CZIBULA & GRUNDMANN GMBH

Precision -Photometer

Operating instructions

Documentation-Version 3.04
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CZIBULA & GRUNDMANN

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1 Introduction

The precision photometer designed by CZIBULA & GRUNDMANN GMBH is a photometer built on latest available technology. It can be used miscellaneous, e.g. as luxmeter or photo current meter (2.4.1). Its modularity is joined by simple and intuitive operation. Dependent on the version of the instrument, it fulfills class A or class L requirements of DIN 5032-7.

With its display range of 0.0001 mcd up to 200 cd and respectively 0.0001 lx up to 200 klx, divided into 7 decade ranges, all measurement tasks may be performed with highest accuracy. The signal processing with a fast amplifier combined with a voltage to frequency converter grants a 16 bit wide digitizing for all signal frequencies which are a multiple of 10 Hz. (others on request). The connected sensor (photocell) is operated in short circuit, which leads to the highest achievable linearity over the whole display range.

The illuminated LC - display uses inverse technology for visualization of the readings, which is ideal for the use in a black laboratory.

The instrument is equipped with a serial interface (RS 232) to be used in automated systems. An IEEE488-interface or USB are available on demand. All functions of the photometer may be controlled by interface.

The firmware inside the photometer can be upgraded by the use of the serial interface.

2 Operation

If the temperature of the photometer is below the surrounding temperature (due to transport etc) it should not be switched on immediately. Moisture may condense inside and lead to malfunction and/or electrical damage.

For high accuracy measurements the instrument should be left switched on at least one hour to get into thermal equilibrium.

2.1 Getting started

Before switching on the instrument, the sensor should be plugged into the socket located on the front panel of the instrument. If the sensor is equipped with a thermostat an additional socket is beside the one for the sensor.

Please connect the instrument with mains voltage, using the mains cable delivered with the instrument. A host computer may be connected via serial interface, USB or IEEE4888. The connectors are found on the rear of the instrument.

Now the instrument may be switched on. After an initialization process the LED found above the keys will change its color from red to green, the photometer is ready to operate now. The display will

immediately start to show readings. If a user factor has been set previously, it will be used for all readings.

2.2   Basic key functions

¦ *manual range selection*	key D or key Ñ
¦ enable *auto-range*	simultaneously keys D and Ñ
¦ *select menu / enter*	key **set**
¦ *back without saving*	key **back**

2.2.1   Range selection

After switching on the instrument, it operates in automatic range switching mode, indicated by * behind the reading. If you would like to operate it in a fixed range, please press the keys Ñ or D. The autorange indicator * will be deleted. The current range will be maintained, but it will not change automatically if an over- or underrange condition is detected.

If an over- or underrange condition is detected, the display indicates them by showing 'O' or 'U' behind the reading. To change the range one of the keys Ñ or D must be pressed. The range is changed, when the key is pressed.

To switch back to automatic range selection, please press and release the keys Ñ and D simultaneously.

2.3 Menu Settings

All other settings of the instrument are menu-driven. The operation is simple :

1. *press* **set** *to enter menu*
2. *press* ÑD *to select menu option*
3. *confirm settings by pressing* **set**
4. *press* ÑD *to select submenu*
or
adjust value by pressing ÑD
5. *confirm settings by pressing* **set**
6. *discard changes or decrease menu level by pressing* **BACK**

Press the 'SET'-key. The reading in the display is replaced by a menu system. To change the displayed menu option, the keys DÑ are used. To select a menu option or to confirm a setting, press the 'SET'-key.

Depending on the function it may contain a sub-menu with other possibilities and settings which also may be selected by DÑ and SET-key. If a number has to be entered/changed, this can also be done by the keys DÑ. If the setting is done to the desired value it must be confirmed by pressing the SET-key or aborted by the BACK-key. Pressing key BACK in the highest menu level will be affect to start measuring and showing the value.

2.4 User menu

The changing of a setting over the menu will be stored directly after pressing the SET-key. Unlike the changing of setting over the interface will be stored not directly, but after sending the command SAVEPARAMS.

2.4.1 Calibrating reflectance, transmission

In Instrument mode rho/tau you can calibrate the actual photo current to 100%. After pressing the SET-key the photometer will measure the photocurrent ten times, calculates the average value and stores it in the internal eeprom.

2.4.2 Instrument mode

The Photometer supports several modes in displaying of the measured readings. The mode can be changed by menu selection or the selected interface.

table 1: measuring modes

Menu index	Menu item	Description	Calibration required
1	Lux	Illumination [lx]	x
2	Iph	Photo current [A]	-
3	Lumen	luminous flux [lm]	x
4	cd/m2	Luminous density [cd/m2]	x
5	User	Can be defined by user [user]	x
6	Volt	Output voltage of the analog amplifier [V]	-
7	Counts	Counter reading over the integration time [couns/integration time]	-
8	rho/tau%	Reflectance, transmission [%]	x
9	Candela	Luminous intensity [cd]	x[*]

The modes marked with x demand a calibration of the photometer together with the associated photometer head.

[*] The calibration in mode candela requires a calibration in mode illumination before.

The mode output voltage and counter reading is implemented for service.

After changing the mode the instrument will display the readings immediately.

If the mode requires a calibration and is not factory calibrated, the message "Not calibrated" will shown on the display.

2.4.3 *CALIB* – User Calibration

The instrument is calibrated in the factory. Sometimes you will need a user defined factor to be multiplied with the reading.

If you select *CALIB,* you will see the calibration mode (user/factory) and the instrument mode for a short time. Then it will showed the current factor on the right half of the display and on the left half the

current reading multiplied by this factor. This will be the new value displayed during continuous measurement.

By pressing key ÑD the factor will be decreased or increased. If holding key ∇ or D, the change of the factor will be speed-up.

CALIB	à	***Mode***	à	ÑD

When holding key ***set*** you can select the quantity of changing the factor. In slow mode the position after decimal point is changed, in fast mode the position before the decimal point is increased/decreased by 1. You can change the mode everytime.

Press the SET-key shortly to save the factor or BACK to discard changes.

2.4.4 Interface selection and settings

By default the instrument is equipped with a RS232 serial interface. On demand also an IEEE488 /GPIB- or an USB- interface are available. The selection of the active interface is done by the I/O-menu in the setup (***IntFace***).

The availability of the submenu for Ieee488 and USB depends on the equipment.

IntFace	à	***RS232***	
	↓		
		IEEE488	optional
	↓		
		USB	optional

By selecting (***set***) an interface it will be activated and the corresponding submenu will be showed. If and IEEE488 modul is installed, it can be used parallel to one of the serial interfaces (RS232/USB). Note that USB and RS232 cannot be used parallel.

2.4.4.1 Parameters of RS232

IntFace	à	RS232	à	Baudrate	à	57600
					à	38400
					à	19200
					à	9600
					à	4800
					à	2400
					à	1200

IntFace	à	RS232	à	Parity	à	none
					à	even
					à	odd

2.4.4.2 Parameters of USB

The USB-Interface has fixed settings. By using a virtual comport the settings are 57600 8N1.

2.4.4.3 Parameter of the IEEE488 interface

It is just necessary to assign a device address to the photometer. The default address is 02. To change the address select the submenu IntFaceà IEEE488à DevNo and press keys ÑD to change it. Press SET to store or BACK to discard changes.

IntFace	à	IEEE488	à	DevNo	à	1
						up to
					à	30

2.4.5   Measure settings

2.4.5.1   Integration time

In the submenu Int-Time you can change the integration time in the range of 10ms up to 400ms with a resolution of 1ms. Be careful if you measure AC-signals. The integration time has to be a multiple of the period of your signal. See the examples below.

f[Hz]	T[ms]	Integration time [ms]
50	20	20,40,60 … 400
60	16,66	100,200,300,400
100	10	10,20,30 … 400

Pressing the key D rather Ñ shortly will increase or decrease the integration time by 1ms. Hold the key for fast changes.

Measure	*à*	*Int-Time*	*à*	*10*
				up to
			à	*400*

2.4.5.2   Autorange loop rejection

Measure	*à*	*AR Loop*	*à*	*on*
			à	*off*

2.4.6   Display settings

Display	*à*	*Format*	*à*	*Exponent*
			à	*Float*
	à	*Speed*	*à*	*Slow*
			à	*Medium*
			à	*Fast*

2.4.6.1 Format of readings

You can select the format of readings between exponential (e.g. 1.435E-06 A) and fixed-point with SI-units (e.g. 1.435 uA). This setting only affects the display. For the PC-interface you can change the settings by command (3.2.1) (default setting is exponential format).

2.4.6.2 Display speed

By changing the display update speed a better clearness of display first of all in short integration times will be reached. Therefore several measurements are made, depending on the integration time, and the average is calculated before the result will be displayed.

Setting	Refresh rate [1/s] (approx.)
Slow	1
Medium	2
Fast	4

This setting doesn`t affect the PC-Interface. Always the actual value will be transmitted.

2.4.7 Service

This function can be used for diagnostics and service. Additional the photometer can be restore factory settings. This doesn`t affect the factory calibration.

Service	à	*Info*	à	*service infos*
	à	*FactRst*	à	*No*
			à	*Yes*

2.5   Analog output

The photometer may be equipped with an analog output. It delivers a voltage between 0 and 10 V which may be measured with any voltmeter which has an input impedance of more than 100 kΩ. The automatic range switching should be disabled when using the analog output.

Note that the output voltage follows the input photometric current in its time responds up to the amplifiers cut-off frequency. This frequency is about 400Hz in the most sensitive range and will increase in insensitive ranges.

range	I_{max} [A] (10V)	I_{LSB} [A]
0	$1*10^{-3}$	$1*10^{-8}$
1	$1*10^{-4}$	$1*10^{-9}$
2	$1*10^{-5}$	$1*10^{-10}$
3	$1*10^{-6}$	$1*10^{-11}$
4	$1*10^{-7}$	$1*10^{-12}$
5	$1*10^{-8}$	$1*10^{-13}$
6	$1*10^{-9}$	$1*10^{-14}$

3   PC communication

3.1   Interfaces

3.1.1   RS232 interface

All commands are sent as ASCII-string which must be terminated by the terminator CR (0x10).

Photometer	Pin No.	PC
Rx (In)	2	Tx (Out)
Tx (Out)	3	Rx (In)
CTS (In)	7	RTS (Out)
RTS (Out)	8	CTS (In)
GND	5	GND

To connect the instrument to a computer, just use a standard 9-pole (DB9) serial cable with a 1:1 connection.

During handling a command the RTS-Line of the RS232-Interface is cleared, otherwise it is set.

3.1.2   IEEE488 Interface

SPOLL-Register:

Name	Bit	Description
Ready	0	1 - Ready 0 - Busy
Error	1	1 - last command finished not correctly 0 - last command finished correctly
Data available	2	1 - measure data are ready to enter
Measure running	3	1 - measure running
Reserved	4	–
Reserved	5	–
Service_Request	6	1 - Service Request
Reserved	7	–

As EOS (End of String) identification the character CR (carriage return) and LF (line feed) followed of the EOI is sent when transmission finished.

Bit0 in the SPOLL-Register indicates the receive readiness. During handling a PC-command the bit is cleared, if the instrument is ready for new commands it is set.

3.1.3   USB interface

To use the USB interface you have to install the provided windows-driver. After first connection of the photometer to the PC a message „new hardware detected" will showed. You have to specify the path where the driver is located.

After successful installation the instrument is showed in the system control. You can use the provided DLL or the Windows software to communicate between PC and photometer (3.2).

The USB-Interface must be activated in the menu. You have to select between RS232 and USB.

3.2   Commands

The command set described below is available in all interfaces. To be compatible with older photometer firmware command sets (firmware versions 1.xx) you can activate the compatibility mode (3.2.16.8).

The changing of a setting over the menu will be stored directly after pressing the SET-key. Unlike the changing of setting over the interface will be stored not directly, but after sending the command SAVEPARAMS.

3.2.1   Formatting reading

The formatting of the reading can set up:

```
Position    1234567890123
            0000000001111
Get         MEAFORMAT f
Answer      Ack / Error

Get         MEAFORMAT?
Answer      f

Content     Description
f           Bitmask Formatting (decimal):
            Bit0 – Range (1=on, 0=off)
            Bit1 – exponent or float (1=exp, 0=float)
            Bit2 – hide unit (1=hidden, 0=visible)
            Bit3 – fixed digits (e.g. 1.5400E-6)
            Bit4 – Rangestat-Mode0
            Bit5 – Rangestat-Mode1

            2 Bit Rangestat-Mode :

            00   – O=Overrange, U=Underrange, no
                   underrange if range=maxrange
            01   – O=Overrange, U=Underrange, underrange
                   if range=maxrange
            10   – AR = Autorange, OVR=Overrange,
                   UR=Underrange, no underrange if
                   range=maxrange
            11   – reserved

            Example 1 (exponent, unit, rangestate Mode 0,
            show range) in mode Iph:
            1.54E-06 A 2 U

            Formatting: 3 (0b00 0011)
```

The default setting is 2 (rangestat Mode 0, exponent)

3.2.2 Request a reading

To request a reading from the photometer the following command has to be sent to the instrument:

The numbers of positions after decimal point depend on the amplitude of the amplifier and the integration time. It can vary of two up to five. If the formatting setting (3.2.2) is set on fixed len the unused digits will be filled with '0'.

```
Position      1234567890123
              0000000001111
Get           ?
              MEA
              MEASURE
Answer        v.vvvvvE+ww uu r sss
(exp)
Answer        f.ffff uu r sss
(float)
```

Content	Description	
v.vvvvv	Mantissa	
E	Exponent, always "E"	
+	Sign of Exponenten, "+" or "-"	
ww	Exponent	
uu	unit (e.g. lx, A)	
r	range	
sss	State	
	U	Underrange
	O	Overrange

The reading depends on the measure mode.

3.2.3 Request the version

To request the firmware version of the instrument the following command has to be sent:

```
Position      1234567890123
              0000000001111

Get           VER
              VERSION
              *IDN?
Answer        C&G Photometer HWhh Vx.xx w MMM TT JJJJ HH:MM:SS
```

Content	Description
	Company + type of instrument
hh	Hardware Version
x.x	Firmware Version
w	(Softwareoption)
MMM TT JJJJ	Date of build
HH:MM:SS	Time of build

3.2.4   Range handling

3.2.4.1   Get minrange / maxrange

The number of ranges can vary. Normally there are 7 (0..6) ranges. On demand there are more than 7 ranges. With this command you can get the minimum and maximum ranges.

```
Position    1234567890123
            0000000001111
Get         MINRANGE?
Get         MAXRANGE?
Answer      r


Content     Description
r           range
```

3.2.4.2   Set / Get range

To set or get the range the following command has to be sent. By setting the range manually the autorange will be disabled.

```
Position    1234567890123
            0000000001111
Set         SETMB r
Answer      Ack / Error

Get         GETMB
Answer      MBr rs

Content     Description
r           Current range (e.g. 0...6)
rs          OVR  Overrange
            AR   Autorange enabled
            UR   Underrange
```

Additional there two more commands to switch and get the range (without status information).

```
Position    1234567890123
            0000000001111
Set         RNG r
Set         RANGE r
Answer      Ack / Error

Get         RNG?
Get         RANGE?
Answer      r

Content     Description
r           range
```

3.2.4.3 Switch into a more insensitive range

This command switches the range into a more insensitive range. If the most insensitive range (MR0) is still set, the command will not be executed. By setting the range manually the autorange will be disabled.

To set the range the following command has to be sent:

```
Position    1234567890123
            0000000001111

Set         RANGEDN
Answer      Ack / Error
```

3.2.4.4 Switch into a more sensitive range

This command switches the range into a more sensitive range. If the most sensitive range (e.g. MR6) is still set, the command will be deleted. By setting the range manually the autorange will be disabled.

To set the range the following command has to be sent:

```
Position    1234567890123
            0000000001111

Set         RANGEUP
Answer      Ack / Error
```

3.2.4.5 Autorange

To let the photometer handle the best range automatically you can activate the autorange.

To set the autorange the following command has to be sent:

```
Position    1234567890123
            0000000001111
set         AUTO x
answer      Ack / Error

get         AUTO?
answer      x

enable      AUTO1 (obsolete, don't use anymore)
disable     AUTO0 (obsolete, don't use anymore)
answer      x

Content     Description
x           0 – disable autorange
            1 – enable autorange

            If there is no parameter x the autorange will
            be enabled.
```

In case of unfavourable input signal (high dynamic, oscillation) it can happen, no range can be detected. A message will be displayed on the display (AR failed). In this case you can enable the autorange loop rejection (3.2.16.6).

3.2.5 Remote Mode

You can lock the keys on the front of the photometer in remote mode.

The following command has to be sent:

```
Position    1234567890123
            0000000001111

Set         REMOTE
Answer      Ack / Error
```

The instrument will be switched in remote mode automatically after receiving any command over the Ieee488 interface or an Ieee488 trigger (DET) occures.

3.2.6 Local Mode

You can unlock the keys on the front of the photometer in local mode.

The following command has to be sent::

```
Position    1234567890123
            0000000001111

Set         LOCAL
Answer      Ack / Error
```

You can press the GotoLocal-key (***back)*** to go to local-mode.

3.2.7 Enable external trigger

The device is in standby. When the command measure (3.2.1) received, the device starts measuring. When finished the reading will be send. Note that you have to set the valid range before execute the trigger. If autorange is enabled and the current range is not valid, the autorange routine will switch the range until a valid range was found. When finished the reading will be sent.

To trigger the photometer by the PC you have to enable the external Trigger by sending the following command:

```
Position    1234567890123
            0000000001111

Get         TRIG ON
Answer      Ack / Error
```

If the photometer is equipped with a IEEE488-Interface the measurement will be started if you send a Group Execute Trigger (DET). After measurement finished the reading will be stored in the transmit buffer. You have the collect the reading when the Data available SPOLL-Bit is set (3.1.2).

3.2.8 Enable internal trigger

To enable the continuous measurement you have to send the command:

```
Position    1234567890123
            0000000001111

Set         TRIG OFF
Answer      Ack / Error
```

The internal trigger is activated after start the device automatically.

3.2.9 Measure mode

The format of readings (only interface) depends on the format settings.

```
Position    1234567890123
            0000000001111
set         MODE x
set         UNIT x
answer      Ack / Error

get         MODE?
get         UNIT?
answer      X

Content     Description
x           Mode index (see table 1 on page 7)
```

3.2.9.1 Set unit in user mode

```
Position    1234567890123
            0000000001111
Set         USER sssss
Answer      Ack / Error

Get         USER?
Answer      sssss

Content     Description
sssss       Unit of reading in user measure mode, max. 5
            characters
```

3.2.10 User calibration factor

```
Position    1234567890123
            0000000001111
Set         FACTOR m f
Answer      Ack / Error

Get         FACTOR? m
Answer      f / Error

Content     Description
m           measurement mode (3.2.9)
f           Set:
            Factor (expontential or float format) e.g.
            1.546E-9 or 0.9889

            Get: always expontential
```

3.2.11 Factory calibration factor

You can get the factory calibration factor by sending the command:

```
Position    1234567890123
            0000000001111
Get         GETFFACT? m
Answer      f / Error

Content     Description
m           measurement mode (3.2.9)
f           always expontential
```

3.2.12 Integration time

You can set and get the integration time with the following command (see 2.4.5.1):

```
Position    1234567890123
            0000000001111
Set         TI t
Set         INTTIME t
Answer      Ack / Error

Get         TI?
Get         INTTIME?
Answer      t

Content     Description
t           Integration time [ms] (10ms … 400ms)
```

3.2.13 Get serial number

The serial number is stored in the internal EEprom and can be read by the command:

```
Position     1234567890123
             0000000001111

Get          SN?
Answer       ssss

Content      Description
ssss         Serial number
```

3.2.14 Display settings

3.2.14.1 Display Mode

The measure mode to show in the display can be changed by the keys (2.4.2) or by command.

```
Position     1234567890123
             0000000001111
Set          DISPMODE m
Answer       Ack / Error

Get          DISPMODE?
Answer       m

Content      Description
m            Mode index (see table table 1 on page 7)
```

3.2.14.2 Display Speed

The measure speed to show in the display can be changed by the keys (2.4.6.2) or by command.

```
Position     1234567890123
             0000000001111
Set          DISPSPEED s
Answer       Ack / Error

Get          DISPSPEED?
Answer       s

Content      Description
s            1 – fast
             2 – middle
             3 - slow
```

3.2.14.3 Display Format

The measure format to show in the display can be changed by the keys (2.4.6.1) or by command.

```
Position     1234567890123
             0000000001111
Set          DISPFMT f
Answer       Ack / Error

Get          DISPFMT?
Answer       s

Content      Description
f            Formatting bitmask (3.2.1)
```

3.2.14.4 Control the display

```
Position     1234567890123
             0000000001111
Display On   DISPON
Display      DISPOFF
Off
answer       Ack / Error
```

3.2.15 Ieee488

3.2.15.1 Ieee488 device address

```
Position    1234567890123
            0000000001111
Set         I488ADR a
Answer      Ack / Error

Get         I488ADR?
Answer      a

Content     Description
a           Ieee488 device address [1..30]
```

3.2.15.2 Ieee488 service request (SRQ)

The behaviour of the service request bit in the SPOLL-Register can be configured. If it is enabled, the service request bit is set after a measure reading is ready to enter.

```
Position    1234567890123
            0000000001111
Set         I488SRQ a
Answer      Ack / Error

Get         I488SRQ?
Answer      a

Content     Description
a           Ieee488 Service Request
            0 = Off
            1 = On
```

3.2.16 Other commands

3.2.16.1 Save Params

The changing of a setting over the menu will be stored directly after pressing the SET-key. Unlike the changing of setting over the interface will be stored not directly, but after sending the command SAVEPARAMS.

```
Position    1234567890123
            0000000001111
Set         SAVEPARAMS
Answer      Ack / Error
```

3.2.16.2 Get timestamp

The internal timer has a resolution of 1ms. It will run after switching on the device. After approx. 50 days the timer will begin at 0.

```
Position    1234567890123
            0000000001111
Get         GETTICKS
Answer      t

Content     Description
t           Timestamp [s] (e.g. 861.023 s)
```

3.2.16.3 Device reset

To reset the device and all components you can send this command. If you have an ieee488-Interface you can execute a device clear.

```
Position    1234567890123
            0000000001111
Set         RESET
Answer      Ack / Error
```

3.2.16.4 Factory Reset

You can send this command to restore factory settings. Factory calibration and serial number will not be deleted.

```
Position    1234567890123
            0000000001111
Set         CLR_EEPROM
Answer      Ack / Error
```

3.2.16.5 Autosend

If you enable the autosend mode the device measures continuous and sends the values when measure finished, if the RTS-Line (3.1.1) is set.

```
Position    1234567890123
            0000000001111
Set         AUTOSEND a
Answer      Ack / Error

Get         AUTOSEND?
Answer      a

Content     Description
a           0: Autosend off
            1: Autosend on
```

3.2.16.6 Autorange loop rejection

In case of unfavourable input signal (high dynamic, oscillation) it can happen, no range can be detected. A message will be displayed on the display (AR failed). In this case you can enable the autorange loop rejection.

```
Position    1234567890123
            0000000001111
Set         ARLOOP a
Set         ARLOOP str
Answer      Ack / Error

Get         ARLOOP?
Answer      a

Content     Description
a           0: ARLOOP off
            1: ARLOOP on
str         Off: ARLOOP off
            On:  ARLOOP on
```

3.2.16.7 Underrange threshold

```
Position    1234567890123
            0000000001111
Set         URTHRESH xxxx
Answer      Ack / Error

Get         URTHRESH?
Answer      xxxx

Content     Description
xxxx        Underrange threshold in counts,(100000 counts
            ≙ 100%), default value is 6600 ≙ 6,6%
            rejection
```

The device must be in factory calibration mode to change this parameter.

3.2.16.8 Command set

To be compatible with older luxmeter firmware versions (V1.xx) you can set the command set to V1. We recommend to use command set 1 only if you have old pc software and have no possibility to change.
The main advantage of command set 2 is that you get a reply on every command request (Ack / Error), so you can check the success of the command.

```
Position    1234567890123
            0000000001111
Set         CMDSET x
Answer      Ack / Error

Get         CMDSET?
Answer      x

Content     Description
x           Command set
            1 : Luxmeter Version 1
            2 : Luxmeter Version 2 and later
```

4   Calibration

The device was tested and calibrated and agrees with the published Technical specifications. The accuracy and the calibration of this device is traceable to the normal of the PTB (Physikalisch-Technischen Bundesanstalt). The calibration is arranged with lamps what are compared and set up with calibrated normales in regular and adequate intervals.

The Photometer is factory calibrated. It is recommend that the device will be recalibrated in intervals of two years by CZIBULA & GRUNDMANN GMBH.

5   Electrical fuses

The luxmeter contains a fuse of 400mA at its mains connector.

6   Warranty

CZIBULA & GRUNDMANN GMBH warrants for the period of one year from delivery that instrument maintains ist technical properties.

Whenever the instrument shows a defect during this period of time it has to be sent to the factory in Berlin. It may be repaired or exchanged. After repair it will be sent to the customer.

No warranty is given if the customer modifies the instrument or changes parts inside.

Also no warranty is given for defective batteries, mechanical defects caused by the customer or third people.

7   Technical specifications

Instrument	Manufacturer		CZIBULA & GRUNDMANN GMBH
	Type		Photometer
	Display Range		0,1pA … 1 mA
			0,001 lx to 200 klx (depending on sensor)
	functions		User-calibration
			Selectable integration time
			Interface parameter settings
			External or internal trigger Trigger
			Firmware-Update using RS232-interface
Use	Application and environment		Laboratory / indoor
	Special application		Goniometers, integrating spheres
Class	Acc. to DIN 5032-7		Class L or Class A
Sensor	Type		Full-filtered Si Photocell
			External, plugged in
	Cable length		3 m / others on request
	Spatial sensitivity		Cosine
	Temperature control		See certificate
	Diameter of sensitive area		8 mm or 25mm
Display Unit	Amplifier		Trans-impedance-amplifier
	Integration time		10ms to 400ms
	Meas rate		Up to 40 s-1 , depends on integration time
	display		16 character LCD illuminated
	Meas ranges		7 ranges, auto or manual
	Interfaces		RS232, on demand IEEE488/USB
	Analog output		0 to 10V (100µA/V .. 100pA/V)
parameters			
DIN 5032-6	calibration deviation	u_{kal}	< 1%
	V(I)- adjustment	f'_1	See test chart
	UV-sensitivity	u	< 0,01%
	IR- sensitivity	r	< 0,01%
	linearity	f_3	< 0,1%
	indicator	f_4	< 0,1%
	fatigue (at 1 klx)	f_5	< 0,1%

	temperature coefficient	α_{25}	< 0,1%/K (Kl. L) bzw. < 0,2%/K (Kl. A)
	Modulated light	f_7	< 0,1%
	Trim fault	f_{11}	< 0,1%
	Overall characteristic	f_{ges}	< 3% bzw. < 5%
Calibration	Normal		bei norm illuminant A
	environmental temperature		(25 ± 1)° C according to DIN 5032-6
	recommend recalibration interval		2 Years
Elektrical specifications	Nominal voltage		230 V / 50 Hz
	Voltage range		120 V – 240 V / 47 Hz – 63 Hz
Temperature	operation		0°C < T < 60°C (75 % rel. humidity, not condens.)
	Stock		-20°C <T<75°C
Metrics	L x B x H Device		315 mm x 255 mm x 120 mm
	L x B x H Standard-photometer head		$\varnothing$ 34 mm x 21 mm
	L x B x H thermostated photometer head		$\varnothing$ 50 mm x 49 mm
Weight	Device		3,2 kg
	Standard-photometer head		50 g
	thermostated photometer head		300 g