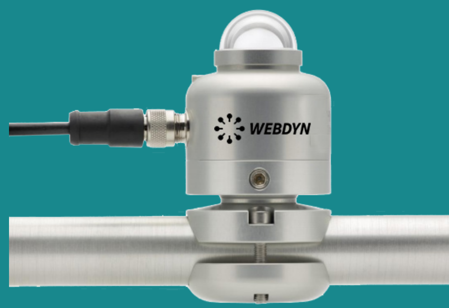
Sens' Pyranometer

Second class pyranometer

Webdyn's Sens' Pyranometer...



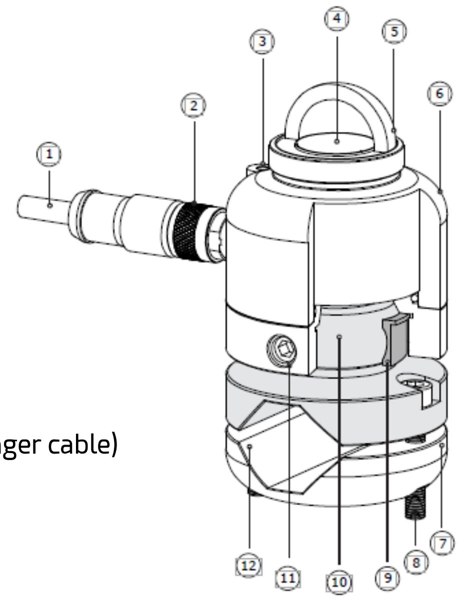
Security Advice - Caution

Putting more than 30 Volt across the sensor wiring of the main power supply can lead to permanent damage to the sensor.

For proper instrument grounding: use the pyranometer with its original factory-made cable. See chapter on grounding and use of the shield.

Using the same Modbus address for more than one device will lead to irregular behaviour of the entire network. Your data request may need an offset of +1 for each pyranometer register number, depending on processing by the network master.

Sensor Principle



(1) Cable (standard length 3 metres, optional longer cable)
(2) Connector
(3) Bubble level
(4) Thermal sensor with black coating
(5) Glass dome
(6) Sensor body
(7) Tube mount (optional)
(8) Mounting screw (included with ball levelling and tube mount; requires 4 mm hex key)
(9) Shim (included with and needed for ball levelling mount)
(10) Ball levelling mount (optional)
(11) Countersunk set screw for levelling adjustment (included with ball levelling mount; requires 4 mm hex key)
(12) Opening for Ø 25 to Ø 40 mm tube when using ball levelling and tube mount

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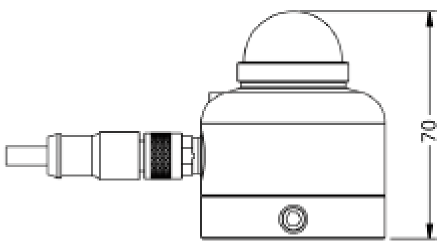
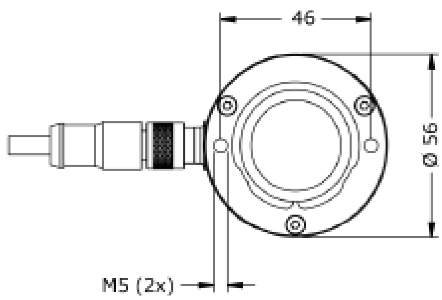
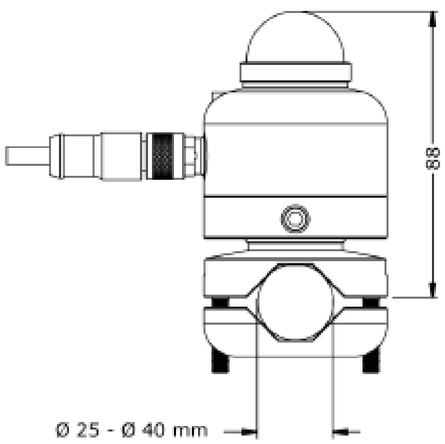
Technical Characteristics

Description	Pyranometer
Measure	Hemispherical solar radiation
ISO classification	Second class pyranometer
Calibration uncertainty	< 1.8% (k=2)
Calibration traceability	WRR
Spectral range	285 to 3000 x 10-9m
Rated operated temperature range	-40 to +80°C
Standard cable length	3m
Rated operated voltage range	5 to 30 VDC
Levelling	Ball levelling
Communication protocol	Modbus over RS485

Dimensions







Installation

Location: the situation that shadows are cast on the instruments is usually not desirable. The horizon should be as free from obstacles as possible. Ideally there should be no objects between the course of the sun and the instrument.

Mechanical mounting/thermal insulation: preferably use the ball levelling mount to mount the pyranometer to a (non-)horizontal surface. A pyranometer is sensitive to thermal shocks. Do not mount the instrument on objects that become very hot (black coated metal plates).

Instrument mounting with 2 bolts: 2 x M5 bolt at 46 mm centre-to-centre distance on north-south axis, connection through the sensor bottom in pyranometer's standard configuration. With ball levelling option: 2 x M5 bolt at 46 mm centre-to-centre distance, connection through ball levelling mount, M5x20 bolts and M5 nuts included. With ball levelling on tube mount option: 2 x M5 bolt at 46 mm centre-to-centre distance, connection through tube and ball levelling mount, M5x30 and M5x40 bolts included.

Performing a representative measurement: the pyranometer measures the solar radiation in the plane of the sensor. This may require installation in a tilted or inverted position. The black sensor surface (sensor bottom plate) should be mounted parallel to the plane of interest. In case a pyranometer is not mounted horizontally or in case the horizon is obstructed, the representativeness of the location becomes an important element of the measurement.

Instrument orientation: by convention with the cable exit pointing to the nearest pole (so the cable exit should point north in the northern hemisphere, south in the southern hemisphere).

Installation height: in case of inverted installation, WMO recommends a distance of 1.5 m between soil surface and sensor (reducing the effect of shadows and in order to obtain good spatial averaging).

Mounting: this pyranometer in its standard configuration is equipped with a visible bubble level and two mounting holes. For easy mounting and levelling on a (non-)horizontal surface:

- Easy cable orientation
- Easy intrument exchange
- Easy mounting (mounting bolts and nuts included)

When using a tube or rod for installing the pyranometer, the optional tube mount is recommended. Combined with ball levelling it allows mounting to a 25 to 40 mm diameter tube with the same ease of levelling and instrument exchange.

From left to right: The pyranometer in its standard configuration with 3 metre cable; with optional ball levelling for easy mounting and levelling on a (non-)horizontal surface; with optional ball levelling and tube mount for easy installation on a 25 to 40 mm diameter tube. Mounting bolts are included with the ball levelling and / or tube mount.

Installing with its ball levelling and tube mount: two M5x20 bolts and two M5 nuts are included with the pyranometer's ball levelling option. These are to be used to mount it with its ball levelling to a (non-) horizontal surface. Two M5x30 bolts and two M5x40 bolts are included with SR05's tube mount with ball levelling. These bolts are to be used to clamp both ball levelling and tube mount to a 25 to 40 mm diameter tube. For tube diameters larger than or equal to 33 mm, use the M5x40 bolts instead of the M5x30 bolts for a secure fit.

The unique ball head mechanism of the pyranometer's ball levelling mount is used to level SR05. When ordering ball levelling with the pyranometer it is delivered attached to it. In that case follow steps 1 to 7 below to mount and level the pyranometer. Make sure the glass dome is protected at all times.
In case the pyranometer is not attached to its ball levelling mount yet, the user has to ensure a shim is placed properly in the centre of the bottom plate of the pyranometer before mounting and levelling. The shim allows smooth levelling and is shown top left. When ordering the pyranometer combined with ball levelling, the shim is already positioned in its place in the factory.

On the left the pyranomer's ball levelling including shim (mounting bolts not displayed) and on the right the pyranometer placed on the ball levelling mount. Loosen the countersunk set screw on the pyranometer's side to unlock, allowing placement of the ball head and its levelling, and tighten it to lock the ball head mechanism. A 4 mm hex key is the only tool needed to place and remove the ball levelling and to allow and disallow levelling adjustment. The shim, included when ordering ball levelling, allows for smooth levelling and should be positioned properly in the centre of the bottom plate of the pyranometer.

- Loosen the pyranometer's countersunk set screw with a 4 mm hex key by turning the hex key counter clockwise until the screw is slightly protruding (sticking out).
- Hold the pyranometer in one hand, the ball levelling mount in the other.
- Separate the pyranometer from the ball levelling mount by gently pulling out the ball levelling mount.
- Mount the ball levelling to a surface or platform with its M5 bolts and nuts. See chapter on tooling required.
- Place the pyranometer on the ball levelling mount pushing the sensor onto the ball head until it clicks.
- The pyranometer can be rotated 360° on its ball head by hand. This rotation allows easy cable orientation adjustment. It can be tilted up to 10°. This allows angle compensation on non-horizontal surfaces up to 10°.
- When the pyranometer is mounted and levelled, judging by its bubble level, lock the ball head mechanism by turning the set screw clockwise with the 4 mm hex key until it is tightened. It is now locked in its position.

A similar approach is followed when levelling the pyranometer on its tube mount in the field :

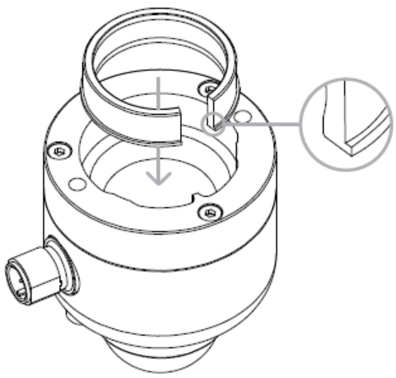
Judge bubble level and cable orientation.

Loosen set screw to tilt and rotate it.

Tighten set screw to lock ball levelling

This is mounted and levelled.

Placing and removing the pyranometer'ball levelling shim: only when ordering the pyranometer and its optional ball levelling separately or when exchanging a pyranometer sensor on a ball levelling mount (retrofitting), the user has to ensure a dedicated shim is placed properly in the centre of the bottom plate of the pyranometer. When ordering the pyranometer combined with ball levelling the shim is already positioned in its place in the factory. The aluminium shim ensures a secure fit between the pyranometer and ball levelling and allows the ball head to rotate smoothly for easy levelling. The shim, a loose set screw, a 4 mm hex key, two M5x20 mounting bolts and two M5 nuts are included when ordering the ball levelling mount separately.



The shim can be placed into the pyranometer's bottom plate following these steps:

- If your pyranometer has a small black plastic cover cap on the countersunk set screw opening on its side, remove it. A small flathead screwdriver may be used. Then insert the loose set screw with a 4 mm hex key by turning the hex key clockwise until the screw is only slightly protruding (sticking out).
- Hold the pyranometer in one hand, the shim in the other.
- Ensure the orientation of the shim fits with that of the pyranometer's bottom plate. Note the position of the protruding ledge.
- Pinch the shim slightly in order to reduce its diameter and to make it fit easily into the pyranometer's bottom plate.
- While pinching, push the shim into its position on the pyranometer's bottom plate. The shim is placed. For mounting and levelling, continue with the following steps:
- Mount the ball levelling with its mounting bolts.
- The pyranometer, with its shim positioned, can now be placed on the ball levelling mount. Gently push the sensor onto the ball head until it clicks.
- The ball head can be rotated 360 ° and allows angle compensation on non-horizontal surfaces up to 10°.
- When the pyranometer is mounted and levelled, judging by its bubble level, lock the ball head mechanism by turning the set screw clockwise with a 4 mm hex key until it is tightened. The set screw should be countersunk and not protruding (not sticking out).

When the ball head is not inserted in the pyranometer, the shim makes a minor rattling noise when moving it. This is caused by mechanical freedom between the parts. The shim can be removed from the pyranometer's bottom plate by hand with the assistance of a small flathead screwdriver. Let the screwdriver gently tip the shim out. When removing or placing the shim, make sure the glass dome is protected at all times.

Electrical connection of pyranometer: wiring diagram: the instrument must be powered by an external power supply, providing an operating voltage in the range from 5 to 30 VDC.
The pyranometer offers irradiance in W/m2 as a digital output (Modbus over RS-485).

PIN	WIRE	Modbus over RS-485
1	Brown	VDC [+]
4	Black	VDC [−]
3	Blue	not connected
2	White	RS-485 B / B' [+]
5	Grey	RS-485 A / A' [−]
	Yellow	shield

Note: at the connector-end of the cable, the shield is connected to the connector housing.

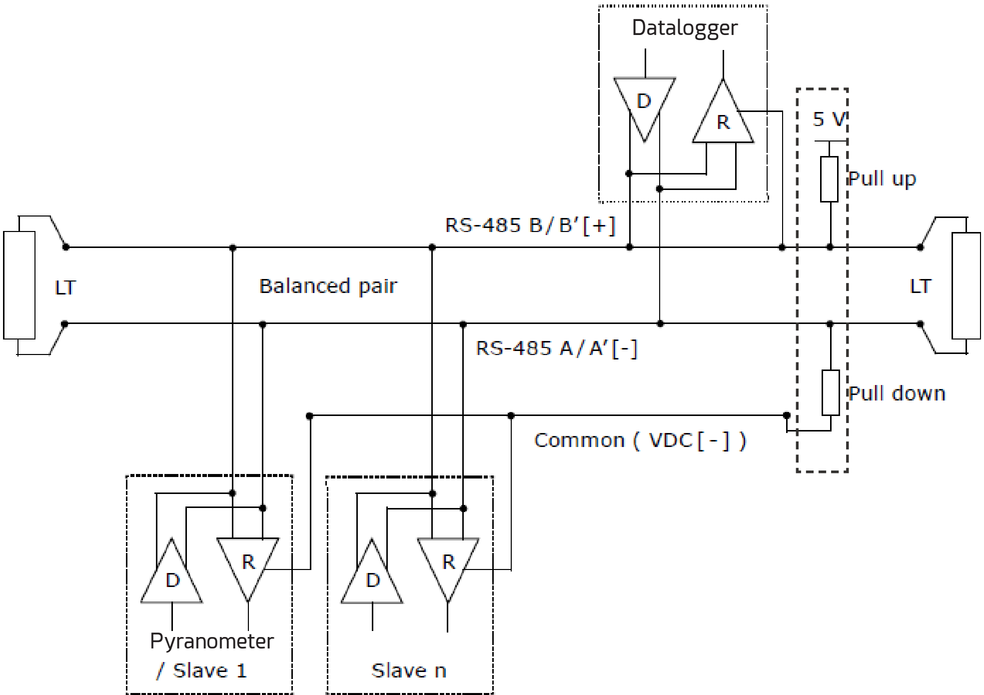
Grounding and use of the shield: grounding and shield use are the responsibility of the user. The cable shield (called shield in the wiring diagram) is connected to the aluminium instrument body via the connector. In most situations, the instrument will be bolted on a mounting platform that is locally grounded. In these cases the shield at the cable end should not be connected at all.

When a ground connection is not obtained through the instrument body, for instance in laboratory experiments, the shield should be connected to the local ground at the cable end. This is typically the ground or low voltage of the power supply or the common of the network.

In exceptional cases, for instance when both the instrument and a datalogger are connected to a small size mast, the local ground at the mounting platform is the same as the network ground. In such cases ground connection may be made both to the instrument body and to the shield at the cable end.

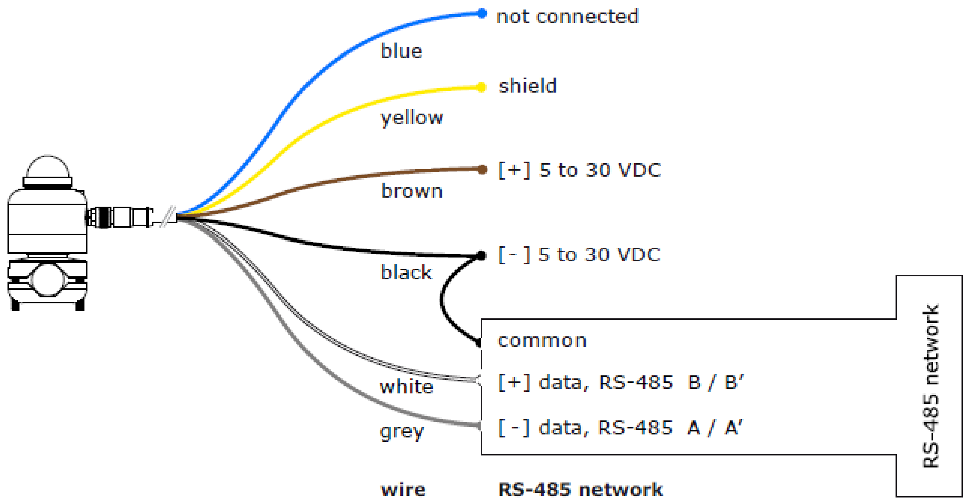
Using the pyranometer's digital output: when using the pyranometer's digital output, it can be connected to an RS-485 network for communication.

Connecting the pyranometer to an RS-485 network: the pyranometer is suited for a two-wire (half-duplex) RS-485 network. In such a network acts as a slave, receiving data requests from the master. An example of the topology of an RS-485 two-wire network is shown in the figure below. The pyranometer is powered from 5 to 30 VDC. The power supply is not shown in the figure. The VDC [-] power supply ground must be connected to the common line of the network.



Typical topology of a two-wire RS-485 network, figure adapted from: Modbus over serial line specification and implementation guide V1.02 (www.modbus.org). The power supply is not shown in this figure.

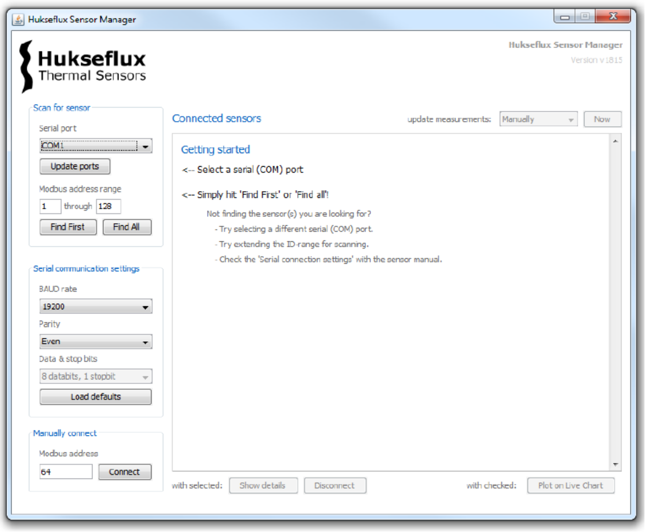
After the last nodes in the network, on both sides, line termination resistors (LT) are required to eliminate reflections in the network. According to the EIA/TIA-485 standard, these LT have a typical value of 120 to 150 Ω. Never place more than two LT on the network and never place the LT on a derivation cable. To minimise noise on the network when no transmission is occurring, a pull up and pull down resistor are required. Typical values for both resistors are in the range from 650 to 850 Ω.



Connection of the pyranometer to an RS-485 network. It is powered by an external power supply of 5 to 30 VDC.

Sensor Management Software

Communication and configuration for Modbus registers with the pyranometer is done via the user interface Sensor Manager that you can download on the pyranometer page on Webdyn website, or by another Modbus testing tool.



Sensor Manager: main window.

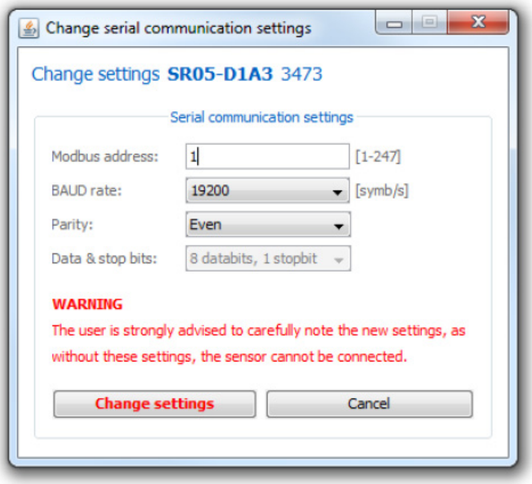
When the Sensor Manager is started and a pyranometer is connected to the PC, the user can communicate with the instrument.

If the instrument address and communication settings are known, the serial connection settings and the Modbus address can be entered directly. Clicking "Connect" will establish contact.
If the instrument address and communication settings are not known, the instrument is found by using the "Find First" or "Find All" function. The Sensor Manager scans the specified range of Modbus addresses, however only using the "Serial connection settings" as indicated on screen. When only one sensor is connected, using "Find First" is suggested because the operation stops when a sensor is found. "Find all" will continue a scan of the complete range of Modbus addresses and may take extra time.

If the “Find First” or “Find all” operation does not find instruments, a dialog box opens, asking to confirm a scan of the address range using all possible communication settings.

The time this operation takes, depends on the address range to be scanned. To complete a scan of 247 addresses will take over 15 minutes. When an instrument is found, a dialog box opens providing its serial number, Modbus address and communication settings. Communicating with the instrument is possible after changing the communication settings and Modbus address in the main window to the values of the instrument, and then clicking “Connect”.

Chaning Modbus address and communication settings: in the “Sensor details” window the “Change serial settings” function opens the “Change serial communication settings” window, as shown in the figure below.



When new communication settings or a new Modbus address are entered, these need to be confirmed by clicking “Change settings”. The instrument will then automatically restart. In case the “Change settings” function is not activated, the original settings remain valid. If the Modbus address is changed, the Sensor Manager will automatically reconnect with the instrument using the new address after restart.

Network Communication: Function Codes, Registers, Coil

Warning: Using the same Modbus address for more than one device will lead to irregular behaviour of the entire network. This chapter describes function codes, data model and registers used in the pyranometer's firmware.

Communication is organised according to the specifications provided by the Modbus Organization.
These specifications are explained in the documents "Modbus application protocol v1.1b" and "Modbus over serial line v1.02". These documents can be acquired free of charge at www.modbus.org.

Supported Modbus function codes

SUPPORTED MODBUS FUNCTION CODES	
FUNCTION CODE (HEX)	**DESCRIPTION**
0x01	Read Coils
0x02	Read Discrete Inputs
0x03	Read Holding Registers
0x04	Read Input Register
0x05	Write Single Coil
0x06	Write Single Holding Register
0x0F	Write Multiple Coils
0x10	Write Multiple Registers

Modbus data model

MODBUS DATA MODEL		
PRIMARY TABLES	**OBJECT TYPE**	**TYPE OF**
Discrete input	Single bit	R
Coil	Single bit	R/W
Input register	16 bit word	R
Holding register	16 bit word	R/W

R = read only, W = write only, R/W = read/write

The instrument does not disinguish between discrete input and coil; neither between input register and holding
register.

Format of data

FORMAT OF DATA	DESCRIPTION
U16	Unsigned 16 bit integer
S16	Signed 16 bit integer
U32	Unsigned 32 bit integer
S32	Signed 32 bit integer
Float	IEEE 754 32 bit floating point format
String	A string of ASCII characters

The data format includes signed and unsigned integers. The difference between these types is that a signed integer passes on negative values, which reduces the range of the integer by half. Up to five 16 bit registers can be requested in one request; if requesting six or more registers, multiple requests should be used.
If the format of data is a signed or an unsigned 32 bit integer, the first register received is the most significant word (MSW) and the second register is the least significant word (LSW).

This way two 16 bit registers are reserved for a 32 bit integer. If the format of data is float, it is a 32 bit floating point operator and two 16 bit registers are reserved as well. Most network managing programs have standard menus performing this type of conversion. In case manual conversion is required, see the appendix on conversion of a floating point number to a decimal number. MSW and LSW should be read together in one request.

This is necessary to make sure both registers contain the data of one internal voltage measurement. Reading out the registers with two different instructions may lead to the combination of LSW and MSW of two measurements at different points in time.

An Unsigned 32 bit integer can be calculated by the formula: (MSW x 216)+LSW = U32. An example of such a calculation is available in the paragraph "Network communication: example master request to pyranometer".

Modbus registers 0 to 11

MODBUS REGISTERS 0-11				
REGISTER ADDRESS	**PARAMETER**	**DESCRIPTION OF CONTENT**	**TYPE OF**	**FORMAT OF DATA**
0	Modbus address	Sensor address in Modbus network, default = 1	R/W	U16
1	Serial communication settings	Sets the serial communication, default = 5	R/W	U16
2 + 3	Irradiance	signal in x 0.01 W/m²	R	S32
4 + 5	Factory use only			
6	Sensor body temperature	In x 0.01 °C	R	S16
7	Sensor electrical resistance	In x 0.1 Ω	R	U16
8	Scaling factor irradiance	Default = 100	R	U16
9	Scaling factor temperature	Default = 100	R	U16
10 + 11	Sensor voltage output	In x 10^{-9} V	R	S32
12 to 31	Factory use only			

Register 0, Modbus address, contains the Modbus address of the sensor. This allows the Modbus master to detect the slave, the pyranometer, in its network. The address can be changed; the value of the address must be between 1 and 247. The default Modbus address is 1.

Note: The sensor needs to be restarted before changes become effective.

Register 1, Serial communication settings, is used to enter the settings for baud rate and the framing of the serial data transfer. Default setting is setting number 5: 19200 baud, 8 data bits, even parity and 1 stop bit. Setting options are shown in the table below. Note: The sensor needs to be restarted before changes become effective.

Setting options of register 1

SETTING OPTIONS				
SETTING NUMBER	**BAUD RATE**	**DATABITS**	**STOPBITS**	**PARITY**
1	9600	8	1	none
2	9600	8	1	even
3	9600	8	1	odd
4	19200	8	1	none
5 (= default)	19200	8	1	even
6	19200	8	1	odd
7	38400	8	1	none
8	38400	8	1	even
9	38400	8	1	odd
10	115200	8	1	none
11	115200	8	1	even
12	115200	8	1	odd

Register 2 + 3, Irradiance, provides the solar radiation output in 0.01 W/m². The value given must be divided by 100 to get the value in W/m². MSW and LSW should be read together in one request.

Register 6, Instrument body temperature, provides the temperature of the instrument body in 0.01 °C. The data must be divided by 100 to achieve the value in °C.

Register 7, Sensor electrical resistance, sensor resistance in 0.1 Ω. The data needs to be divided by 10 to get the value in Ω. This register returns a 0 by default. To read the resistance, first a measurement has to be performed. This can be done by writing 0xFF00 to coil 2. Hukseflux recommends to use this function only when necessary for diagnostics in case of sensor failure.

Register 8, Scaling factor irradiance, default scaling factor is 100

Register 9, Scaling factor temperature, default scaling factor is 100.

Register 10 + 11, Sensor voltage output, sensor voltage output signal of the thermopile in x 10-9 V.

Modbus registers 32 to 62, sensor and calibration information

MODBUS REGISTERS 32-62				
REGISTER ADDRESS	**PARAMETER**	**DESCRIPTION OF CONTENT**	**TYPE OF**	**FORMAT OF DATA**
32 to 35	Sensor model	Part one of sensor description	R	String
36 to 39	Sensor model	Part two of sensor description	R	String
40	Sensor serial number		R	U16
41 + 42	Sensor sensitivity	In x 10^{-6} V/(W/m^2)	R	Float
43	Response time	In x 0.1 s	R	U16
44	Sensor resistance	In x 0.1 Ω	R	U16
45	Reserved	Always 0	R	U16
46 + 47	Sensor calibration date	Calibration date of the sensor in YYYYMMDD	R	U32
48 to 60	Factory use			
61	Firmware version		R	U16
62	Hardware version		R	U16

Registers 32 to 39, Sensor model, String of 8 registers. These registers will return 8 numbers which can be decoded to find the sensor model name. Sensors with serial number 3819 or higher and sensors with serial number 3524 or higher use method A for storing the name in these registers. Sensors with lower serial numbers than these use method B. Method A and B are explained in Appendix 9.12 of this manual.

Register 40, Sensor serial number.

Register 41 + 42, Sensor sensitivity, the sensitivity of the sensor in x 10-6 V/(W/m²). Format of data is float.

Register 43, Response time, the response time of the sensor as measured in the factory in x 0.1 s. The value must be divided by 10 to get the value in s.

Register 44, Sensor electrical resistance, returns the electrical resistance measured during the sensor calibration. The resistance is in x 0.1 Ω and must be divided by 10 to get the value in Ω.

Register 46 + 47, Sensor calibration date, last sensor calibration date, from which the sensitivity in register 41 and 42 was found, in YYYYMMDD.

Register 61, Firmware version.

Register 62, Hardware version.

Modbus registers 63 to 82, calibration history

MODBUS REGISTERS 63-82				
REGISTER ADDRESS	**PARAMETER**	**DESCRIPTION OF CONTENT**	**TYPE OF**	**FORMAT OF DATA**
63 + 64	Sensor sensitivity history 1	In x 10^{-6} V/(W/m^2) Default value is 0	R	Float
65 + 66	Calibration date history 1	Former calibration date of the sensor in YYYYMMDD Default value is 0	R	U32
67 + 68	Sensor sensitivity history 2	See register 63 + 64	R	Float
69 + 70	Calibration date history 2	See register 65 + 66	R	U32
71 + 72	Sensor sensitivity history 3	See register 63 + 64	R	Float
73 + 74	Calibration date history 3	See register 65 + 66	R	U32
75 + 76	Sensor sensitivity history 4	See register 63 + 64	R	Float
77 + 78	Calibration date history 4	See register 65 + 66	R	U32
79 + 80	Sensor sensitivity history 5	See register 63 + 64	R	Float
81 + 82	Calibration date history 5	See register 65 + 66	R	U32

Register 63 to 82: Only accessible for writing by Sensor Manager power users: power users can write calibration history to registers 63 to 82.

If default values are returned, no re-calibration has been written. Last calibration sensitivity and calibration date are available in register 41 + 42 and 46 + 47 respectively.

Please note that if your data request needs an offset of +1 for each register number, depending on processing by the network master, this offset applies to coils as well.

Coils

COILS				
COIL	**PARAMETER**	**DESCRIPTION**	**TYPE OF**	**OBJECT TYPE**
0	Restart	Restart the sensor	W	Single bit
1	Reserved			
2	Check	Measure sensor electrical resistance	W	Single bit

Coil 0, Restart, when 0xFF00 is written to this coil the sensor will restart. If applied, a new Modbus address or new serial settings will become effective.

Coil 2, Check, when 0xFF00 is written to this coil the internal electronics will measure the electrical resistance of the thermopile. After the measurement, a new value will be written into register 7.

Requesting to write this coil with a high repetition rate will result in irregular behaviour of the sensor; the check must be executed as an exceptional diagnostics routine only.

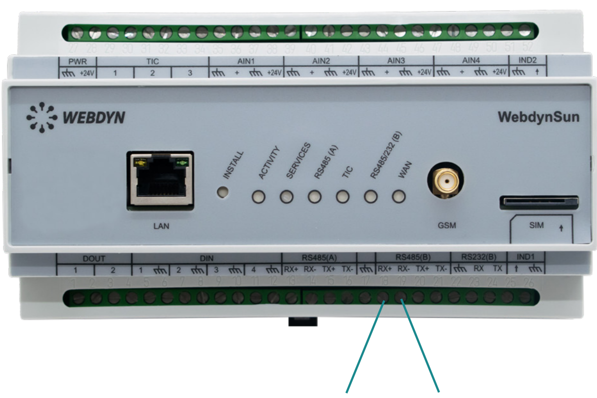
Interconnection with WebdynSun

Electrical Wiring

The AC1401-01 Pyranometer is connected to the WebdynSun on the RS485 port dedicated to Modbus devices, ie the RS485 port (B). It is connected in 2 wires and therefore requires an RX / TX loopback on the WebdynSun.

Pyranometer AC1401-01		WebdynSun		
Signal	Wires	Description	Signal	Bornes
[+] data B	white	DATA +	RS485 (B) RX+	18
[-] data A	grey	DATA -	RS485 (B) RX-	19
		Rebouclage 2 fils Relier sur RX+ (broche 18)	RS485 (B) TX+	21
		Rebouclage 2 fils Relier sur RX- (broche 19)	RS485 (B) TX-	22
[+] 5 à 30V (*)	brown	Power (+)	+24V	38, 42, 46 ou 50
[-] 5 à 30V	black	Power (-)	GND	37, 41, 45 ou 49

Example of bornes:



Borne 18 Borne 19

Configuration and Data Exploitation

In order to be taken into account in the configuration of your WebdynSun, the accessory must be set correctly in the configuration files of this one. This setting can be manual or via a portal depending on the portal used. It consists in modifying on your FTP server the acquisition file IDsite_daq.ini by inserting or modifying the following parameters:

IDsite_daq.ini configuration file (Please refer to the WebdynSun user manual for more details).

```
MODBUS_Mode=1
MODBUS_BaudRate=19200
MODBUS_Parity=1
MODBUS_DataBit=8
MODBUS_StopBit=1

MODBUS_Addr[0]=1
MODBUS_Name[0]=Pyranometer 1
MODBUS_FileDefName[0]=WEBDYN_AC1401-01.ini
MODBUS_Interface[0]=0
```

The definition file associated with the AC1401-01 pyranometer is described below.
This file must be made available to the WebdynSun via the FTP server (refer to the WebdynSun user manual for more details).

Definition file WEBDYN_AC1401-01.ini

```
Modbus_RequestsTables={
# Description des champs
# reqIndex;reqName;reqReadFctCode;reqWriteFctCode;reqStartRegister;reqNbRe-
gisters;reqEnableReading;reqEnableWritting;reqOption1;reqOption2
1;Req_1;3;16;0;2;1;2;0;0
2;Req_2;3;0;2;2;1;2;0;0
3;Req_3;3;0;6;1;1;2;0;0
4;Req_4;3;0;7;1;1;2;0;0
5;Req_5;3;0;8;1;1;2;0;0
6;Req_6;3;0;9;1;1;2;0;0
7;Req_7;3;0;10;2;1;2;0;0
8;Req_8;3;0;32;4;1;2;0;0
9;Req_9;3;0;36;4;1;2;0;0
10;Req_10;3;0;40;1;1;2;0;0
11;Req_11;3;0;41;2;1;2;0;0
12;Req_12;3;0;43;1;1;2;0;0
13;Req_13;3;0;44;1;1;2;0;0
14;Req_14;3;0;46;2;1;2;0;0
15;Req_15;3;0;61;1;1;2;0;0
16;Req_16;3;0;62;1;1;2;0;0
17;Req_17;3;0;63;2;1;2;0;0
18;Req_18;3;0;65;2;1;2;0;0
19;Req_19;3;0;67;2;1;2;0;0
20;Req_20;3;0;69;2;1;2;0;0
21;Req_21;3;0;71;2;1;2;0;0
22;Req_22;3;0;73;2;1;2;0;0
23;Req_23;3;0;75;2;1;2;0;0
24;Req_24;3;0;77;2;1;2;0;0
25;Req_25;3;0;79;2;1;2;0;0
26;Req_26;3;0;81;2;1;2;0;0
}
```

```
Modbus_VariablesTables={
# Description des champs
# varIndex;varReqIndex;varName;varType;varSigned;varPosition;varOption1;va-
rOption2;varCoeffA;varCoeffB,varUnit,varAction;
# measurements
1;1;Modbus address;3;2;1;;;1;0;-;1
2;1;Serial communication settings;3;2;2;;;1;0;-;1
#1 :  9600  ,8,1,none
#2 :  9600  ,8,1,even
#3 :  9600  ,8,1,odd
#4 :  19200 ,8,1,none
#5 :  19200 ,8,1,even               ( = default)
#6 :  19200 ,8,1,odd
#7 :  38400 ,8,1,none
#8 :  38400 ,8,1,even
#9 :  38400 ,8,1,odd
#10:  115200,8,1,none
#11:  115200,8,1,even
#12:  115200,8,1,odd
3;2;Irradiance;5;1;1;;;0.01;0;W/m2;4
4;3;Sensor body temperature;3;1;1;;;0.01;0;C;4
5;4;Sensor electrical resistance;3;2;1;;;0.1;0;Ohm;4
6;5;Scaling factor irradiance;3;2;1;;;1;0;-;4
7;6;Scaling factor temperature;3;2;1;;;1;0;-;4
8;7;Sensor voltage output;5;1;1;;;1;0;uV;4
# sensor and calibration information
9;8;Sensor model part1;9;1;1;;;1;0;-;1
10;9;Sensor model part2;9;1;1;;;1;0;-;1
11;10;Sensor serial number;3;2;1;;;1;0;-;4
12;11;Sensor sensitivity;7;1;1;;;0.001;0;mV/(W/m2);1
13;12;Response time;3;2;1;;;0.1;0;s;1
14;13;Sensor resistance;3;2;1;;;0.1;0;Ohm;1
15;14;Sensor calibration date;5;2;1;;;1;0;-;1
16;15;Firmware version;3;2;1;;;1;0;-;1
17;16;Hardware version;3;2;1;;;1;0;-;1
# calibration history
18;17;Sensor sensitivity history 1;7;1;1;;;0.001;0;mV/(W/m2);1
19;18;Calibration date history 1;5;2;1;;;1;0;-;1
20;19;Sensor sensitivity history 2;7;1;1;;;0.001;0;mV/(W/m2);1
21;20;Calibration date history 2;5;2;1;;;1;0;-;1
22;21;Sensor sensitivity history 3;7;1;1;;;0.001;0;mV/(W/m2);1
23;22;Calibration date history 3 ;5;2;1;;;1;0;-;1
24;23;Sensor sensitivity history 4;7;1;1;;;0.001;0;mV/(W/m2);1
25;24;Calibration date history 4;5;2;1;;;1;0;-;1
26;25;Sensor sensitivity history 5;7;1;1;;;0.001;0;mV/(W/m2);1
27;26;Calibration date history 5;5;2;1;;;1;0;-;1
}
```

References

PRODUCTS

- Sens' Pyranometer - Second Class Pyranometer **AC1401-01**