standard

6.3.3 Command MeasureTemp()

This command triggers a temperature measurement in the inner part of the measuring head. Temperature variations can have an influence on the measured gloss value.

The function is not meant to determinate the absolute temperature but rather for the detection of possible, bigger temperature differences, for example between the last calibration and the precedent measurement.

MeasureTemp(SerialNo, TID)

OP-Code: 36

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number of the host

Return string:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number
Temperatur	temperature value in °C 2 digits + sign, no decimal place

6.3.4 Command ControlLedOn()

This command turns on one of the two control LEDs. The second red LED is not installed.

ControlLedOn(SerialNo, TID, LED)

OP-Code: 48

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number of the host
LED	Bool value: 0 = green LED 1 = optional red LED

Return string:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number

6.3.5 Command ControlLedOff()

Turns off one of the two control LEDs. The second, red LED is not installed.

ControlLedOff(SerialNo, TID, LED)

OP-Code: 52

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number of the host
LED	Boolean value: 0 = green LED 1 = optional red LED

Return string:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number

6.3.6   Command Error()

This command can only be sent from the client to the host. The command Error() will be send as answer to a command which due to whatever reasons was not accomplished properly.

Error(SerialNo, TID, ErrorCode, ErrorDetails)

OP-Code: 56

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number of the command at which the error occurred.
ErrorCode	for example, function which has caused the error
ErrorDetails	detail about the cause of the error

For further information please refer to section 6.5.

6.3.7   Command Reset_Device()

With the help of this command, a hardware reset can be carried out on the measuring head.

Reset_Device(SerialNo, TID)

OP-Code: 64

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number of the host

Return string:

6.3.8   Command Calibrate()

This command accomplishes a calibration of ONE angle. With the parameter Cal2Standard it is possible to choose between a calibration on the provided working standard (0) or on an alternative, customised second standard (1). With a calibration on a second standard, the calibration value (in deci gloss units [dGU]), can additionally be delivered as parameter.

Calibrate(SerialNo, TID, Angle, Cal2Standard, Cal2StandValue)

OP-Code: 72

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number of the host
Angle	Indication of the angle to be calibrated 1 = Angle 1 (A1), 2 = Angle 2 (A2), 4 = Angle 3 (A3)
Cal2Standard	Flag, indicating on which calibration standard the calibration will be carried out: 0 = working standard 1 = 2nd calibration standard
Cal2StandValue	Calibration value of the 2nd calibration expressed in deci gloss units (e.g. 95.8 GU => 958).

Return string:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number
deviation	Deviation to the original Zehntner factory calibration in ppm (points per million), e.g. 6235 = 0.6235%.

Example:

If you want to calibrate the 85° angle of a three-angle glossmeter (20°/60°/85°) on the working standard, you need to use the following command string:

```
72| 401120999|xy|4|0:
```

Operation code:	`72`	(Calibrate)
Serial-No:	`401120999`	(with preceding blank)
TID:	`xy`	(can be chosen freely)
Angle:	`4`	(angle A3)
Cal2Standard:	`0`	(calibration on the calibration standard)

The corresponding return string could be as follows:

```
72| 401120999|xy|5361
```

Operation code:	`1` (Calibrate)
Serial-No:	`401120999` (with preceding blank)
TID:	`xy` (mirrored TID of the command string)
deviation:	`5361`ppm (corresponds to 0.5361 % of the original factory calibration)

> ⓘ The value of the calculated deviation to the factory calibration should be smaller than 10 % at a calibration on the calibration standard. If the deviation is higher than 10 %, please check if the working standard is clean and repeat the calibration. If the deviation is still higher than 10 %, the ZGM 1120 Zehntner-Glossmeter should be sent to Zehntner for maintenance and factory calibration.

6.4 Command AutoSend()

If the AutoSend function is enabled the gloss meter will send a measurement return string when the measure button on the device is pressed.

The result string is sent automatically, without having sent a measure command in advance.

AutoSend(SerialNo, TID, AutoSendCluster)

OP-Code: 6

Parameter:

SerialNo	9-digit serial number with preceding blank
TID	2 characters transaction number of the host
AutoSendCluster	3 characters

AutoSendCluster:

1st character	Enables the AutoSend function `1` = AutoSend enabled `0` = AutoSend disabled
2nd character	Indication of the angle(s) that has to be measured Binary coded integer number (see table below)

Integer	A3 Binary Digit 2^2	A2 Binary Digit 2^1	A1 Binary Digit 2^0
1	0	0	1

2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

3rd character   Flag indicates whether the temperature is measured while measuring.

0 = without temperature measurement

1 = with temperature measurement

Return string:

SerialNo   9-digit serial number with preceding blank

TID   2 characters transaction number

Example:

If you want to enable the Autosend function for the first angle, without temperature with a three angle gloss meter (20°/60°/85°), the following command string has to be used:

`6| 401120999|xy|110:`

Operation code   `6` (AutoSend)

Serial-No: `401120999` (with preceding blank)

TID: `xy` (can be chosen freely)

AutoSendCluster   `1` (enable AutoSend)

`0` (angle 1)

`0` (no temperature measurement)

When pressing the measuring button on the device, the corresponding return-string could be as follows:

`1| 401120999|xy|958|94|984|91|993|78|1|0`

Operation code: `1` (MeasureValue)

Serial-No: `401120999` (with preceding blank)

TID:	`xy` (mirrored TID of the command string)
Value1:	`958` dGU for the angle 20° (corresponds to 95.8 GU)
Offset1:	`94` (raw value of the A/D-converter)
Value2	`984` dGU for the angle 60° (corresponds to 98.4 GU)
Offset2:	`91` (raw value of the A/D-converter)
Value3:	`993` dGU for the angle 85° (corresponds to 99.3 GU)
Offset3:	`78` (raw value of the A/D-converter)
Count:	`1` (this parameter is always `1`!)
isTemp:	`0` (measured temperature in °C, `0` if no measurement)

6.5 Error handling

Although the biggest part of the logic is located within the „GlossTools" software, the measuring head also includes some logic. E.g. it should be checked if a measuring angle really exists before a command shall be processed.

If not, a certain return string (error) including error code will be sent back to the host.

The error command includes besides the parameter **SerialNo** also an **Error-Code** (in which function the error has occurred), the **Error Details** (what is the cause of the error) and the **TID (Transaction ID)** of the failed command:

Error(SerialNo, TID, ErrorCode, ErrorDetails)

The following table is a collection of all possible error codes:

Error Code	Explanation
0	NO_FUNCTION
100	SWITCH_COMMANDS
200	PARSE_STRING
300	MEASURE_VALUE
400	MEASURE_ADC
500	MEASURE_TEMP
600	SET_FLASH
700	GET_FLASH
800	GET_DEVICE_ESSENTIALS
900	GET_DEVICE_DETAILS
1000	GET_AX_ALL
1100	GET_IS_ON_STANDARD
1200	UPDATE_COUNTERS
1300	AX_LED_ON
1400	AX_LED_OFF
1500	CONTROL_LED_ON
1600	CONTROL_LED_OFF
1700	SEND_DATA
1800	GET_DATA
1900	CALIBRATION

The following table is a collection of all possible error-details:

Error Details	Erklärung
-2	STACK_OVERFLOW
-1	UNDEFINED_ERROR
0	NO_ERROR
1	OPCODE_NOT_FOUND
2	VARCODE_NOT_FOUND
3	WRONG_SERIALNO
4	WRONG_ANGLE
5	LED_DEFECT
6	SEND_BUFFER_OVERFLOW
7	RECEIVE_BUFFER_OVERFLOW
8	LEDSETCURRENT_TOO_SMALL
9	NO_STANDARD_VALUE
21	UART_TX_ERROR
22	UART_RX_ERROR

Example:

If the following error string is received:

```
56| 401120999|aa|300|5
```

It means that the error "LED defect" occurred while proceeding the command „MeasureValue()".

7 Practical measuring suggestions

7.1 General

❗ Always indicate the used measuring geometry for all measurements.

❗ Measurements of different measuring geometries cannot be compared and cannot be "converted" from one geometry into another. Therefore a series of measurement must always be taken with the same measuring geometry.

7.2 How to choose the correct measuring geometry for paints and varnishes

The following explanations apply to smooth coated surfaces, they do not fully apply for metallic and textured coatings or uneven surfaces. They do not apply at all for other surfaces such as foils, metals, textiles and paper.

According to the standard ISO 2813 and ASTM D523 the correct measuring geometry should be determined by a pre - measurement taken at 60°. Related to that the correct measuring geometry can be determined with the table below.

ISO 2813		ASTM D523	
Value @ 60°	Geometry	Value @ 60°	Geometry
>70 GU	20°	>70 GU	20°
10 GU – 70 GU	60°	10 GU – 70 GU	60°
<10 GU	85°	<10 GU	85°

7.3 Measuring special samples

Depending on the application area, shape and size of the measuring samples (uneven or very small surfaces), it is possible that a holder or positioning support for the precise positioning of the ZGM 1120 is needed in order to get reproducible measuring values.

The following shows an example, which can serve as an example for your own holder.

Positioning support example for measurements on small parts

8   Maintenance and Cleaning

8.1   Maintenance carried out by the user

You may only carry out the following maintenance and repair by yourself:

Outer cleaning of the device (see section 8.2)

Cleaning of the standard (see section 8.3)

! All other maintenance and repair operations may only be done by Zehntner or your authorized Zehntner-agent, otherwise all warranty will be void.

8.2   Cleaning of the aluminum housing

Before cleaning disconnect the USB-cable from your computer. For cleaning of the aluminum housing use a proper,-soft and moist cloth. Use exclusively soft cleaning agents.

! Do not use strongly acidic or alkaline liquids.

! Never immerse the device in water or other liquids.

! If the device has to be disinfected, do not use disinfectants that contain sodium hydroxide.

8.3   Cleaning of the standard

The accuracy of measurements can be impaired significantly by using dirty or damaged standards. Since the surface of the standards is highly sensitive, cleaning must be undertaken with great care. To clean standards, use the included microfiber cleaning cloth.

! Apply only slight pressure during cleaning and make sure there are no large particles on the standard or in the cloth that could damage or scratch the surface.

! Do not use any aggressive and abrasive cleaning agents to clean the standard.

9 Technical Specification

Geometry	1-angle: 20°/60°/85° 2-angle: 20° and 60° 3-angle: 20°, 60° and 85°
Surfaces	All kind of materials such as e.g. paint, coatings, plastic and metals

	20°	High gloss
	60°	Semi gloss
	85°	Low gloss

Measurement range	20°: 0 – 2'000 GU 60°: 0 – 1'000 GU
Resolution	0.1 GU
Measuring area	20°: 4.2 x 2 mm / 0.17 x 0.08 in 60°: 4.7 x 2 mm / 0.19 x 0.08 in 60°: 4.7 x 2 mm / 0.19 x 0.08 in
Opening area*	20°: 8 x 5 mm / 0.3 x 0.2 in 60°: 8 x 5 mm / 0.3 x 0.2 in 85°: 40 x 6 mm / 1.6 x 0.24 in
Bearing area*	20°: 15.6 x 14.8 mm / 0.61 x 0.58 in 60°: 15.6 x 14.8 mm / 0.61 x 0.58 in 85°: 84 x 14.8 mm / 3.3 x 0.58 in
Interface	USB1.1 – Universal Serial Bus RS232 (with adapter cable)
PC software	GlossTools PC Software for easy control, operation and display.

Precision	Range	0 – 199.9 GU	200 – 2'000 GU
	Repeatability	0.1 GU	0.1 %
	Reproducibility	0.5 GU	0.4 %

Units	GU, %
Spectral evaluation	V(λ) adapted
Light source	LED
Power supply	via USB
0-Directives	89/336/EEC
Warranty	2 years
Operating Temperature	5°C to +40°C
Storage Temperature	- 10°C to +60°C
Relative humidity	up to 85 %, non condensing
Dimensions*	20°: 78 x 56 x 15 mm / 3.1 x 2.2 x 0.6 in 60°: 88 x 56 x 15 mm / 3.5 x 2.2 x 0.6 in 85°: 99 x 56 x 15 mm / 3.9 x 2.2 x 0.6 in
Weight	1-angle: 76 - 109 g / 2.7 – 3.8 oz 2-angle: 96 g / 3.4 oz 3-angle: 120 g / 4.2 oz
Standards compliance	ASTM D523, ASTM D2457 BS 3900-D6, ISO 2813, GB/T 9754-2007, JIS Z 8741

*for multi-angle versions please refer to the biggest dimensions
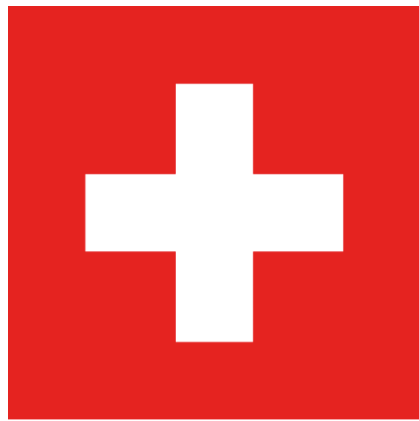
SWISS MADE

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