

USER MANUAL



MP SERIES

SMARTMETERS

MODEL GRP-1

Software Version 1.06



**Your source of optical and measurement
technology**

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GENERAL DESCRIPTION

The GOLDILUX MP series Smartmeters are designed and programmed for use with GOLDILUX MP series probes. Ask your authorized GOLDILUX dealer for an up-to-date product chart if you need to select the appropriate combination of probe and readout unit for your requirements.

When you plug a probe into a micro-processor controlled MP series Smartmeter, the microprocessor first reads all the relevant probe parameters from a memory circuit in the probe. These parameters include probe serial number, probe type, units of measurement, measuring range, overall calibration factor, range calibration factor for each probe amplification, probe offset and calibration date. Then it displays the measurements from the probe sensor in the selected units on the Smartmeter's LCD display.

The microprocessor in the Smartmeter also has full control over the gain switching circuits in the probe and will autorange the probe (if autoranging mode is selected) over its full measuring range.

OPERATING INSTRUCTIONS

1. Remove the meter and probe from their case and plug the probe cable into the probe socket on the Smartmeter (E in Fig. 1).
2. Mount or place the probe in the position in which the measurements are to be made. The probe has two 1/4" mounting holes, which allow it to be mounted either vertically or horizontally on e.g. a camera tripod.
3. Switch on the Smartmeter (A in Fig. 1) and wait until it has read the probe parameters.
4. Check the probe zero with the cap firmly on the detector. If necessary, zero the probe by pressing the ZERO key on the keypad (B in Fig. 1) of the Smartmeter.
5. Remove the protective cap from the meter and take readings.

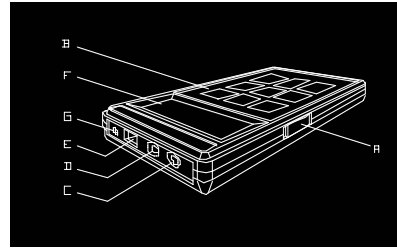


Fig. 1

KEYBOARD FUNCTIONS

1. The Smartmeter's ZERO key toggles the unit between two "zero" modes. In the "Abs" mode, A/D (analog to digital converter) zero readings (with the A/D inputs shortened) are taken at regular intervals by the micro-processor and subtracted from consequent probe readings. In the other ZERO mode, "Rel", the probe reading present when the key is pressed is subtracted from subsequent probe readings. Whenever "Abs" mode is entered or when the Smartmeter is switched on, the "Rel" offset value is re-set to zero. A permanent "Rel" offset can be introduced by storing a non-zero value in the probe's PO ("probe offset") parameter (password required). The main use of the PO feature is to ensure a zero reading on the display when measuring with the cap on the detector.
2. If you would like to "freeze" the displayed reading momentarily, press the HOLD/RUN key on the Smartmeter. Press the key again to see a continuously updated display of the readings.
3. If you would like to change the units of measurement (e.g., from lux to footcandle in the case of a light probe), press the UNITS key on the Smartmeter and toggle through the available options using the UP and DOWN keys. Once your selection is made, press the UNITS key again to go back to measuring mode. The selected unit is stored in non-volatile memory in the probe and the last selected unit will thus be used automatically, when you switch on the readout unit with the same probe the next time.
4. The main probe parameters are displayed in a series of consecutive screens on the LCD display whenever the PROBE ID key is pressed.
5. In case of a dose measurement, press the NORMAL / DOSE key on the Smartmeter and toggle through the available choices of integration time by using the UP and DOWN keys. Then press the START / STOP key on the Smartmeter to start the dose integration over the selected time interval. The received dose and the elapsed time will be displayed simultaneously on the LCD display until the selected integration period has expired. Then both the timer and the dose reading will be frozen in the display until either the START / STOP key is pressed to commence another dose measurement or the NORMAL / DOSE key is pressed (twice) to return to NORMAL measuring mode.
6. In case the MANUAL option is chosen when selecting the integration time, the dose measurement will be started when the START / STOP key is pressed and stopped when it is pressed again.
7. By pressing the AUX key in normal measuring mode, the following additional instrument features can be selected by toggling through the various options with the UP and DOWN keys:
 - a. Display of the ambient temperature in the Smartmeter.
 - b. Display of the Smartmeter battery voltage.
 - c. RS232 communications (initiated by pressing the START button while in this selection). The RS232 interface is described in a later section and the available commands are listed in Table 1.
 - d. Switch from normal to economy mode (longer battery life, at the cost of slower operation and less flexibility). In economy mode all keyboard selections remain as set in normal operating mode and the unit no longer responds to any keyboard or RS232 input.

In order to exit economy mode, the unit must be switched off.

- e. Display the raw analog-to-digital converter output (needed for Smartmeter calibration).

CARE AND MAINTENANCE

When not in use, keep the Smartmeter in a protective case.

Have a replacement battery ready when the "battery low" warning appears in the display ("BL" is displayed in the lower left part of the LCD display when the battery voltage reaches a level of about 8 V). The Smartmeter stops measurements altogether once the battery voltage drops to about 7 V. Instrument accuracy is not affected while the battery low warning is displayed.

SMARTMETER CALIBRATION

1. Open the meter housing and, without a probe being plugged into the readout unit, adjust R9 until the voltage across C15 is 5.0 ± 0.1 V. (Note: Two of the housing screws are covered by the rear panel label, the other two are accessible through the open battery compartment).
2. For dose measurements, one of the micro-processor's counter/timers is used together with the processor's 1.8432 Mhz crystal to derive a time-base, which interrupts the processor precisely 100 times a second to increment the time count. Because of the high stability of the crystal frequency, it should never be necessary to adjust this dose timebase. To check it, an oscilloscope probe can be attached to pin 11 of IC U7, which generates a timing pulse for every processor timing interrupt. In the unlikely case that it should need adjustment, read the timer constant via the RS232 interface (see later section) using the command "tr". The factory default is 64038. Change the value of this constant as required, using command "ts" (password required), until you observe a precise frequency of 100.0 ± 0.1 Hz on the oscilloscope. Close the meter housing.

3. Insert the calibration cable (included as an accessory) in the meter's probe connector and apply 300.00 mV from a calibrated voltage source between its red (+) and yellow wires. Adjust the calibration adjustment on the Smartmeter (G in Fig. 1) until the displayed A/D count (viewed in AUX mode) is $(-20\ 000 + AD\ OFFSET) \pm 5$. Put a calibration sticker over the adjustment hole.

For the calibration of a particular probe, consult its user manual. Probe calibrations should only be performed in combination with a calibrated Smartmeter.

NOTE: *Calibrations should only be performed by trained metrologists in a recognized calibration laboratory.*

OPTIONAL ADJUSTMENTS

The displayed battery voltage is calculated from the output of the A/D converter (value = AD) according to the formula

$$\text{Battery voltage} = (\text{AD} - \text{B0}) * \text{BS}.$$

The constants BS and BO can be adjusted as required to obtain an accurate reading (the true battery voltage can be established by measuring it with a calibrated digital voltmeter). The factory defaults are BS = 0.0154 and BO = 12. For the applicable commands see the RS232 command set (Table 1) and the more detailed explanation of the commands in the file README.TXT on the supplied disk..

The displayed ambient temperature is sensed via a thermistor mounted on the Smartmeter PCB. Due to the thermistor circuit, the temperature T is related to the output of the A/D converter (value = AD) as

$$T (^{\circ}\text{C}) = \text{TS1} / \{\log[(\text{AD} * \text{TS2}) / (1024 - \text{AD})] - \text{TO1}\} - \text{TO2}.$$

The default values are TS1 = 4090, TS2 = 100 000, TO1 = -2.96 and TO2 = 273.15. For the applicable commands see the RS232 command set (Table 1).

RS232 SERIAL INTERFACE

All the functions accessible via the Smartmeter keypad can also be exercised by issuing the corresponding commands via the RS232 interface. In addition, all calibration-related operations for the probe and many additional functions, which are not accessible via the keypad, can be performed via the RS232 command set.

An RS232 interface cable for connecting the Smartmeter serial port (C in Fig. 1) to a 9-pin PC serial port is supplied as an accessory. The RS232 communications parameters are listed in the specifications section of this manual.

All bytes sent from the PC to the Smartmeter are echoed back for error detection. The PC communications programme is responsible for detecting communications errors. After receiving a command, the Smartmeter sends one of five possible return bytes to the PC:

- o - OK (sent after execution of valid command),
- e - Error (undefined command),
- p - no password (wrong or missing password),
- r - retype password (to verify new password),
- w - waiting for input (terminate input with enter).

For commands requiring a password, first supply the correct password with pwXXXXX (see RS232 command set below), where XXXXX is the password. If correct, a "o" return byte is sent, whereupon the desired command may be entered. Once the correct password has been entered, all commands requiring passwords can be executed. On quitting RS232 mode, the unit is automatically returned to its password-protected state.

When changing the password to some new five-character string, the command pc should be used. After typing the new password for the first time, the return byte "w" is sent, whereupon it should be typed a second time for crosschecking.

In case of a mismatch, an "r" return byte will be sent, requiring a repeat of the procedure. Password checking is automatically enabled every time the password is changed. The default, factory-set password of the instrument is "abcde".

Commands that do not require parameters are recognized directly and require no carriage return (ENTER) to execute. For commands requiring numerical values, these values should be entered directly after the "w" return byte is received and should be terminated with a carriage return (ENTER). Most commands associated with the entry of numerical values require that the correct password must first have been entered. After making all the necessary entries of new values, **the new data must be saved to the non-volatile EEPROM using the either the "ssm" or "ssp" command (see Table 1). Otherwise the changes will be lost when the Smartmeter is switched off.**

Any general-purpose, RS232 communications program for PCs (like TERMINALJ for WINDOWSJ) can be used for issuing the commands in the RS232 command set listed in Table 1.

Should any change in either the Smartmeter or the probe parameters result in incorrect operation of the instruments, the original factory settings can be restored by issuing the command "sdm" (set defaults for Smartmeter) or "sdp" (set defaults for probe). Both commands require the password.

SUPPLIED DEMO PROGRAMME

A programme written in Visual Basic 6.0, entitled GOLDILUX_GRP1.EXE is supplied on the compact disk (CD) delivered with the Smartmeter. It enables the user to operate and calibrate the Smartmeter from a PC, without having to know the Smartmeter command set.

To install the programme on a PC, insert the supplied CD in the CD drive of your PC and run the programme Setup.exe. This installs the demo program and all the support files needed to run it.

Before issuing any command to the Smartmeter, the Smartmeter must be switched to RS232 communications mode (one of the AUX functions on the keyboard, as described earlier).

SPECIFICATIONS

Measurement parameter	:	Probe dependent.
Display	:	Alphanumeric LCD display.
Analog output	:	+5 V for probe full-scale reading, output impedance 1 M Ω .
RS232 interface	:	8 data bits, 1 stop bit, no parity, 2400 baud.
Power source	:	9V type PP3 battery.
Current consumption	:	15 mA nominal in normal mode.
Operating environment	:	0 to 50 EC (32 to 122 EF) .
Mass	:	230 g.
Accessories	:	User manual, RS232 interface cable, calibration cable, analog output cable, disk with communications software.
Re-calibration	:	Return unit to a recognized calibration laboratory for re-calibration every 12-18 months (depending on frequency of

usage) or if calibration is in doubt for any reason.

WARRANTY INFORMATION

One (1) year limited warranty

The manufacturer warrants the light meters and probes against defects in materials and workmanship for a period of one (1) year from the date of original retail purchase (proof of purchase required). If an approved distributor receives notice of such defects during the warranty period, he will either, at his option, repair or replace products which prove to be defective and receive a replacement from the manufacturer.

Exclusions

The above warranty shall not apply to defects resulting from improper or inadequate maintenance by the customer, customer-supplied software or interfacing, unauthorized modifications or misuse, operation outside the environmental specifications for the product, improper site operation and maintenance, an accident or abuse.

Obtaining warranty service

To obtain warranty service, the products must be returned by the purchaser to an approved distributor. Such approved distributor shall, at its discretion, repair or replace products which prove to be defective. On notifying the manufacturer of the cause of the warranty claim and returning the defective product to the manufacturer, the manufacturer will replace the defective product free of charge.

Shipping charges from the customer to an approved distributor shall be to the account of the customer and shipping charges from the approved distributor to the manufacturer shall be paid by the approved distributor. The manufacturer shall pay for the return of the replacement product to the approved distributor, who shall be responsible for the shipping charges to the customer.

Warranty limitations

The manufacturer makes no other warranty, either expressed or implied, with respect to these products. The manufacturer specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. Some states or provinces do

not allow limitations on the duration of an implied warranty, therefore the above limitations or exclusion may not apply to you. However, an implied warranty of merchantability or fitness is limited to the one (1) year duration of this written warranty.

This warranty gives you specific legal rights, and you may also have other rights, which may vary from state to state, or province to province.

Exclusive remedies

The remedies provided herein are the customer's sole and exclusive remedies. In no event shall the manufacturer be liable for any direct, indirect, special, incidental or consequential damages, whether based on contract, tort, or any other legal theory. Some states or provinces do not allow the exclusion or limitations of incidental or consequential damages, thus the above limitation or exclusion may not apply to you.

Approved distributor's address

TABLE 1: GOLDILUX™ MODEL GRP-1 SMARTMETER, RS232 COMMAND SET, Version 1.06 (in alphabetic order)

COM-MAND	FUNCTION	COMMENT
ab	Sets unit type 0	e.g, lx (lux)
ax0	Sets TS1	Password required
ax1	Sets TS2	Password required
ax2	Sets BS	Password required
bx0	Sets TO1	Password required
bx1	Sets TO2	Password required
bx2	Sets BO	Password required
cc	Returns PO	PO = probe offset
cd	Sets cal day	Password required
cm	Sets cal month	Password required
cy	Sets cal year	Password required
c1	Sets PO	Password required
db	Sets unit type 2	e.g, lxs (luxsecond)
dc	Returns AD reading	In the range 0 – 30000
dd	Returns PM	PM = Probe multiplier
d1	Sets PM	Password required
ds	Sets dose mode	

COM-MAND	FUNCTION	COMMENT
dt	Sets time mode	Selects integration time
id	Returns ID	ID = probe data
ka	Returns R0	R0 = Range factor 0
kb	Return R1	R1 = Range factor 1
kc	Return R2	R2 = Range factor 2
kd	Return R3	R3 = Range factor 3
k1	Set R0	Password required
k2	Set R1	Password required
k3	Set R2	Password required
k4	Set R3	Password required
kx0	Return TS1, TS2, TO1 and TO2	Constants of thermistor temperature sensor
kx1	Return BS and BO	Constants for battery voltage A/D channel
mw	Set unit type 3	e.g, fcs (footcandlesecond)
pc	Change password	In display unit EEPROM, 5 characters, old password required
pw	Enter password	To execute commands requiring password
qu	Manual mode	Exit RS232 mode

COM-MAND	FUNCTION	COMMENT
r1	Set probe gain 1	Lowest amplification, least sensitive range
r2	Set probe gain 2	
r3	Set probe gain 3	
r4	Set probe gain 4	Highest amplification, most sensitive range
ra	Autoranging	Enables autoranging
rda	Return RI	RI = instantaneous probe reading
rdd	Return RA	RA = averaged probe reading
re	Set unit type 1	e.g., fc (footcandle)
rx0	Return RT	RT = temperature reading
rx1	Return RB	RB = battery voltage reading
sa	Set absolute zero mode	No return value
sdm	Set meter defaults	Resets meter factory defaults
sdp	Set probe defaults	Resets probe factory defaults
sr	Set relative zero mode	No return value.
ssm	Save current meter settings	To display unit EEPROM

COM-MAND	FUNCTION	COMMENT
ssp	Save current probe settings	To probe EEPROM
sz	Do A/D zero	No return value
tr	Read timer const	Timer constant
ts	Set timer const	Password required