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Solar Irradiation Sensor (Modbus RS485 Output) - Operation and Installation Manual
Models –MBMet-500AB, MBMet-500BB, MBMet-500CB and MBMet-500DB

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(Suitable for HW Version-101 and SW Version – 101)

Contents

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1. Warnings

- Installation at site should be done by skilled and qualified personal after taking required approvals.
- Use proper protection gear and tool while installing the device.
- Be aware of your surroundings while doing the installation work.
- Serious injury can occur if proper safety norms are not followed.
- Compliance with all utility and electrical safety codes regulations are mandatory.
- Read the manual and get acquainted with the senor connections and terminals before commencing installation activity.
- Before connecting the sensor system, read its label to confirm power supply requirements.
- All connections should be done only when power to the sensor is switched off.
- Improper installation and connections may damage the device and sensor connected to the same.
- Protect from overvoltage and static electricity.
- Physically damaged sensors should not be used or connected to main power.
- Use proper earth connection.
- **Use proper size screwdriver (tools) and cable for connection else the terminals might get damaged.**

2. Technical Specifications Solar Irradiation Sensor

Technical specifications for the Solar Irradiation sensor are provided in table-2.1 below.

Model/ Parameters	MBMet-500AB	MBMet-500BB	MBMet-500CB	MBMet-500DB
Output signal	RS485 Modbus			
Sensor	Silicon			
Power Supply	9-32 VDC			
Power Consumption	100mW			
Solar Irradiation				
Range	0-1500 W/m2			
Accuracy	±5 W/m2 ±3 % of reading			
Resolution	1			
Response Time	2-3 seconds			
Stability	0.5% per annum			
Cell Temperature				
Range	-40 to 90^{0}C			
Accuracy	±0.3% FS			
Resolution	0.1			
Response Time	2-3 seconds			
Ambient Air Temperature (Integrated Sensor)				
Sensor Type	-	RTD- PT100	-	-
Range	-	-40 to 90^{0}C	-	-
Accuracy	-	±0.3% FS	-	-
Resolution	-	0.1	-	-
Response Time	-	3-5 seconds	-	-
Ambient Air Temperature (External Sensor with three meters silicon cable)				
Sensor Type	-	-	RTD- PT1000	-
Range	-	-	-40 to 90^{0}C	-
Accuracy	-	-	±0.3% FS	-
Resolution	-	-	0.1	-
Response Time	-	-	3-5 seconds	-
PV Module Temperature (External Sensor with three meters silicon cable)				
Sensor Type	-	-	-	RTD- PT1000
Range	-	-	-	-40 to 90^{0}C
Accuracy	-	-	-	±0.3% FS
Resolution	-	-	-	0.1
Response Time	-	-	-	4-6 seconds

Table-2.1: Technical specifications

General specifications are provided in table 2.2 below:

Parameter	Specification
Irradiation Sensor Enclosure	Cast Aluminum
Ingress Protection	IP65
Irradiation Sensor Enclosure Size	120 (L) x 76 (W) x 65 (H) mm
Weight	350 grams (approx.)
Mounting clamp (suitable for mounting on PV module side)	SS 304
Cable terminals	1.5 sq. mm. copper
Integrated Ambient Temperature Sensor	40mm x 4mm (SS304)
Cable glands (EMC protected)	M12x1.5mm
Ambient operating temperature	-30 to 70^{0}C
Ambient operating humidity	0 to 99% RH

Table -2.2: General specifications

3. Parts of Solar Irradiation Transducer

Details of parts shipped along with Solar Irradiation Transducer are provided in table 3.1 below.

Mark in Fig	Description	MBMet-500AB (Fig 3.1)	MBMet-500BB (Fig 3.2)	MBMet-500CB (Fig 3.3)	MBMet-500DB (Fig 3.4)
1	Transducer	01	01	01	01
2	Temperature sensor	NA	Integrated PT100	External Ambient PT1000	External PV Module PT1000
3	SS Spring Clip for Temperature sensor mount	NA	NA	01	NA
4	Mounting Plate (SS-304)	01	01	01	01
5	M5 X 32mm SS Hex Screw	02	02	02	02
6	M5 SS Washer	04	04	04	04
7	M5 Spring Washer	04	04	04	04
8	M5 SS Nut	04	04	04	04
9	M5 X 20mm SS Round Screw	02	02	02	02

Table-3.1: Parts shipped with MBMet-500.

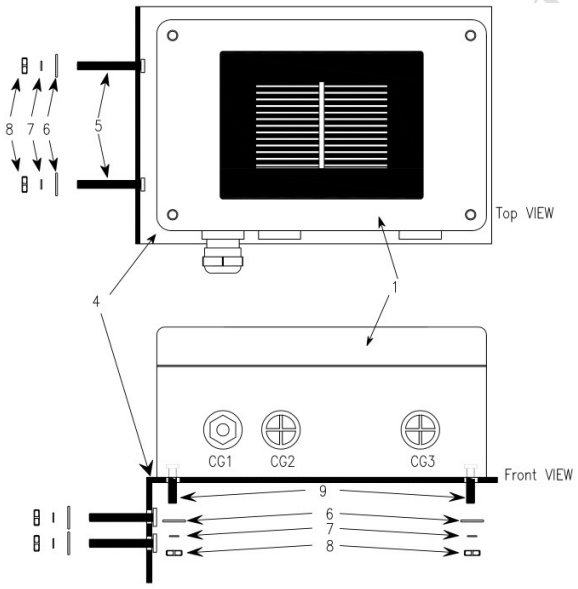

Fig-3.1: MBMet-500AB Parts

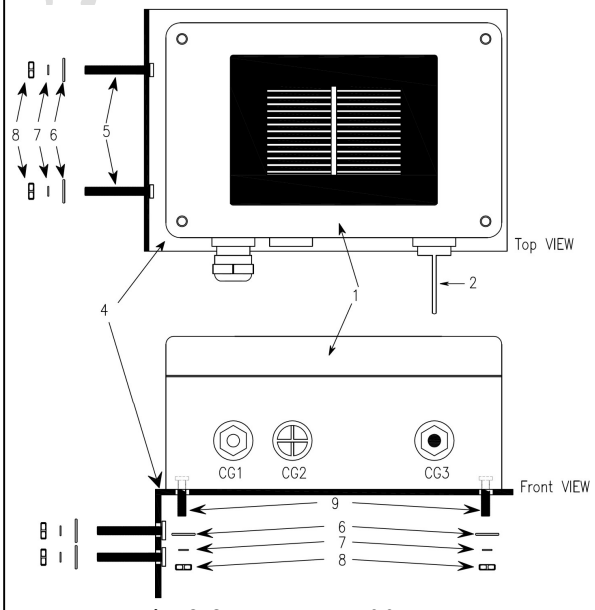

Fig-3.2: MBMet-500BB Parts

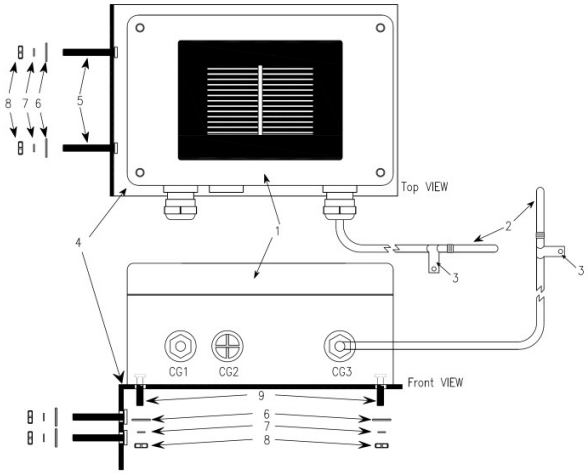

Fig-3.3: MBMet-500CB Parts

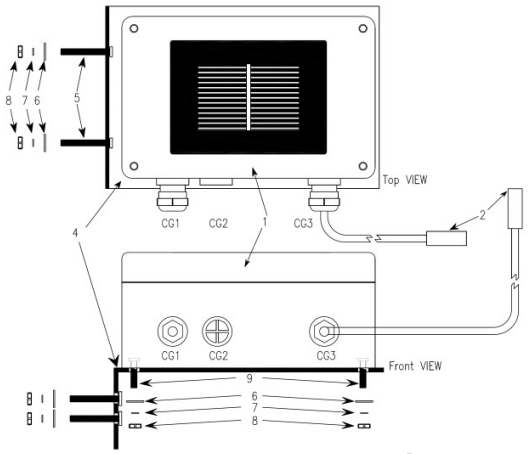

Fig-3.4: MBMet-500DB Parts

4. Solar Irradiation Transducer– Installation

Use the sensor mounting clamp provided along with the sensor to install it at side of the PV module (or any other location). Care must be taken that the sensor inclination is same as PV Module.

Step – 1: Drill two holes (M6) at site where the Solar Irradiation sensor is intended to be installed according to the following figure 4.1.

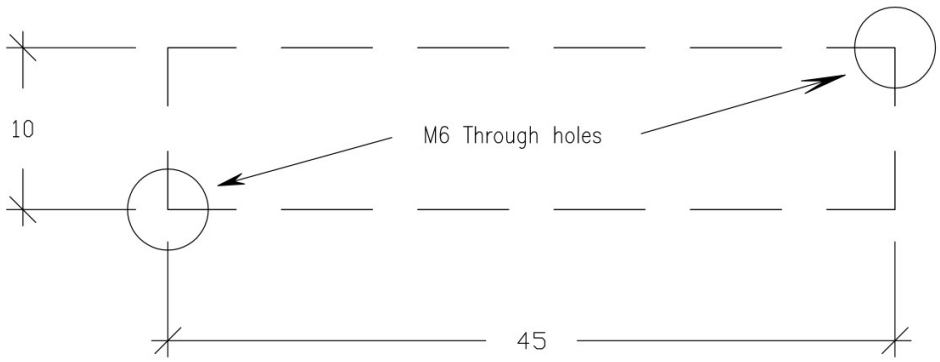

Fig – 4.1: Mounting holes' dimension

Step – 2: Install the sensor Mounting Clamp alongside the solar panel with the M5 x 32mm screws, nut, spring washer and washer provided as shown in the figure 4.2.

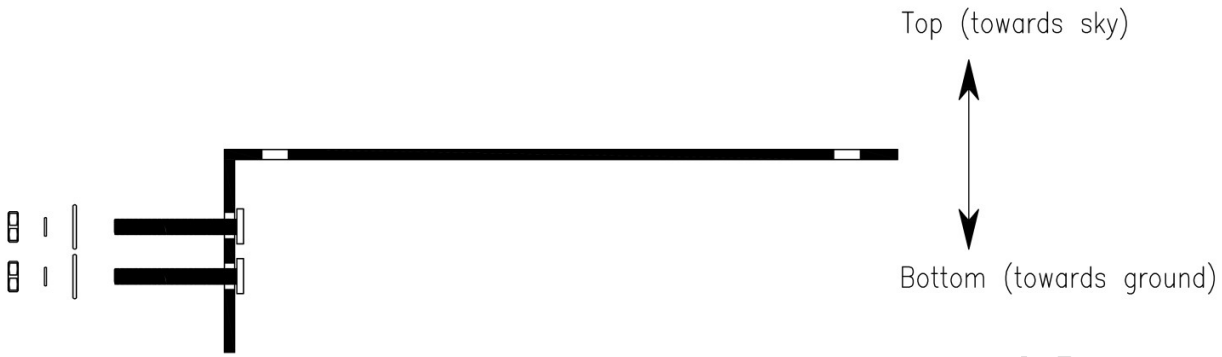

Fig – 4.2: Mounting clamp position

Step – 3: Open the cover of the sensor and mount the sensor to the clamp with the M5X20mm SS Round Head screws provided along with the sensor. The holes for mounting the sensor are shown in the figure 4.3.

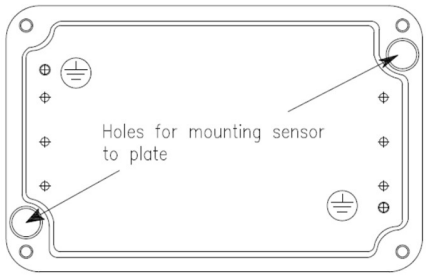

Fig – 4.3: Holes for fixing sensor to mounting plate.

Note: Keep the sensor cover with solar cell safely. Ensure that there is no scratch on the solar cell and it is not soiled.

Step – 4: Connect the interface cable according to the sensor specification. Connection details are given in Section 5 of this manual. After connection is done, close the cover and tighten the screws fully for retaining the IP protection.

5. Solar Irradiation Sensor – Connections

Care should be taken so that no components on the PCB are touched.

Terminal numbers on the sensor PCB are given in the picture 5.1 below.

Picture – 5.1: Terminal Numbers of PCB

Connections for the transducer terminals are given in the table 5.1 below.

Terminal	MBMet-500AB	MBMet-500BB	MBMet-500CB	MBMet-500DB
1	9-32 V DC +	9-32 V DC +	9-32 V DC +	9-32 V DC +
2	GND	GND	GND	GND
3	RS485 D+	RS485 D+	RS485 D+	RS485 D+
4	RS485 D-	RS485 D-	RS485 D-	RS485 D-
5	NA	Integrated Ambient Temperature RTD (A)	External Ambient Temperature RTD (A)	External PV Module Temperature RTD (A)
6	NA	Integrated Ambient Temperature RTD (A)	External Ambient Temperature RTD (A)	External PV Module Temperature RTD (A)
7	NA	Integrated Ambient Temperature RTD (B)	External Ambient Temperature RTD (B)	External PV Module Temperature RTD (B)
8	NA	Integrated Ambient Temperature RTD (B)	External Ambient Temperature RTD (B)	External PV Module Temperature RTD (B)

Table-5.1: MBMet-500 connections

6. MBMet-500: – Default Configuration

Default configuration for solar irradiation sensor with RS485 output are shown in table-5 below.

Sr. No	Parameter	Default Setting
1	**Communication Parameters**	
1.1	Device MODBUS address	1
1.2	Baud rate	9,600
1.3	Parity	None
1.4	Stop bits	1
2.	**RTD Channel**	
2.1	Temperature Unit	^{0}C

Table-6: Default configuration for SmartBox

7. MODBUS Registers

7.1 MODBUS Registers:

MODBUS registers are provided only for models with RS485 communication port.
Parameter values shall be provided as per selected model. Un-supported values will be read as '0'.
Parameters from the sensor can be read via MODBUS protocol in both signed integer and float data formats.

MODBUS Register Address	Parameter	Default Values	Length (bits)	Register Type	Parameters Type
Parameters Read Registers					
0	Solar Irradiation	-	16	Read only	Unsigned Integer
1	Cell Temperature	-	16	Read only	Signed Integer
2	External temperature (Ambient or PV Module)	-	16	Read only	Signed Integer
10	Solar Irradiation	-	32	Read only	Float
12	Cell Temperature	-	32	Read only	Float
14	External temperature (Ambient or PV Module)	-	32	Read only	Float
MODBUS Communication Parameters					
100	MODBUS ID (Default:1) 1<ID<247	1	16	Read/Write	Unsigned Integer
101	Baud rate (Default: 1)	1	16	Read/Write	Unsigned

	0=4800; 1=9600; 2=19200				Integer
102	Parity (Default: 0) 0=None; 1=Odd; 2=Even	0	16	Read/Write	Unsigned Integer
103	Stop bits. 1 (only stop bit 1 setting is allowed)	1	16	Read/Write	Unsigned Integer
104	Temperature Units (Default: 0) 0 = °C; 1 = °K; 2 = °F	0	16	Read/Write	Unsigned Integer
105	Save configuration parameters *	1	16	Write only	Unsigned Integer
Device Manufacturing Details- Read only					
110	Device Model No: =0 - MBMet500-AB =1 - MBMet500-BB =2 - MBMet500-CB =3 - MBMet500-DB	-	16	Read only	Unsigned Integer
111	Hardware Version	-	16	Read only	Unsigned Integer
112	Software Version	-	16	Read only	Unsigned Integer
113	Manufacture Year	-	16	Read only	Unsigned Integer
114	Device Serial number	-	16	Read only	Unsigned Integer

Table: 7.1 – MODBUS registers

Note:

* To save the communication parameters, write '1' in the register else the settings will not be saved.

7.2 Configuration of MODBUS Communication Parameters

Example is provided below for setting required communication parameters.

Modbus ID: 10
Baud rate: 19200
Parity: Even
Stop Bit: 2

Step-1: Connect the SmartBox to the Modbus Master Software with the default settings.

Step-2: Set the following in the MODBUS Master:
Function: Write Multiple Registers
Starting Address: 100
Number of registers: 5

Data Type: 16 bits Integer

Step-3: Set the communication parameters as per your requirement. (See example settings)

MODBUS Register Address	Parameter	Example settings
100	MODBUS ID	10 (Modbus ID=10)
101	Baud rate	2 (Baud Rate = 19200)
102	Parity	2 (Parity = Even)
103	Stop bits	2 (Stop Bit = 2)
104	Temperature Unit	0 (°C)
105	Save	1 (Save)

Table No: 7.2 – Modbus communication parameter configuration

Notes:

i) To save the communication parameters, write 1 in register 105 else the settings will not be saved.

ii) Please note that writing single register is not allowed. All the registers are to be written in one MODBUS write command.

Step-4: After all the parameters are set in MODBUS Master, write the same to the sensor. The sensor will stop communication and restart again with modified parameters.

Step-5: Connect to sensor using the modified MODBUS communication parameters in the MODBUS Master that is set in Step-3. The Solar Irradiance transducer will start communicating.

Step-6: Configured communication parameters can be verified by reading the communication MODBUS registers (100 to 104) of the sensor.

7.3 Setting Default MODBUS Communication Parameters

Procedure for re-setting default communication parameters is as follows.

Step-1: Switch Off the power supply of the device.

Step-2: Locate the Jumper-1 on the PCB as shown in Fig – 7.3.1. The normal position of the jumper is shown in Fig 7.3.2

Fig – 7.3.1: Location of the Jumper 1

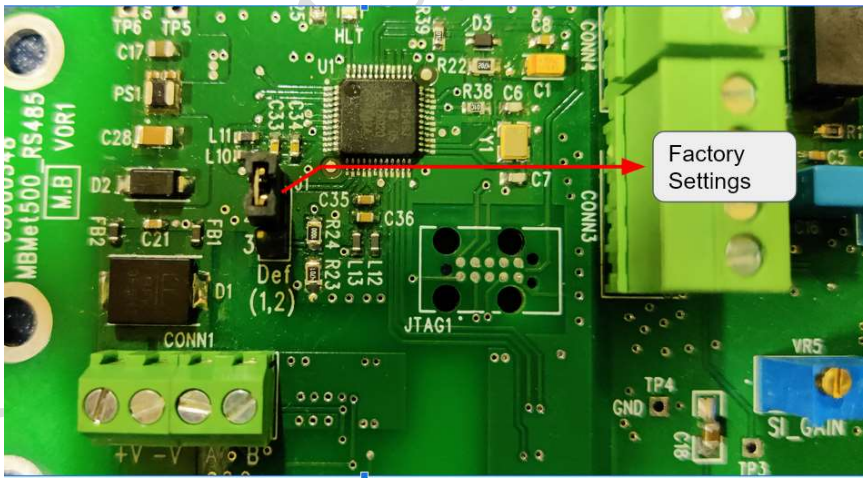

Fig – 7.3.2: Normal Position of Jumper-1 on board.

Step-3: Change the jumper position from Fig 7.3.2 to Fig 7.3.3

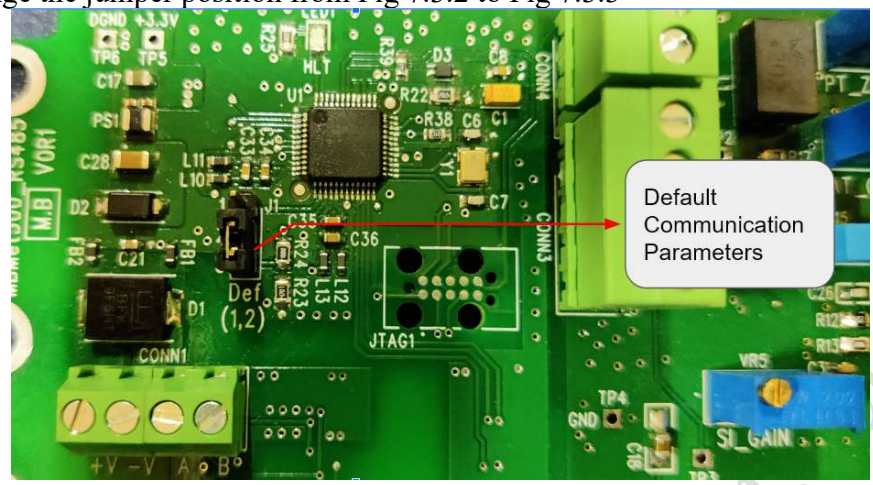

Fig – 7.3.3 Jumper position (for factory resetting)

Step-4: Switch On power supply, wait for 30 sec and switch off the power supply
Step-5: Reconnect the jumper in the original factory position as in Fig 7.3.2

Communication parameters is reset to default settings. This will not change any other settings of the device.

8. General Maintenance

General maintenance procedures are described below:

i) Keep the solar cell glass clean of any dust.

ii) Use soft cloth to clean the solar panel glass. Do not make any scratches on the glass. This will produce wrong results.