MS-80SH Plus+
Modbus Register Map

A-2 Communication specifications

At the factory, the specification for communication between the RSB-02 and C-BOX is set as follows. In order to connect a pyranometer, the address of the pyranometer must be entered into the C-BOX.

* The default address are **2** and **3** respectively for the main pyranometer and optional pyranometer. To configure your pyranometer on the C-Box write modbus registers 69 (GHI_NODE_ADDR) and 71 (EXT_NODE_ADDR). Insert the last two digits of the pyranometer serial number.
“100” if the last two digits are “00”.

A-2-1 C-BOX Communication Specification (Summary)

This device supports RS485 (Modbus RTU). ASCII mode is not supported. The communication specification is as follows.

Table A-2-1. C-BOX Communication Specification

Item	Remarks
Electrical specification	EIA-485
Connection form	Multi-drop method
Communication protocol	Modbus RTU (slave)
Communication speed (baud rate in bps)	9600 /19200 (default) /38400 /57600 /115200
Data length	8 bit
Stop bit	1 bit (default) / 2bit
Parity bit	None /Even (default) /Odd
Transmission distance	10m (using included cable)
Error detection system	CRC-16

A-2-2. C-BOX communication specification (Function codes)

Data is read and written to the holding Register.

Table A2-2. Supported function codes

Function Code (Hexadecimal)	Function
0x03	Read Holding Registers
0x10	Write Multiple Registers

A-2-3. C-BOX communication specifications (Data format)

Data is read and written to the holding Register.

Table A2-3. Data formats used

16-bit	Abstract
U16	Unsigned 16-bit Integer
S16	Signed 16-bit Integer
U32	Unsigned 32-bit Integer

The communication byte order of communication is big endian.
2-byte values are sent in H-byte -> L-byte order,
4-byte values are sent in H-word -> L-word order.
The table below shows how each format is allocated.

Table A2-4. Assignment of 8/16/32-bit values

8-bit	0x12	0x34	0x56	0x78
16-bit	0x1234 (MSW)		0x5678 (LSW)	
32-bit	0x12345678			

The word order for 32-bit registers is low word (LSW) first, followed by high word (MSW). The table below shows when 0x12345678 can be assigned to address “n” of the Modbus registers.

Table A2-5. Relationship between 32-bit values and Modbus registers.

32-bit	0x12345678
Modbus register (address n)	0x5678 (LSW)
Modbus register (address n+1)	0x1234 (MSW)

A-2-4. C-BOX Communication Specifications (Register map)

This device is for use only with holding registers.

Table A2-6. Holding registers

[a] Core Measurement Data (recommended for all applications)
[b] Optional Derived or Auxiliary Irradiance Values
[c] Sensor
[d] GPS and Location Data
[e] Quality Control Flags and Diagnostic Metrics
[f] Timekeeping
[g] Configuration (optional unless you plan to remotely manage the device)

These may be useful for commissioning logs, remote debugging, or when programmatically switching the shadow band mode during specific campaigns.

Recommended Minimal Dataset for Routine Logging

For typical applications such as PV performance monitoring or irradiance trend analysis, we recommend storing the following at your selected sampling interval:

• Registers 5 (time), 7 (GHI), 8/10 (DHI TSB/RSB), 9/11 (DNI TSB/RSB), 18 (temperature), and 19–20 (tilt)

This ensures physical measurements are logged alongside key diagnostic metrics.

Address	Label	R/W	Format	Description
0	FW_VERSION	R	UINT16	Firmware version
1	SERIAL	R	UINT16	Last 4 digits of serial number
2	SENSOR_MODEL	R	UINT16	Sensor model: **2:** CBOX1 RSB **3:** C-Box-S2 (MS-80 Plus+) **9001:** CBOX1 MS90 **9002:** C-Box-S1 (MS-90 Plus+)
3	STATUS_FLAGS	R	UINT16	**Bitwise flags:** RESERVED 0x1 NO_GPS 0x2 NO_CAL 0x4 OFFSET_ERROR 0x8 NO_MOTOR 0x16
4	ACTIVE_MODE	R	UINT16	**ACTIVE mode:** **0:** STARTUP mode **1:** RSB mode **2:** DHI mode **3:** Calibration mode **4:** Engine off **5:** Manual control To change the mode after startup use the WORK_MODE register 74
5 [f]	TIMESTAMP	R	UINT32	UTC timestamp (UNIX epoch, lower 16 bits only)
6				Timestamp from GPS : High
7 [a]	GHI	R	INT16	GHI (Global Horizontal Irradiance) ×10 (W/m²)
8 [a]	DHI	R	INT16	TSB mode DHI corrected (W.m-2) (x10)
9 [a]	DNI	R	INT16	TSB mode DNI corrected (W.m-2) (x10)

Table A2-6. Holding registers

10 [a]	DHI	R	INT16	RSB mode DHI corrected (W.m-2) (x10)
11 [a]	DNI	R	INT16	RSB mode DHI corrected (W.m-2) (x10)
12 [b]	TRANSPOSED IRRADIANCE	R	INT16	Transposed irradiance (based on sensor tilt and sun geometry)
13 [b]	IRR2	R	INT16	Additional irradiance channels (IRR2–IRR5, pyranometer output)
14 [b]	IRR3	R	INT16	Additional irradiance channels (IRR2–IRR5, pyranometer output)
15 [b]	IRR4	R	INT16	Additional irradiance channels (IRR2–IRR5, pyranometer output)
16 [b]	IRR5	R	INT16	Additional irradiance channels (IRR2–IRR5, pyranometer output)
17 [b]	PYR1_READING	R	INT16	Additional irradiance channels (IRR2–IRR5, pyranometer output)
18 [c]	PYR1_TEMP	R	INT16	Pyranometer internal temperature (°C)
19 [c]	PYR1_TILT_X	R	INT16	Tilt angle X (inclination in one axis)
20 [c]	PYR1_TILT_Y	R	INT16	Tilt angle Y
21 [c]	PYR1_RH	R	UINT16	Relative humidity inside sensor (%)
22 [c]	PYR2_IRRAD	R	INT16	MS-80S 2nd (W.m-2) (x10)
23 [c]	PYR2_TEMP	R	INT16	MS-80S 2nd Temperature (degree C°) (x10)
24 [c]	PYR2_TILT_X	R	INT16	MS-80S 2nd Tilt X(degree °) (x10)
25 [c]	PYR2_TILT_Y	R	INT16	MS-80S 2nd Tilt Y (degree °) (x10)
26 [c]	PYR2_RH	R	UINT16	MS-80S 2nd Relative Humidity (x10)
27 [d]	GPS_SATS	R	UINT16	Number of GPS satellites
28 [d]	GPS_HDOP	R	UINT16	HDOP (horizontal dilution of precision)
29 [d]	GPS_VDOP	R	UINT16	VDOP (vertical dilution of precision)
30 [d]	LAT	R	INT16	Latitude ×100 (°)
31 [d]	LON	R	INT16	Longitude ×100 (°)
32 [d]	ELEVATION	R	INT16	Solar elevation ×100 (°)
33 [d]	AZIMUTH	R	UINT16	Sun azimuth ×100 (°)
34 [e]	QC_ETN	R	UINT16	QC-ETN (extraterrestrial normal irradiance)
35 [e]	QC_KN	R	UINT16	QC-DNI/ETN ratio
36 [e]	QC_KD	R	UINT16	QC-GHI/ETR ratio
37 [e]	QC_KT	R	UINT16	QC-GHI/DHI ratio
38 [e]	QC_GHI	R	UINT16	QC-GHI (general quality)
39 [e]	QC_OFF	R	UINT16	QC-OFFSET-B (thermally induced offset diagnostics)
40	BA	R	INT16	Calculated band-angle (degree °) (x10)
41	DT	R	UINT16	Band sweep time in millisecond
42	RSB_CAL	R	UINT16	RSB Motor calibration value
43	RSB_ENC	R	UINT16	RSB Encoder value 0...1024
44 [f]	SUN_RISE	R	UINT32	Calculated Sunrise time stamp : Low
45 [f]				Calculated Sunrise time stamp : High
46 [f]	SUN_SET	R	UINT32	Calculated Sunset time stamp : Low
47 [f]				Calculated Sunset time stamp : High
48 [b]	PYR2_CALC	R	INT16	DNI if Mode is TSB (x10) RHI if Mode is RSB Albedo (RHI/GHI) (x1000)

Registers **49** till **63** are reserved

Table A2-6. Holding registers

64 (g)	UPDATE	R/W	UINT16	EEPROM UPDATE trigger
65 (g)	BAUDRATE	R/W	UINT16	Baud rate, parity, node ID
66 (g)	PARITY_STOPBITS	R/W	UINT16	Baud rate, parity, node ID
67 (g)	SLAVE_NODE_ID	R/W	UINT16	Baud rate, parity, node ID
68 (g)	GHI_SENSOR_TYPE	R/W	UINT16	Sensor configuration (type, node address, dual-sensor enable)
69 (g)	GHI_NODE_ADDR	R/W	UINT16	Sensor configuration (type, node address, dual-sensor enable)
70 (g)	EXT_SENSOR	R/W	UINT16	Sensor configuration (type, node address, dual-sensor enable)
71 (g)	EXT_NODE_ADDR	R/W	UINT16	Sensor configuration (type, node address, dual-sensor enable)
72 (g)	PYR2_ENABLED	R/W	UINT16	Sensor configuration (type, node address, dual-sensor enable)
73 (g)	S	R/W	UINT16	Geometrical correction factor
74 (g)	WORK_MODE	R/W	UINT16	WORK_MODE (TSB/RSB toggle)
75	NEW_RSB_MODE	R/W	UINT16	Set requested RSB_MODE, use SET_RSB_MODE to activate. **This register is used to shift to Calibration mode. When this register is set to 3 and register No.76 is set to 1, the device enters Calibration mode.**
76	SET_RSB_MODE	R/W	UINT16	Set to 1 to activate the RSB mode written in NEW_RSB_MODE register. See the description of register No.75.
77	MANUAL_ANGLE	R/W	UINT16	When RSB_MODE is manual control: Set manual bandangle (x10): 45 degrees is 450. Activate by SET_ANGLE
78	SET_ANGLE	R/W	UINT16	Set to 1 to activate the angle when RSB_MODE is manual control
79	MANUAL_GPS	R/W	INT16	Set to 1 to enable fake GPS. Time, date and location is taken from registers 61 to 67 at the moment this register becomes 1. Set to 0 to enable normal GPS mode.
80	YEAR	R/W	UINT16	Year to be used when MANUAL_GPS is set to 1
81	MONTH	R/W	UINT16	Month to be used when MANUAL_GPS is set to 1
82	DAY	R/W	UINT16	Day to be used when MANUAL_GPS is set to 1
83	HOUR	R/W	UINT16	Hour to be used when MANUAL_GPS is set to 1
84	MINUTE	R/W	UINT16	Minute to be used when MANUAL_GPS is set to 1
85	LAT_MANUAL	R/W	INT16	Latitude (x100) to be used when MANUAL_GPS is set to 1
86	LON_MANUAL	R/W	INT16	Longitude (x100) to be used when MANUAL_GPS is set to 1
87	DEMO_MODE	R/W	UINT16	Set to 1 to enable demo mode (Manual GPS). By sending Update = 1, this mode will be stored and active after power-cycle.
88	SET_CAL	R/W	UINT16	When in RSB_MODE is CAL, set this register to 1 to fix calibration.

89	BA_OFFSET	R/W	UINT16	Band-angle offset (degree °). Set to 0 to turn off band-angle offsets. Use UPDATE to store in EEPROM
90	AZIMUTH OF TRANSPOSITION	R/W	UINT16	Azimuth of transposition, store to EEPROM using UPDATE
91	ANGLE OF TRANSPOSITION	R/W	INT16	Angle of transposition, store to EEPROM using UPDATE