



**PV Remote Unit
A 1378
Instruction manual**
Version 2.4.2, Code no. 20 752 010

Distributor:

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Mark on your equipment certifies that this equipment meets the requirements of the EU (European Union) concerning safety and electromagnetic compatibility regulations

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Table of contents

1	Preface	4
2	Safety and operational considerations.....	5
2.1	Warnings and notes	5
2.2	Battery and charging	5
2.3	Standards applied	7
3	Instrument description.....	8
3.1	Front panel	8
3.2	Connector panel	9
3.3	Back side.....	10
3.4	Battery indication.....	11
3.5	Warnings and messages	11
3.6	Help screens	11
3.7	Backlight and contrast adjustments.....	11
3.8	Measuring probes.....	12
4	Instrument operation.....	13
4.1	Function selection	13
4.2	Settings	13
4.2.1	Language	13
4.2.2	Clear memory.....	14
4.2.3	Irradiance sensor.....	14
4.2.4	Temperature sensors	14
4.2.5	Date and time.....	15
5	Measurements	16
6	Saving of results and synchronization with the instrument.....	18
7	Upgrading the instrument.....	19
8	Maintenance.....	20
8.1	Cleaning	20
8.2	Periodic calibration	20
8.3	Service	20
9	Technical specifications	21
9.1	Irradiance	21
9.2	Temperature (cell and ambient)	21
9.3	General data (PV remote unit).....	21

1 Preface

The PV Remote unit is a professional hand-held accessory intended to perform temperature and solar irradiance measurements.

PV modules and connection terminals for measuring are often not on the same location. For examples PV modules are on the roof and connection terminals are at the inverter inside the building. With the PV Remote environmental parameters can be measured while electrical parameters are measured with the instrument on another location. The clocks of main instrument and PV Remote unit can be synchronized. This enables an easy pooling of data measured at the same time after the tests are finished.


Contemporary measurement of electrical and environmental values is demanded in some standards for calculation of efficiency of PV systems.

The graphic display with backlight offers easy reading of results, indications, measurement parameters and messages.

2 Safety and operational considerations

2.1 Warnings and notes

In order to maintain a high level of accuracy while carrying out various tests and measurements, Metrel recommends keeping your Remote unit in good condition and undamaged. When using the instrument, consider the following general warnings:

- ❑ The  symbol on the instrument means »Read the Instruction manual with special care for safe operation«. The symbol requires an action!
- ❑ Service intervention or adjustment is only allowed to be carried out by a competent authorized personnel!
- ❑ The instrument comes supplied with rechargeable or Ni-MH battery cells. The cells should only be replaced with the same type as defined on the battery compartment label or as described in this manual. Do not use standard alkaline battery cells while the power supply adapter is connected, otherwise they may explode!

2.2 Battery and charging

The instrument uses six AA size alkaline or rechargeable Ni-MH battery cells. Nominal operating time is declared for cells with nominal capacity of 2100 mAh.

Battery condition is always displayed in the lower right display part.

In case the battery is too weak the instrument indicates this as shown in figure 2.1. This indication appears for a few seconds and then the instrument turns itself off.

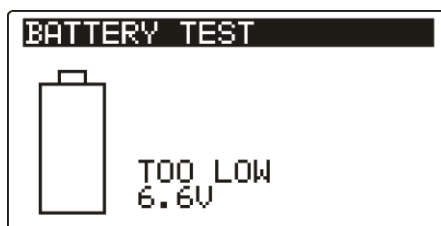


Figure 2-1: Discharged battery indication

The battery is charged whenever the power supply adapter is connected to the instrument. The power supply socket polarity is shown in figure 2.2. Internal circuit controls charging and assures maximum battery lifetime.



Figure 2-2: Power supply socket polarity

The instrument automatically recognizes the connected power supply adapter and begins charging.

Symbols:

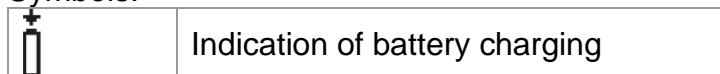



Figure 2-3: Charging indication

Warnings related to safety

- ❑  When connected to an installation, the instrument's battery compartment can contain hazardous voltage inside! When replacing battery cells or before opening the battery/fuse compartment cover, disconnect any measuring accessory connected to the instrument and turn off the instrument,
- ❑ Ensure that the battery cells are inserted correctly otherwise the instrument will not operate and the batteries could be discharged.
- ❑ If the instrument is not to be used for a long period of time, remove all batteries from the battery compartment.
- ❑ Alkaline or rechargeable Ni-MH batteries (size AA) can be used. Metrel recommends only using rechargeable batteries with a capacity of 2100mAh or above.
- ❑ Do not recharge alkaline battery cells!
- ❑ Use only power supply adapter delivered from the manufacturer or distributor of the test equipment to avoid possible fire or electric shock!

Notes:

- ❑ The charger in the instrument is a pack cell charger. This means that the battery cells are connected in series during the charging. The battery cells have to be equivalent (same charge condition, same type and age).
- ❑ One different battery cell can cause an improper behavior of the entire battery pack.
- ❑ Unpredictable chemical processes can occur during the charging of battery cells that have been left unused for a longer period (more than 6 months). In this case Metrel recommends to repeat the charge / discharge cycle at least 2-4 times.
- ❑ If no improvement is achieved after several charge / discharge cycles, then each battery cell should be checked (by comparing battery voltages, testing them in a cell charger, etc). It is very likely that only some of the battery cells are deteriorated.
- ❑ The effects described above should not be confused with the normal decrease of battery capacity over time. Battery also loses some capacity when it is repeatedly charged / discharged. This information is provided in the technical specification from battery manufacturer.

2.3 Standards applied

The unit is manufactured and tested in accordance with the following regulations:

Electromagnetic compatibility (EMC)

EN 61326	Electrical equipment for measurement, control and laboratory use – EMC requirements Class B (Hand-held equipment used in controlled EM environments)
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Safety (LVD)

EN 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements
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Reference standard for photovoltaic systems

EN 62446	Grid connected photovoltaic systems – Minimum requirements for system documentation, commissioning tests and inspection
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Note about EN and IEC standards:

- Text of this manual contains references to European standards. All standards of EN 6XXXX (e.g. EN 61010) series are equivalent to IEC standards with the same number (e.g. IEC 61010) and differ only in amended parts required by European harmonization procedure.

3 Instrument description

3.1 Front panel



Figure 3-1: Front panel

Legend:

1	LCD	128 x 64 dots matrix display with backlight.
2	TEST	Starts / stops measurements.
3	UP/ DOWN	Modifies selected parameter.
4	Function selectors	Selects test function
5	HELP	Help screens.
6	Backlight, Contrast	Changes backlight level and contrast.
7	ON / OFF	Switches the instrument power on or off. <i>The instrument automatically turns off 15 minutes after the last key was pressed.</i>
8	MEM	No function in this version
9	TAB	No function in this version

3.2 Connector panel

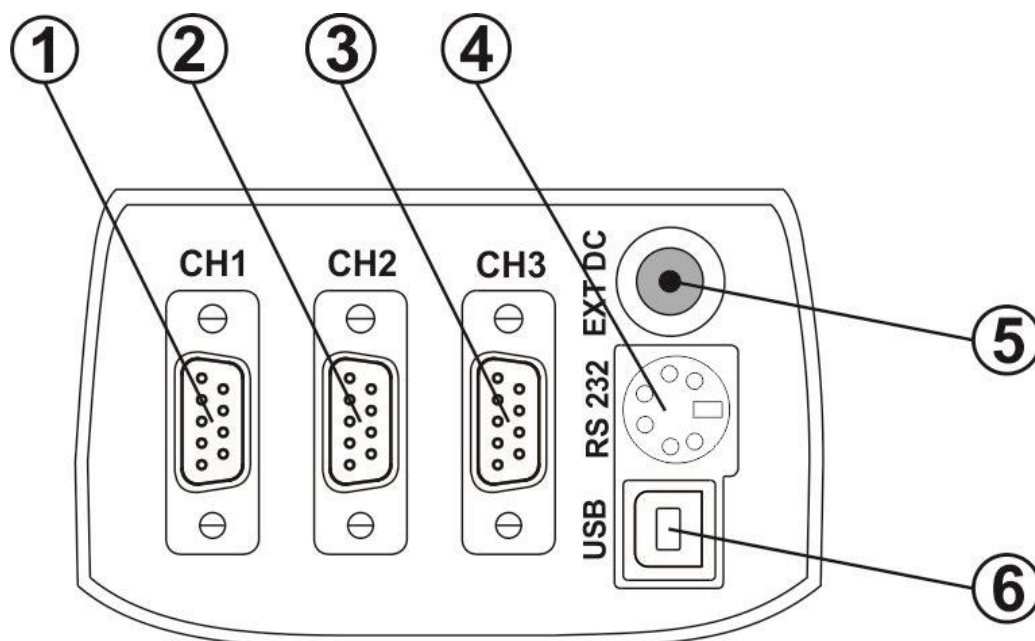


Figure 3-2: Connector panel

Legend:

1	Input 1	Input for measuring Irradiance
2	Input 2	Input for measuring Ambient / Cell temperature
3	Input 3	Input for measuring Cell temperature
4	PS/2 connector	Connection to the measuring instrument Connection to the wireless adaptor
5	Charger socket	
6	USB connector	No function in this version.

Warnings!

- ❑ **Maximum short-term voltage of external power supply adapter is 14 V!**
- ❑ **Maximum short-term voltage on measuring inputs is 12 V!**

3.3 Back side



Figure 3-3: Back side

Legend:

- | | |
|---|--|
| 1 | Side belt |
| 2 | Battery compartment cover |
| 3 | Fixing screw for battery compartment cover |
| 4 | Back panel information label |
| 5 | Holder for inclined position of the instrument |






Figure 3-4: Battery compartment

Legend:

- | | | |
|---|---------------------|---|
| 1 | Battery cells | Size AA, alkaline or rechargeable NiMH / NiCd |
| 2 | Serial number label | |

3.4 Battery indication

The indication indicates the charge condition of battery and connection of external charger.

	Battery capacity indication.
	Low battery. Battery is too weak to guarantee correct result. Replace or recharge the battery cells.
	Recharging in progress (if power supply adapter is connected).

3.5 Warnings and messages

In the message field warnings and messages are displayed.



Measurement is running, consider displayed warnings.

3.6 Help screens

HELP	Opens help screen.
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The Help menu contains diagrams for illustrating how to properly connect the probes and instrument.

Keys in help menu:

UP / DOWN	Selects next / previous help screen.
Function selectors / HELP	Exits help menu.

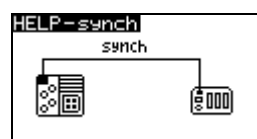
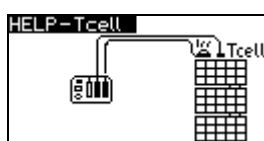


Figure 3-5: Examples of help screens

3.7 Backlight and contrast adjustments

With the **BACKLIGHT** key backlight and contrast can be adjusted.

Click	Toggles backlight intensity level.
Keep pressed for 1 s	Locks high intensity backlight level until power is turned off or the key is pressed again.
Keep pressed for 2 s	Bargraph for LCD contrast adjustment is displayed.

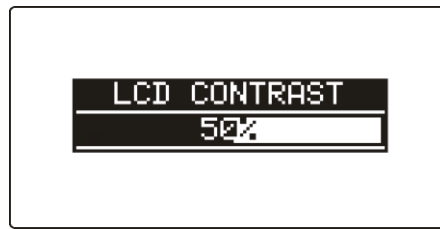


Figure 3-6: Contrast adjustment menu

Keys for contrast adjustment:

DOWN	Reduces contrast.
UP	Increases contrast.
TEST	Accepts new contrast.
Function selectors	Exits without changes.

3.8 Measuring probes

List of compatible measuring probes is available on request from your distributor.

4 Instrument operation

4.1 Function selection

For selecting main functions the **FUNCTION SELECTOR** shall be used.

Keys:

FUNCTION SELECTOR	Select function:
	<ul style="list-style-type: none"> <input type="checkbox"/> <SOLAR> Measurements <input type="checkbox"/> <SETTINGS> Instrument settings.

4.2 Settings

In the **SETTINGS** menu language can be selected, memory can be cleared and irradiance sensor can be configured.

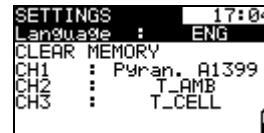


Figure 4-1: Options in Settings menu

Keys:

UP / DOWN	Selects option.
TEST	Enters menu for selecting parameter

4.2.1 Language

In this menu the language can be set.

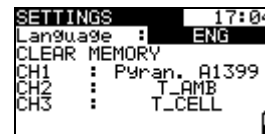


Figure 4-2: Language selection

Keys:

UP / DOWN	Selects language.
TEST	Confirms selected language.

4.2.2 Clear memory

In this menu data logs can be cleared.

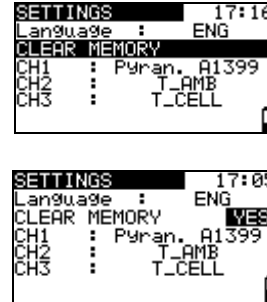


Figure 4-3: Clear memory screens

Keys:

UP / DOWN	Selects option.	
TEST	YES	Confirms memory clear.
	NO	Returns to setting menu without memory clear.

4.2.3 Irradiance sensor

In this menu the type of irradiance sensor can be set.

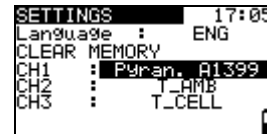


Figure 4-4: Irradiance sensor selection

Supported irradiance sensors:

- ❑ PV cell A 1427: measuring monocrystal PV cell
- ❑ Pyran. A 1399: pyranometer

Keys:

UP / DOWN	Selects type of irradiance sensor.
TEST	Confirms selected sensor.

4.2.4 Temperature sensors

In this menu the use of temperature sensor on Channel 2 can be set.



Figure 4-5: Use of temperature sensor selection

Keys:

UP / DOWN	Selects use of temperature sensor (Ambient or Cell temperature)
TEST	Confirms selected use.

Notes:

- If the temperature sensor on Channel 2 is set as a Cell sensor the mean value of both cell sensors (on Channel 2 and Channel 3) will be considered as the Cell temperature in the instrument.
- Use of two cell temperature sensors can improve the accuracy of the measured cell temperatures and calculated STC results.

4.2.5 Date and time

Time is displayed in the upper right part of the LCD. Refer to chapter *Synchronization* on MI 3108 / MI 3109 Instruction manual for more information

.

5 Measurements

The following environmental measurements can be performed with the Remote unit:

- ❑ Solar irradiance
- ❑ Ambient temperature
- ❑ Cell temperature (using single sensor or two sensors)

Temperature and solar irradiance must be measured:

- ❑ for calculation of nominal PV values at standard conditions.
- ❑ for conversion of solar to electric power of the PV panels.
- ❑ to check that environmental conditions are proper for carrying out the PV tests

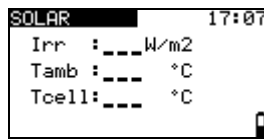


Figure 5-1: Measuring menu

Connections for measuring of environmental parameters

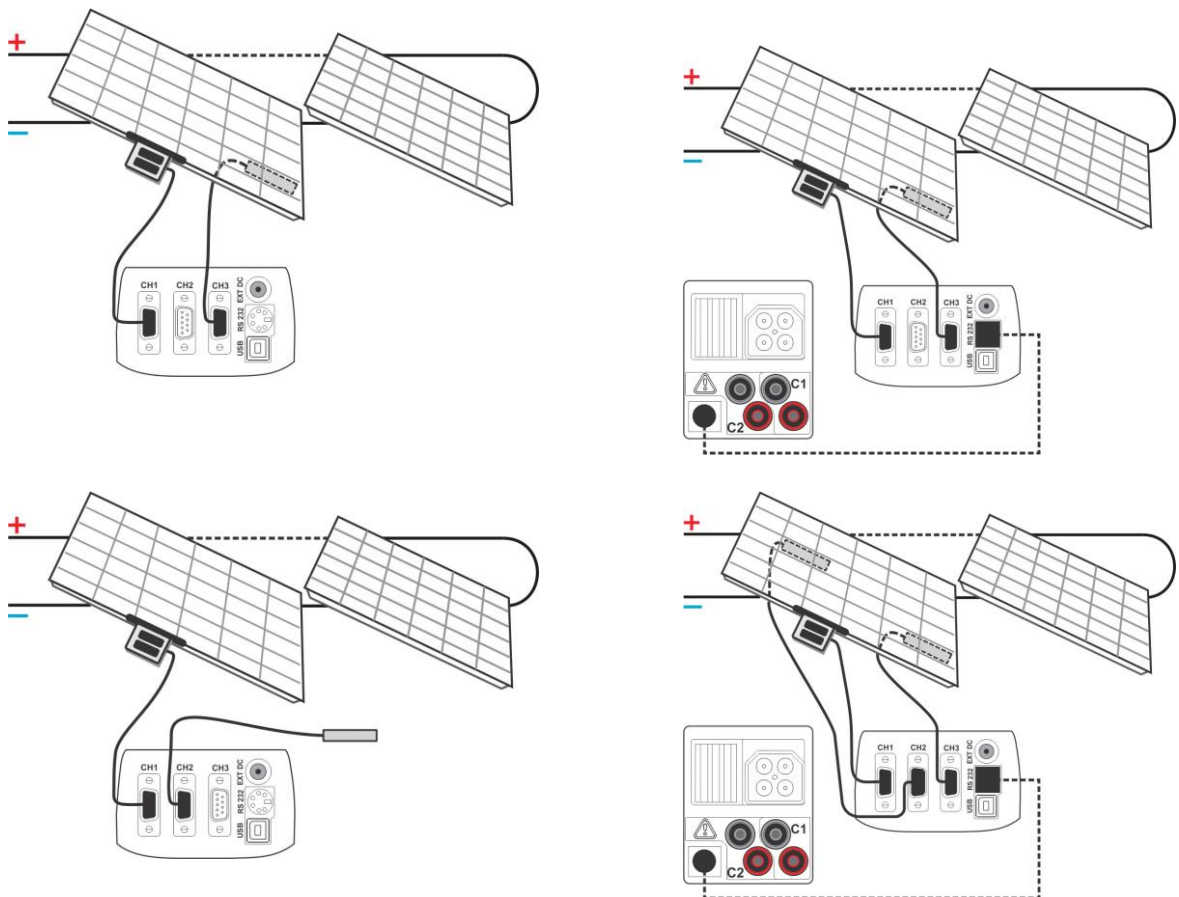


Figure 5-2: Measurement of environmental parameters

Procedure for measuring of environmental parameters

- ❑ Select **SOLAR** function using the function selector switch
- ❑ **Connect** environmental probes to the PV Remote unit
- ❑ **Connect** the probes to the item to be tested (see figure 5.2).
- ❑ **Connect** the PV Remote unit to the instrument (optional)
- ❑ Press the **TEST** key to start the measurement.
- ❑ Press the **TEST** key to stop the measurement.

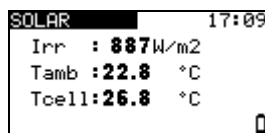


Figure 5-3: Example of results - measurement

Displayed results for environmental parameters:

Irr.....solar irradiance
Tamb.....ambient temperature
Tcell.....cell temperature

Note:

- ❑ If PV Remote unit is connected with the instrument the measured data are sent to the instrument. For more information about this feature refer to MI 3108 / MI 3109 Instruction Manual.
- ❑ If the temperature sensor on Channel 2 is set as a Cell sensor the mean value of both cell sensors (on Channel 2 and Channel 3) will be considered as the Cell temperature in the instrument.

6 Saving of results and synchronization with the instrument

The measured results and time of measurement are automatically stored into the PV Remote unit's memory.

After the measurement the stored results can be synchronized with results in the instrument MI 3108 / MI 3109 that were measured at the same time. The instrument can then calculate correct STC values.

Before the measurements the time and date between the instrument and Remote unit should be synchronized. For more information about this feature refer to MI 3108 / MI 3109 Instruction Manual.

For time and results synchronization the RS232 port on the instrument MI 3108/9 must be connected with the RS232 port on the remote unit. Use the PS/2 to RS232 (female) data cable delivered with the MI 3108/9 and the RS232 (male) to PS/2 cable adapter delivered with A 1378.

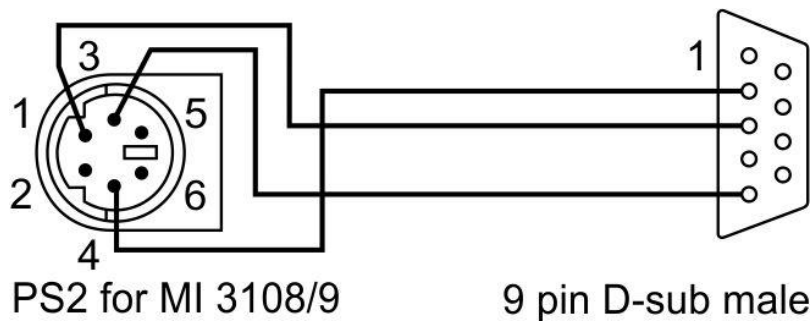


Figure 6-1: Interface connection for the RS232 (male) to PS/2 cable adapter

Connection for synchronization

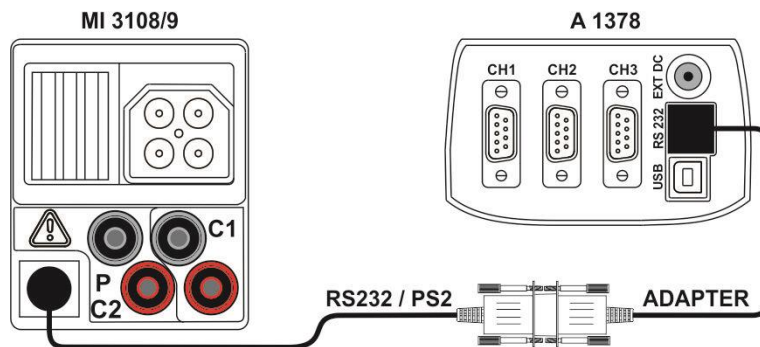


Figure 6-2 Connection of the instruments during synchronization

7 Upgrading the instrument

The instrument can be upgraded from a PC via the RS232 communication port. This enables to keep the instrument up to date even if the standards or regulations change. Please contact your dealer for more information.

8 Maintenance

Unauthorized persons are not allowed to open the PV Remote unit. There are no user replaceable components inside the instrument, except the battery under rear cover.

8.1 Cleaning

No special maintenance is required for the housing. To clean the surface of the instrument use a soft cloth slightly moistened with soapy water or alcohol. Then leave the instrument to dry totally before use.

Warnings:

- ❑ Do not use liquids based on petrol or hydrocarbons!
- ❑ Do not spill cleaning liquid over the instrument!

8.2 Periodic calibration

It is essential that the test instrument is regularly calibrated in order that the technical specification listed in this manual is guaranteed. We recommend an annual calibration. Only an authorized technical person can do the calibration. Please contact your dealer for further information.

8.3 Service

For repairs under warranty, or at any other time, please contact your distributor.

9 Technical specifications

9.1 Irradiance

Probe A 1399

Measuring range	Resolution (W/m ²)	Accuracy
300 ÷ 999 W/m ²	1	± (5 % + 5 digits)
1.00 ÷ 1.75 kW/m ²	10	± 5 %

Measuring principle: Pyranometer

Operation conditions:

Working temperature range -40 °C ÷ 55 °C

Designed for continuous outdoor use.

Probe A 1427

Measuring range	Resolution (W/m ²)	Accuracy
300 ÷ 999 W/m ²	1	± (4 % + 5 digits)
1.00 ÷ 1.75 kW/m ²	10	± 4 %

Measuring principle: Monocrystall PV cell, temperature compensated

Operation conditions:

Working temperature range -20 °C ÷ 55 °C

Protection degree IP 44

9.2 Temperature (cell and ambient)

Probe A 1400

Measuring range (°C)	Resolution (°C)	Accuracy
-10.0 ÷ 85.0	0.1	± 5 digits

Designed for continuous outdoor use.

9.3 General data (PV remote unit)

Power supply voltage..... 9 V_{DC} (6×1.5 V battery or accu, size AA)

Operation..... typical 20 h

Charger socket input voltage 12 V ± 10 %

Charger socket input current 400 mA max.

Battery charging current 250 mA (internally regulated)

Protection degree IP 40

RS232 Baud rate 9600

Number of memorized results: > 3000, circular buffer

In case the instrument gets moistened, the results could be impaired. In such case, it is recommended to dry the instrument and accessories for at least 24 hours.

The error in operating conditions could be at most the error for reference conditions (specified in the manual for each function) $\pm 5\%$ of measured value.

Display 128x64 dots matrix display with backlight

Dimensions (w × h × d) 14 cm × 8 cm × 23 cm

Weight 1.0 kg, without battery cells

Reference conditions

Reference temperature range..... 10 °C ÷ 30 °C

Reference humidity range..... 40 %RH ÷ 70 %RH

Operation conditions

Working temperature range 0 °C ÷ 40 °C

Maximum relative humidity 95 %RH (0 °C ÷ 40 °C), non-condensing

Operation..... Outdoor use

Storage conditions

Temperature range -10 °C ÷ +70 °C

Maximum relative humidity 90 %RH (-10 °C ÷ +40 °C)

80 %RH (40 °C ÷ 60 °C)