



Instruction Manual

METEON 2.0



Declaration of Conformity



Kipp & Zonen B.V.
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The Netherlands

declares under our sole responsibility that the product

METEON 2.0

to which this declaration relates, is in conformity with European Harmonised Standards
as published in the Official Journal of the EU, based on the following standard

IEC/EN 61000-6-1, Class B, RF emission requirements

IEC CISPR 11

EN 55011

IEC/ EN 61326-2-1: 2013

IEC/ EN 61326-2-3: 2013, Class B requirements

IEC/EN 55011

IEC/EN 61326-2-1

IEC/EN 61326-2-3

Delft, January 2019

A handwritten signature in blue ink, appearing to read "E. Valks".

E. Valks^{*} Managing Director
Kipp & Zonen B.V.

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3 NOTES

Reading this entire manual is recommended for a full understanding of this product.



The exclamation mark within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance instructions in the literature accompanying the instrument.

Kipp & Zonen reserve the right to make changes in the specifications without prior notice.

3.1 WARRANTY AND LIABILITY

Kipp & Zonen guarantees that the product delivered has been thoroughly tested to ensure that it meets its published specifications. The warranty included in the conditions of delivery is valid only if the product has been installed and used according to the instructions supplied by Kipp & Zonen. This product is under warranty for 24 months from the date of purchase.

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4 Introduction

The METEON 2.0 is a compact handheld data logger specialized for PV related Solar Radiation measurement. It is supplied in a small carrying case that has also room for a pyranometer with cable. It accepts simultaneously up to 5 Smart and one analog Kipp & Zonen pyranometers plus a Mencke & Tegtmeyer PV panel temperature sensor. An S0 input / output for kWh meter or Inverter pulses and an USB port are present. The large 8 x 22 character display is readable in full sunlight and has back light for low light conditions. The keypad with 7 keys can be used to navigate through the different menus. When using the UBS connection the METEON 2.0 can be set in transparent mode to act as a universal RS-485 interface for the connected Modbus sensors. The Internal batteries (5 x AA) provide the METEON and the Smart radiometers with power. For a M&T temperature sensor an external power supply (12 VDC) has to be connected. The Meteon can measure, display and log up to 8 devices. Depending on the log interval it logs up to weeks of data. Comparison of pyranometers is possible with one as reference instrument. Log files are transferred to the PC via the USB interface. Log data can be visualized and/or exported to a csv file with the free available software. Instruments, time and settings are copied in the header of each file.

5 METEON function overview

The following functions are available in the Meteon.

- Setting of Modbus radiometer communication parameters
- Setting of METEON communication and logging parameters
- Connection of up to 5 Smart and one analog radiometer
- Connection of M&T temperature sensor and kW pulses
- Display of measured values on screen
- Logging of measured values and transfer to PC
- Comparison of 2 pyranometers (DUT and a reference instrument)
- Transparent mode, to act as a RS-485/Modbus to USB converter

5.1 Front view

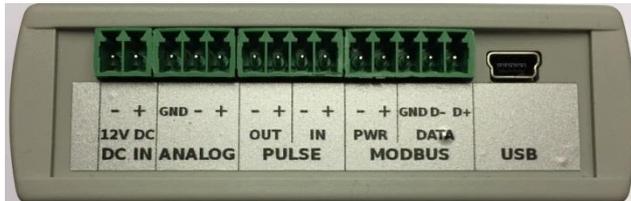


Display 8 x 22 characters with backlight or sunlight view

Keypad with 7 keys with tactile feedback (see keyboard and functions)

Knobs to release the battery compartment latch (see section batteries)

5.2 Top view



All connection are done on the top

The provided connectors have the possibility to tie the cable to the strain relief.



6 Meteon connections

DC IN		ANALOG			PULSE				MODBUS					
12 VDC					OUT		IN		PWR		DATA			USB
-	+	GND	-	+	-	+	-	+	-	+	GND	D-	D+	

6.1 DC IN

Beside batteries the Meteon can be operated on external DC power. When using the Mencke & Tegtmeier temperature sensor this is a must, because it requires 12 VDC.

The DC input can accept 10 – 24 Volt DC, nominal 12 VDC. If DC power is not present or below 10 Volt, the Meteon will switch to battery use.

6.2 Analog

Here an analog radiometer can be connected like CMP11. The GND connection can be used to connect the shield of the radiometer cable.

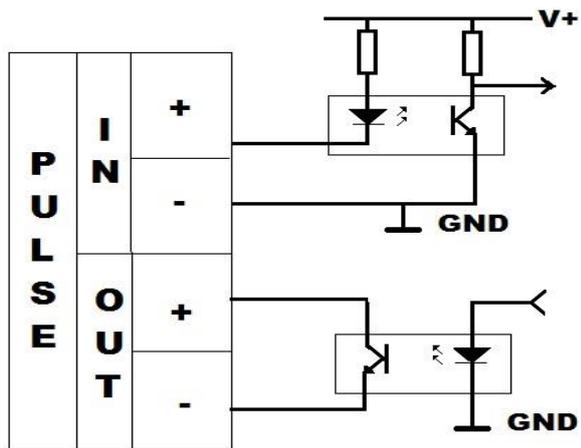
6.3 Pulse

The pulse input connection to relate the incoming radiation to the generated electrical power can be used when your power meter has a so called S0-output. The number of pulses per kWh can be set in

the Pulse input menu. If the energy is generated by a number of PV panels, the number of square meters of your panels can be set as well. In this way the total amount of kWh per m² is calculated. Because only one connection per S0 output can be made, the Meteon also as an output to connect this to a second device, without blocking further use of the S0 port.

Physical connection

Terminal block / Inside Meteon



The S0 outputs (often called S0+, S0- or S+ and S-) have to be connected to the Pulse input of the Meteon. Both pulse in- and output are optically isolated. The input can be tested by connecting the + and – inputs to simulate an input pulse. The picture on the left shows a simplified schematic of the inside of the Meteon.

The nominal Pulse in- and output current is 20 mA [max is 50 mA], and the opto-coupler isolation is 5kV.

6.4 Modbus

On the Modbus input multiple Modbus devices can be connected. Up to 5 Smart radiometers and a M&T temperature sensor. Of course they have to be configured with identical communication settings and different Modbus addresses. The Smart sensors can be powered by the Meteon 2.0 when this option is enabled in the Configuration menu.

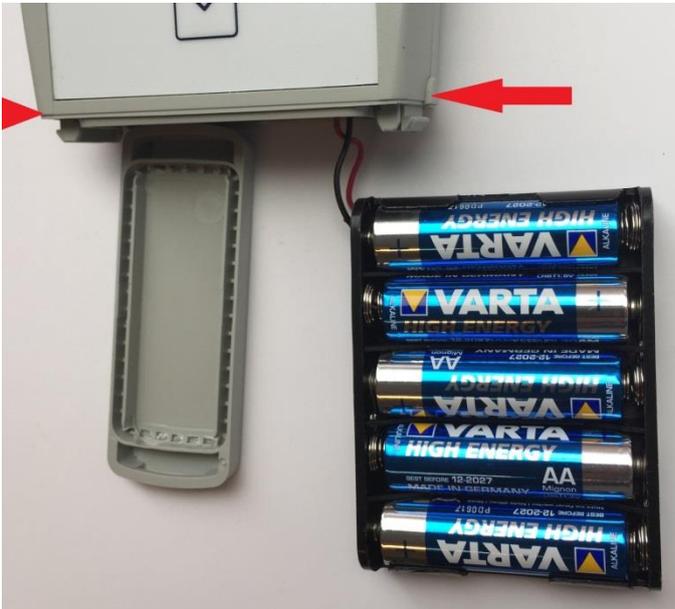
The Modbus Common or Ref connection is connected to the Modbus GND on the METEON

For a K&Z Smart radiometer these connections are:

Radiometer Connection			
Anschluss • Raccordement • Conexión			
Wire Kabel Fil Cable	Function Funktion Fonction Función	Connect with Anschluss an Relier à Conectar con	
3 Green Grün • Vert • Verde	Analogue out	V+/4-20 mA(+)	
6 Brown Braun • Brun • Marrón	Analogue ground	V-/4-20 mA(-)	
4 Yellow Gelb • Jaune • Amarillo	Modbus® RS-485	B/B'+	D+
5 Grey Grau • Gris • Gris	Modbus® RS-485	A/A'-	D-
7 White Weiss • Blanc • Blanco	Power 5 to 30VDC (12V recommended)		PWR +
8 Black Schwarz • Noir • Negro	Power ground		PWR -
1 Red Rot • Rouge • Rojo	None	Not connected	
2 Blue Blau • Bleu • Azul	Modbus® common / Ground		Modbus GND
 Shield Abschirmung Protection Malla	Housing Gehäuse Boîte Cubierta	Ground * Erde Terre Tierra	
* Connect to ground if radiometer not grounded Mit Erde verbinden, wenn das Radiometer nicht geerdet ist Reliez à la terre si le radiomètre n'est pas connecté Conectar a tierra si el radiómetro no lo está			

6.5 Batteries

Changing the batteries can be done by pressing the 2 buttons near the bottom on both sides of the housing (indicated with red arrows) At the same time the lid closing the battery compartment can be pulled off. The last battery becomes visible and the battery holder can be pulled out. Five AA alkaline batteries are required to supply the METEON with 7.5 Volt. When batteries are replaced the holder and lid can be pushed back in place. Make sure the lid clicks properly in place.



6.6 Supplied parts

The Meteon is supplied with

Mounted batteries (5 x AA)

A carrying case with room for a
pyranometer

A calibration certificate

Connectors for the four inputs

Mini USB cable



7 Specifications

Measurement Requirements	Specification
Analog mV range full scale	Suitable for all K&Z radiometers
Analog resolution	0.1W
Basic accuracy after calibration	0.1%
Temperature sensitivity over full temperature range	< 0.5%
Offset drift over full temp range	< 3 μ V
Input circuit	>2M Ω 470 nF
Sampling / filter	1s, 50 / 60 Hz filtering
Logging	1,2,5... s, min, h, aver, min, max
Modbus input	5 x Smart Sensor
RTC accuracy	5 min /y
Logging	Internal memory
Functionality	
Display, logging	Up to 7 sensors
Meteon RS485 port setting	Set communication parameters
Modbus / comm. setting	Set address & comm. (per 1 dev)
Comparison & logging	2 radiation sensors
RS485 to USB	Transparent mode
Design	
PC / Calibration	Via mini USB connector
Sensor connectors	Wago / Phoenix
LCD	Graphic, 8 lines of text, back light Good sunlight readability
Keyboard	Up, Down, Left, Right, OK, On/Off, Back Light
Batteries	5 x AA type
Battery life	>3 days, 3 sensors logging
DC connector	input for DC power supply 10 – 24 V (\pm 10%)
Connected instruments	
Analogue	CM, CMP, CUV, SP-Lite, PQS
Modbus	SMP, SUV, SGR, SHP, PR1, PH1, RT1, M&T
Communication	USB, transparent mode RS-485 to USB
USB	Mini USB, opto isolated

RS485	70V tolerant TVS protection
PC Software	Dedicated PC software to: Visualize - Display actual sensor values - Comparison data - Data graph Calibration of METEON 2.0 Export of csv data
Delivery	METEON 2.0 Carrying case with Room for 1 pyranometer Calibration certificate USB cable Connectors for inputs
Environment / Testing	
Temperature range operating	-10 °C to +40 °C
	< 95% RH non-condensing
Temperature range storage	-20 °C to +50 °C
	< 95% RH non-condensing
Approvals	CE / FCC / RoHS

8 Power consumption

On batteries the METEON consumes 2.5 mA, with back light on this is 12 mA.

Each additional SMP adds 7 mA, So logging of one analog and one smart sensor consumes 9.5 mA. With Alkaline batteries of 2200 mAh this means a lifetime of approximately 230 hour.

Keep in mind that the M&T temperature sensor need a 12V power supply. When the METEON is powered with 12VDC this can be transferred to the Modbus sensors as well.

9 Memory usage

The METEON can store approximately 380.000 values. Per log interval for each radiometer and temperature sensor 3 values are stored (min, max and average). The pulse input stores one value per interval.

Example calculation:

Logging with 2 radiometers and one pulse input connected.

This means logging of $(2 \times 3) + 1 = 7$ values per interval.

With a log interval of 15 seconds this gives $4 \times 7 \times 60 = 1680$ values per hour.

When logging is 24h per day, the memory will last $(380.000 / 40.320)$ for 9.4 days.

10 Menu structure overview

Mode (menu only present when connected to USB)

- PC communication

- Transparent

Configuration

- Modbus settings

- Pulse input

- Temperature sensor

- Analog sensor

- Smart sensors (Channel 1-5)

Measurement

- Start Measurement (without logging)

- Logging

 - Interval (hh:mm:ss)

 - Start

 - Start delay

 - Days, hours

 - Start delayed

 - Erase, % filled

Differential measurement

- Reference sensor

- DUT sensor

- Start

Device setting

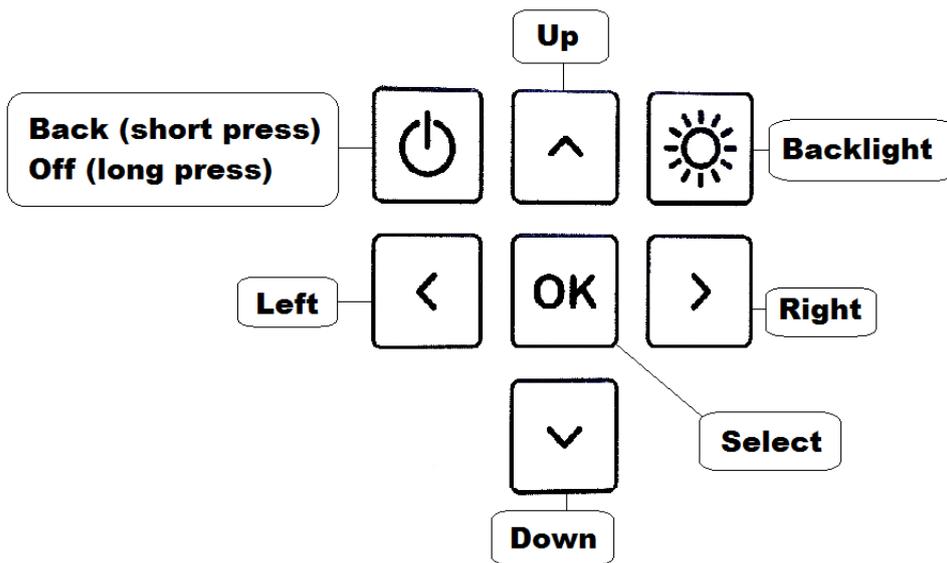
- Language

Date / time

Device info

Calibration date

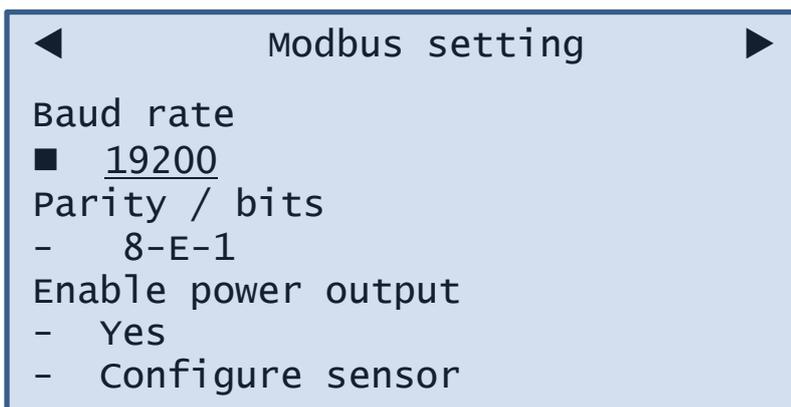
11 Keyboard functions



The On/Off – Back key will turn on the Meeon after a short press and turn off after a long press (>1 second, and only when in top level menu). When on, a short press will go one level up.

The backlight key will toggle the LCD backlight. To save energy the backlight turns off automatically after 30 seconds.

The Left/Right – Up/Down keys will navigate through the available menu options and OK will activate/store the selected value.



If present, the top left and right arrows indicate you can move to the next or previous menu within this level with the Left/Right keys.

Up and down keys will move through the page, indicated by the black square ■.

Pressing OK will select that line and underline the selected value. Up/Down keys will then scroll through the available options. Pressing OK again will select the displayed value. (underline will disappear)

12 Operation mode

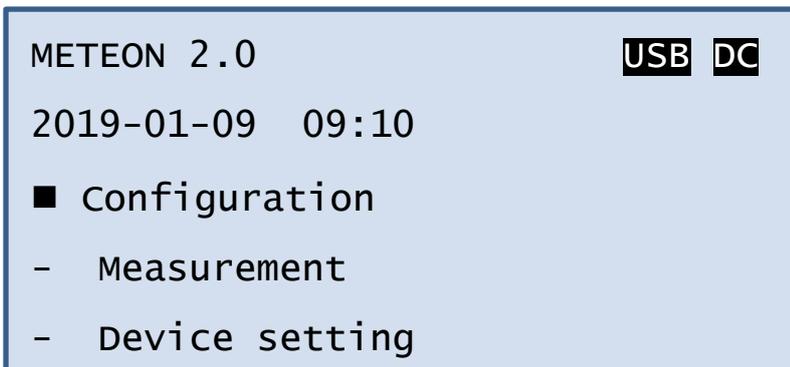
When the USB cable is connected at power on, or during operation and logging is off, the menu asks you to select between:

12.1 PC communication

This sets normal operation with the possibility to use the Meteon 2.0 PC software. See chapter 16 for a detailed description.

12.2 Transparent

This sets the Meteon to act just as an RS485 to USB interface. In this mode the Meteon functionality and Meteon PC software are not functional. However it does allow the use of K&Z Smart sensors such as SMP pyranometers to communicate with the SmartExplorer software. After selecting this option the Meteon asks you if (sensor) power is required from the Meteon, or not. If your radiometer has no other power source, select Yes.



The top line shows USB and DC power connected. When on batteries, the DC indicator is replaced with a battery symbol. 4 lines in the battery symbol means battery is full, 1 line means batteries needs to be replaced. With batteries below 5.5V the Meteon will not start and show battery empty in the start menu.

13 Configuration

13.1 Modbus setting

In the configuration menu the Modbus and sensor settings can be adjusted. Make sure all connected Modbus sensors are enabled, have power, are set to the same communication parameters but have different Modbus addresses. When transferring new settings to a Modbus sensor, only one sensor can be connected.

13.2 Pulse input

Here the number of pulses per kWh can be set. These pulses are normally generated by an inverter or kWh meter that is connected to a number of solar panels that covers $x \text{ m}^2$. In this way the generated energy per m^2 can be calculated and compared with the incoming radiation from the pyranometer. See section Meteon connections how to make the physical connection to the pulse input.

13.3 Temperature sensor

This sets the Modbus address for the Mencke & Tegtmeyer temperature sensor. The Test sensor option let you check the connection and Modbus setting.

13.4 Analog sensor

In this menu an analog sensor can be selected. Selecting the sensor sets the nominal sensitivity, but this has to be adjusted to the value of the connected instrument. Testing this sensor will always pass, but when nothing is connected will give a low or zero reading.

13.5 Smart sensor

Here a maximum of 5 Modbus sensors can be set. Once the Modbus address is set, the Meteon will check what type of Radiometer is connected and show the correct name.

14 Measurement

3 types of measurements can be selected

14.1 Measurement without logging

This menu will show the data from the connected sensors. The Left/Right key will skip through the different sensors if more than one is connected.

The display will show the actual value plus hourly, daily and weekly integrals.

14.2 Logging

During logging the same measurement information screens are displayed but there is one extra Logging active screen that shows the status of the memory and the selected interval. Here also Left/Right keys will skip through the different sensor screens.

14.3 Differential Measurement

This is a special measurement type to compare a reference sensor and a device under test (DUT)

The DUT is compared over a period of time with an identical or better known good sensor to verify the operation and sensitivity (calibration) of the DUT. It is not a real calibration but this test can be used to decide if a calibration is required.

Both the reference sensor and the DUT have to be set in the Configuration menu.

Example of Comparison report

METEON		
COMPARISON		SENSORS
Compare begin	18-2-2019 10:19:23	
Compare finish	18-2-2019 16:06:37	
	Reference sensor	Compared sensor
Sensor model	SMP6	CMP6
Analog sensor sensitivity		12.91
Analog input calibration date		19-9-2018
Digital sensor serial	100003	
Digital sensor calibration date	2-9-2015	
Accumulated Wh/m2	683175.85	673812.749
Result of the comparison (%)	1.4	→ ADD TO REPORT
<pre> Start of compare..... 18-2-2019 10:19:23 End of compare..... 18-2-2019 16:06:37 Reference sensor model..... SMP6 Reference sensor serial..... 100003 Reference sensor calibration date 2-9-2015 Compared sensor model..... CMP6 Compared sensor sensitivity..... 12.91 Analog input calibration date... 19-9-2018 Accumulated Wh/m2 reference..... 683175.85 Accumulated Wh/m2 compared..... 673812.749 Error of compared vs reference... 1.4% ----- </pre>		
		<input type="button" value="Clear"/> <input type="button" value="Copy all"/> <input type="button" value="Print"/>

A good comparison requires the two sensors to be mounted side by side, either horizontal or both the same orientation and angle. No obstructions are allowed and a clear sky is required. For a useful result it takes at least a few hours around noon, but better is to measure a full day. Keep in mind that an outdoor calibration of a pyranometer according to the ISO 9847 standard requires a 2 to 3 days period with clear sky, or longer for cloudy conditions. If a comparison is required where all individual data points are required, a normal logging can be used. The deviation between the two sensors then needs to be calculated afterwards from the downloaded csv file.

15 Device setting

This menu gives the option to set language (at present only English and Dutch are implemented) and set the time and date. Device info gives the serial number, and hardware and firmware versions. Finally the last Meteon calibration date is shown. Also the PC software has an option to transfer PC time and date to the connected Meteon.

16 PC software

For connecting the Meteon 2.0 to the PC, a mini USB cable is supplied. The Software can be downloaded from the METEON 2.0 product page. When connecting it either finds the Meteon 2.0 directly or a COM port has to be selected where to Meteon is connected.

The METEON PC software has the following functionality

Connect and disconnect

Download data and export to CSV file.

Visualize one of the registrations

Check / Edit the pre-defined analog sensor list

Download / upload sensor list to Meteon or file

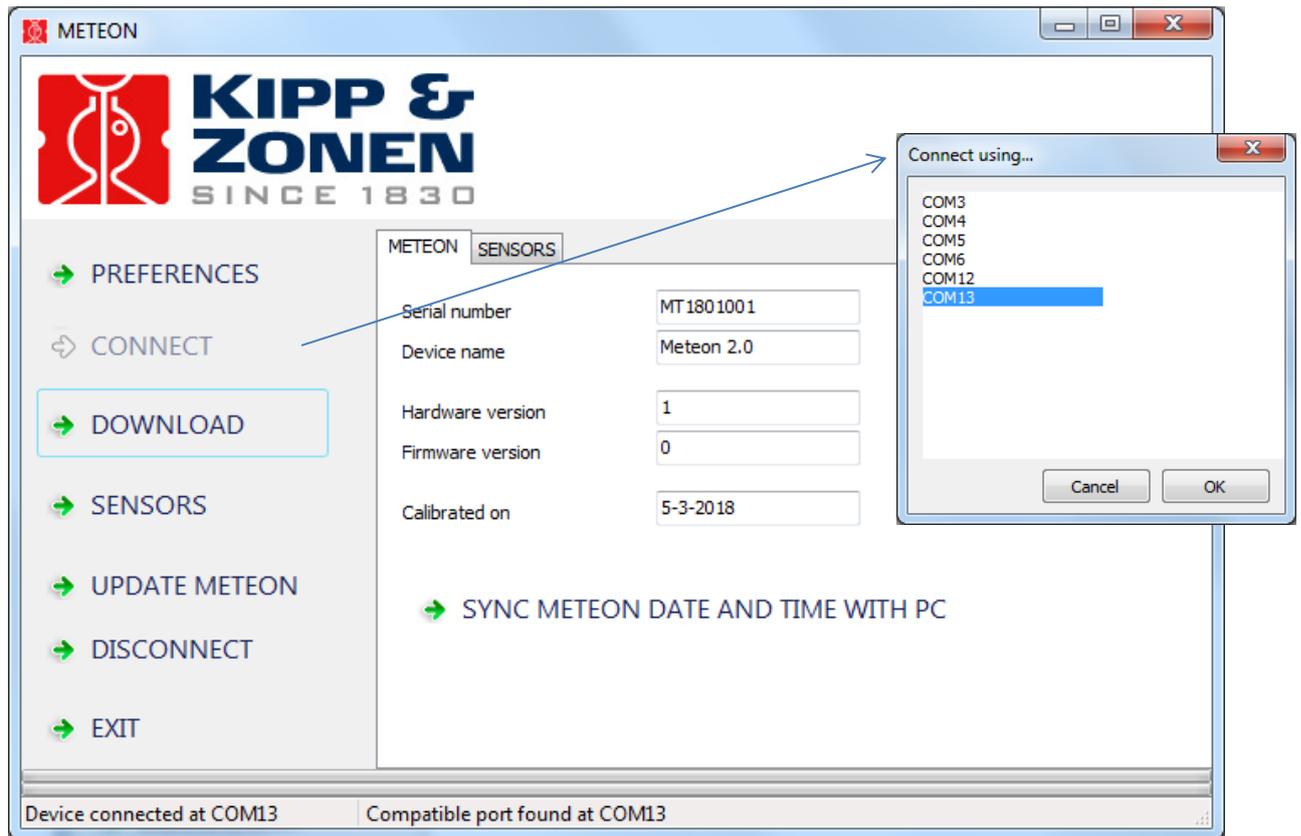
Set the preferences (colors) for graphic visualization

Upload new Firmware to the Meteon

Show Comparison data from 2 sensors

Sync Meteon with PC date and time

16.1 Start Screen

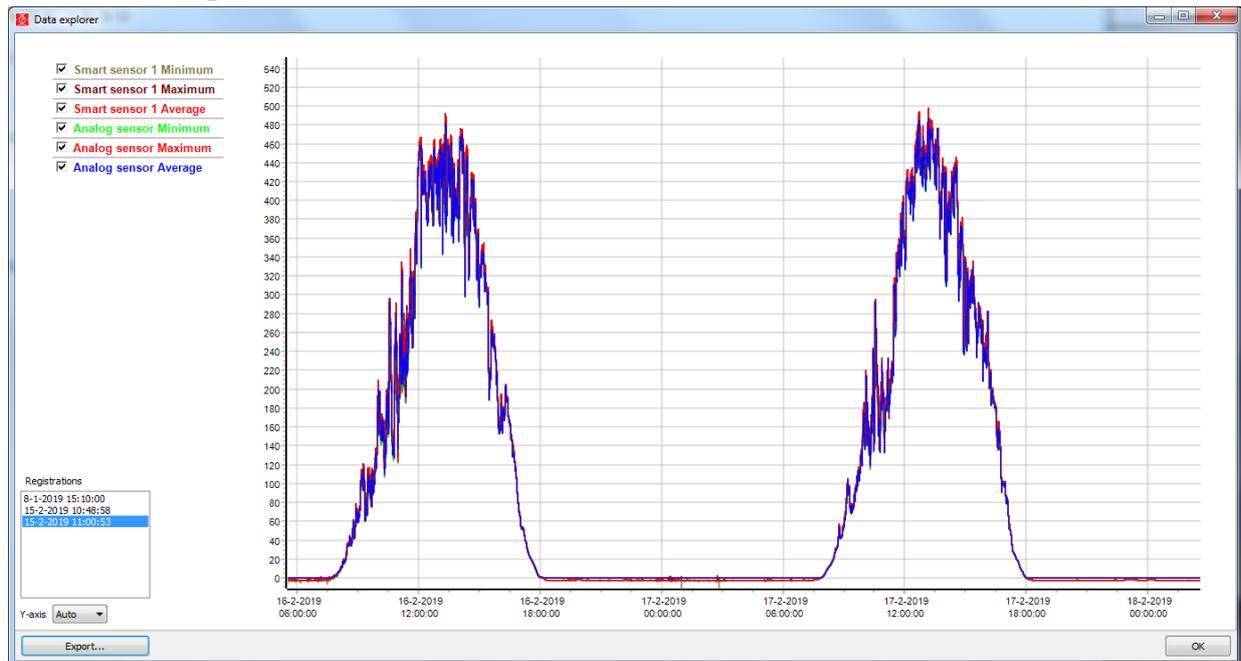


The bottom line of the start screen shows if a Meteon is found on one of the available COM ports, if not, the sub-menu [Connect using..] offers the option to pick one of the available COM ports by hand.

Sync METEON Date and Time with PC, transfers the PC Date and Time settings to the Meteon.

All other menu options are described in the following sections of this chapter.

16.2 Data Explorer screen



When downloading the data from the METEON it is visualized with the above Data Explorer screen.

This graph with auto scaling shows the selected sensors as selected in the top left corner. When sensors are not required they can be deleted with by deleting the checkmarks in the top left section.

In the registration menu (bottom left corner) one of the downloaded registrations can be selected.

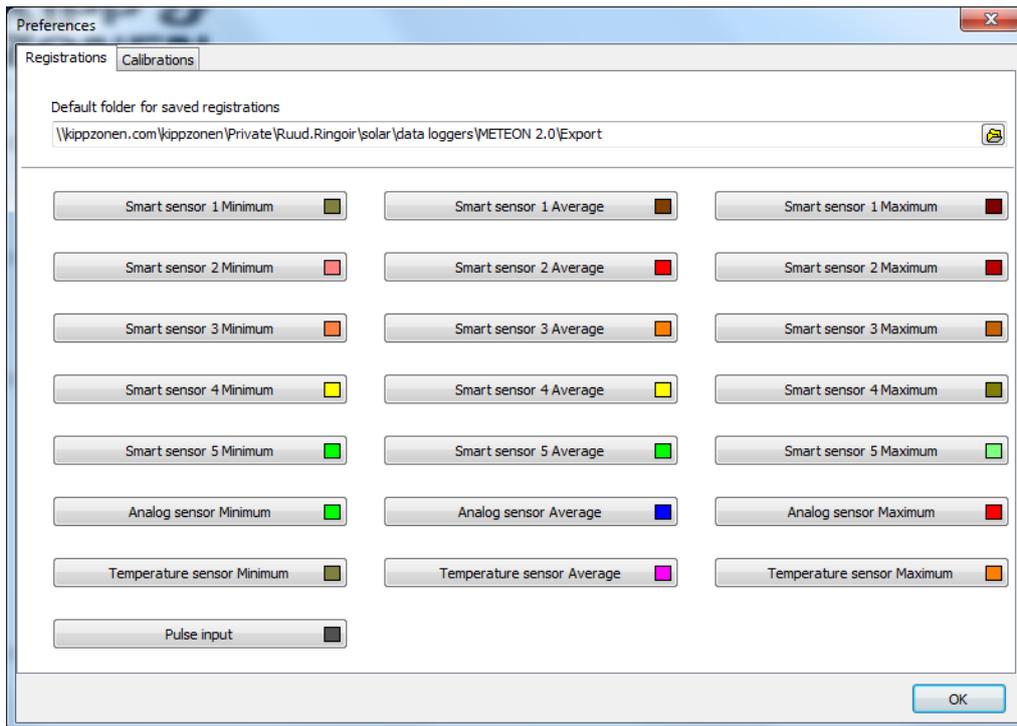
16.3 Export

With export the selected registration can be transferred to the PC in XLS or CSV format.

Registration start date and time		Interval (s)		Number of channels		METEON Serial		METEON calibration date			
6-4-2018 16:32:21		60,00		4,00		MT1801001		5-3-2018			
Sensor model	Serial number	Sensitivity (uV)	Sensor calibrated on	Measured units							
SMP3	120042		18-5-2015	W/m2							
SMP11	999999		19-3-2012	W/m2							
SP Lite2		63900		W/m2							
10 ppkwh @ 1050 m2											
Time	Smart sensor 1			Smart sensor 2			Analog sensor			Pulse input	
	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Pulses	
6-4-2018 16:33:21	2,00	25,22	444,00	1,50	1,76	3,30	0,93	15,55	145,03	0,00	
6-4-2018 16:34:21	1,00	1,56	2,00	1,30	1,53	1,60	0,75	1,24	1,33	0,00	
6-4-2018 16:35:21	0,00	0,16	1,00	1,30	1,38	1,50	1,32	1,33	1,34	0,00	
6-4-2018 16:36:21	-1,00	-0,10	0,00	1,20	1,23	1,30	1,33	1,33	1,35	0,00	
6-4-2018 16:37:21	-1,00	-1,00	-1,00	1,10	1,12	1,20	1,33	1,33	1,35	0,00	
6-4-2018 16:38:21	-1,00	-1,00	-1,00	1,00	1,07	1,10	1,33	1,34	1,35	0,00	
6-4-2018 16:39:21	-2,00	-1,53	-1,00	1,00	1,00	1,00	1,34	1,34	1,36	0,00	
6-4-2018 16:40:21	-2,00	-2,00	-2,00	1,00	1,00	1,00	1,34	1,34	1,35	0,00	
6-4-2018 16:41:21	-2,00	-2,00	-2,00	0,90	0,98	1,00	1,34	1,34	1,35	0,00	

Example of xls import format

16.4 Preferences screen



Here the default folder for downloaded data can be set, as well as the colors used per sensor.

The Calibrations tab to define a location to store calibrations is not used at this moment.

16.5 Sensor list

Supported analog sensors									
Model	Min. sens. (µV)	Max. sens. (µV)	Scalar	Unit	Int. timebase (s)	Integral	nr. of Decimals	Only positive values	Max. Full scale input
CA2	20	50		W/m2	3600	Wh/m2	1	True	2000
CHP1	7	14		W/m2	3600	Wh/m2	1	True	4000
CM11	4	10		W/m2	3600	Wh/m2	1	True	4000
CM3	5	35		W/m2	3600	Wh/m2	1	True	2000
CM4	4	12		W/m2	3600	Wh/m2	1	True	4000
CMP10	7	14		W/m2	3600	Wh/m2	1	True	4000
CMP11	7	14		W/m2	3600	Wh/m2	1	True	4000
CMP21	7	14		W/m2	3600	Wh/m2	1	True	4000
CMP22	7	14		W/m2	3600	Wh/m2	1	True	4000
CMP3	5	25		W/m2	3600	Wh/m2	1	True	2000
CMP6	5	20		W/m2	3600	Wh/m2	1	True	2000
CLV5	300	500		W/m2	3600	Wh/m2	2	True	100
LUX Lite	50	150	k	Lux	3600	Lux.h	2	True	200
NR Lite	10	10		W/m2	3600	Wh/m2	1	False	2000
PAR Lite	4	10	u	E/m2/s	1	E/m2	1	True	10000
PQS1	4	10	u	E/m2/s	1	E/m2	1	True	10000
SP Lite 10uV	10	10		W/m2	3600	Wh/m2	1	True	4000
SP Lite2	10	70		W/m2	3600	Wh/m2	1	True	2000

The above list comes as standard with the METEON but can be edited by the user.

When a new (analog) sensor needs to be added this can be done by pressing the + field and entering the relevant data for this sensor. By clicking in one of the cells, the present data can be altered. With [SAVE TO METEON] the new sensor list can be transferred to the METEON memory. After this upload it will be available in the METEON menu under the available analog sensors.

The options [LOAD FROM FILE] and [SAVE TO FILE] give you the option to save (and load) the sensor list to PC as well. The format is XML.

16.6 Update METEON

If available this screen asks for the location of a "bin" file that contains the new METEON Firmware.

Once loaded it requires a reset and will shows the new functionality afterwards.