

Sol-Ark Modbus RTU Protocol

Version	Changelog	Editor	Date of Revision
V1.0	Initial Release	William Hopkins, Yang Chen	2021-03-31
V1.1	Updated Disclaimer & Notes	William Hopkins	2021-04-15

Disclaimer:

Sol-Ark does not offer technical support for 3rd party Modbus devices nor this Modbus map.

The inverter only supports read operations.

Any damage caused to the inverter due to the use of any Modbus device is NOT covered by Sol-Ark's warranty.

Important notes before use:

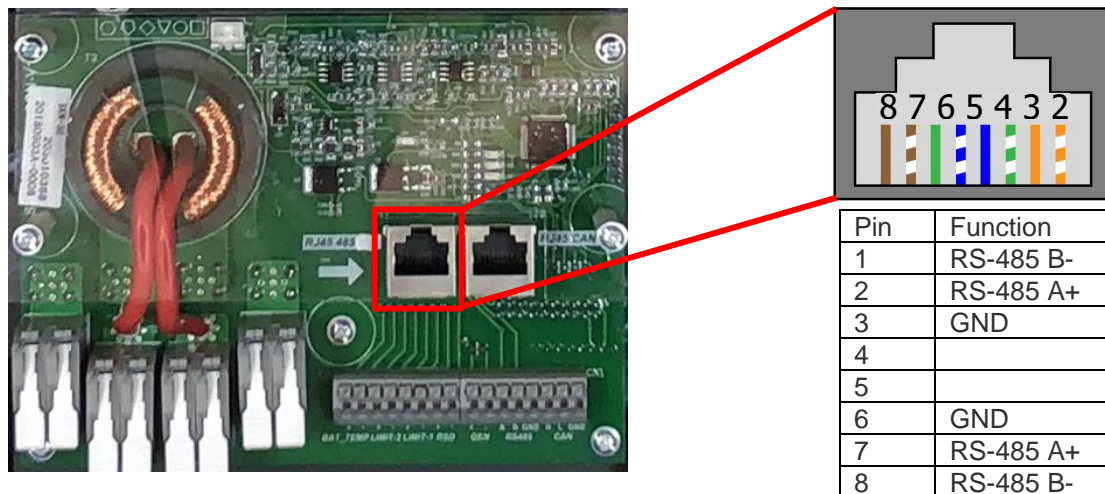
1. The inverter must be in “BMS Lithium Batt” mode “00” for this protocol to function. The check box next to “BMS Lithium Batt” can be either checked or unchecked so long as the value in this field is “00”.
2. The Sol-Ark Modbus RTU Protocol cannot be used simultaneously with Modbus or RS-485 based battery communications.
3. If a battery is using CAN Bus based battery communications with “BMS Lithium Batt” set to “00”, this protocol can still be used to read data from the system.
4. A 120 Ohm termination resistor should be used on the master side of the communication cable. The inverter already has termination internally.
5. The inverter’s Slave ID is 0x01. This cannot be changed. The “Modbus SN” under the “Parallel” tab does not affect the Slave ID for this map and is only relevant to parallel configurations.
6. Ground **MUST** be connected between the inverter and master device. Without ground connected, communication can be easily disrupted by external noise sources.
7. Sol-Ark Support **WILL NOT** provide support for this document nor communications with 3rd party controllers! Sol-Ark Technical Support will still be able to help with normal system questions but will not be able to solve problems relating to this document nor the information in it.

Inverter Pinouts:

Sol-Ark 8K:

Communications on the Sol-Ark 8K are achieved through either of the 2 RJ-45 ports labeled “RJ45_485” and “RJ45_CAN” or the terminal connectors for RS-485 and CAN.

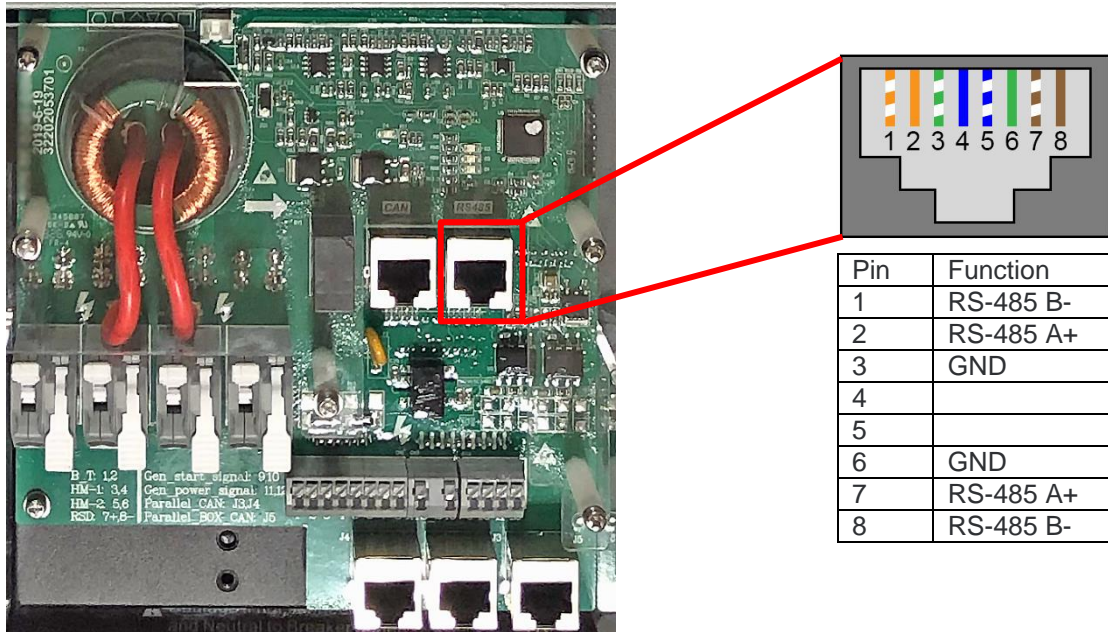
The ports are shown below alongside pin diagrams and detailed pin configurations for each port.



Sol-Ark 12K:

Communications on the Sol-Ark 12K are achieved through the RJ-45 ports labeled “RS-485” and “CAN”.

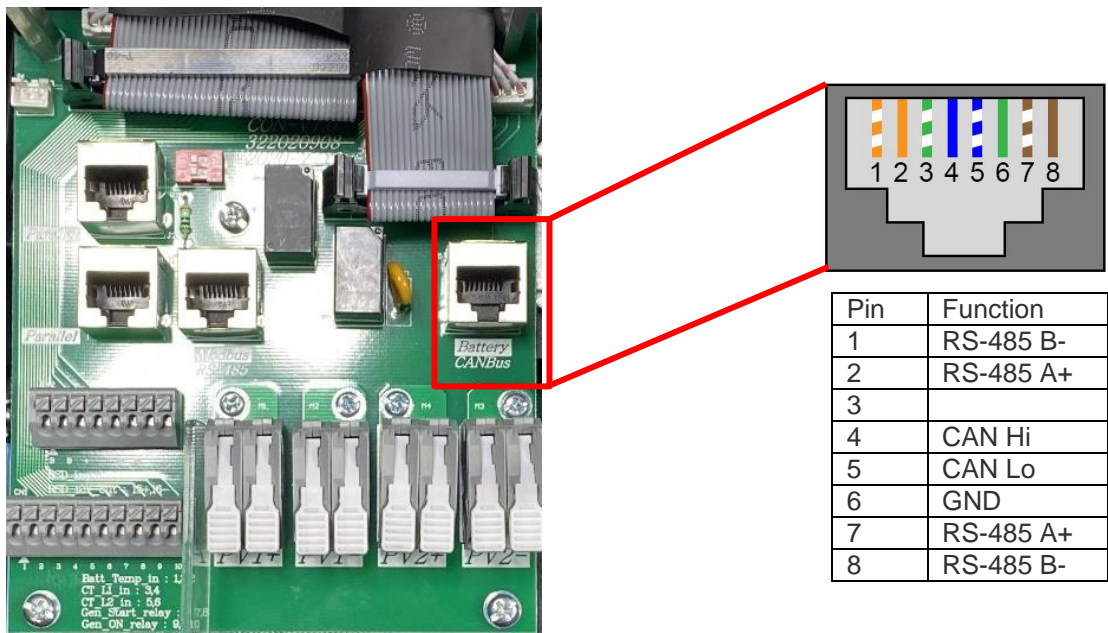
The ports are shown below alongside pin diagrams and detailed pin configurations for each port.



Outdoor Sol-Ark 8K & 12K:

Communications on the Outdoor rated units are achieved through a single RJ-45 port labeled “Battery CAN Bus”. This port combines the pin configurations of the RS-485 and CAN ports on the indoor rated 12K.

The port is shown below alongside a pin diagram and detailed pin configuration.



Note: The “Modbus RS-485” port on the outdoor rated systems is not for battery communications and is currently not implemented.

RTU Settings: Baud rate: 9600bps, Parity: None, Data Bits: 8, Stop Bits: 1

[Note] Reserved words, reserved bytes, reserved bits, and unsupported registers are all filled with 0x00.

Function codes of the Modbus RTU protocol

The following table lists only the function codes to which this protocol applies.

Function code	Function code type	Name	Description
0x03 (FC3)	Public function code	Read Multiple Holding Registers	Contents read from either a single register or multiple registers

Reading Multiple Holding Registers (function code: 0x03)

(1) Request PDU

Data structure	Data length	Data range
Function code	1 byte	0x03
Starting register address	2 bytes	0x0000~0xFFFF
Number of registers	2 bytes	0x0001~ 0x007D

(2) Normal Response PDU

Data structure	Data length	Data range
Function code	1 byte	0x03
Byte count	1 byte	Nx2
Register values	Nx2 byte	

Note: N = number of registers

(3) Abnormal response PDU

Data structure	Data length	Data range
Error code	1 byte	0x83
Exception code	1 byte	See "exception code" for details.

(4) Example

Request to read from three consecutive registers starting at address 107 (the following describes only the PDU):

Request		Normal response		Abnormal response	
Field name	Value	Field name	Value	Field name	Value
Function code	0x03	Function code	0x03	Error code	0x83
Starting address Hi	0x00	Byte count	0x06	Exception code	0x04
Starting address Lo	0x6B	Register [107] Hi	0x02		
Number of registers Hi	0x00	Register [107] Lo	0x2B		
Number of registers Lo	0x03	Register [108] Hi	0x00		
		Register [108] Lo	0x00		
		Register [109] Hi	0x00		
		Register [109] Lo	0x64		

Intrinsic Attribute Table					
Addr	Register description	R/W	Data range	Unit	Note
3	SN byte 01	R	'0'~'9'; 'A'~'Z'		The serial number is ten ASCII characters, If "AH12345678", Byte 01 is 0x41 (A), The 02nd byte is 0x48 (H), The 09th byte is 0x37 (7), The tenth byte is 0x38 (8).
	SN byte 02				
4	SN byte 03	R	'0'~'9'; 'A'~'Z'		
	SN byte 04				
5	SN byte 05	R	'0'~'9'; 'A'~'Z'		
	SN byte 06				
6	SN byte 07	R	'0'~'9'; 'A'~'Z'		
	SN byte 08				
7	SN byte 09	R	'0'~'9'; 'A'~'Z'		
	SN byte 10				

Real-time Running Data					
Addr	Register description	R/W	Data range	Unit	Note
60	Day Active Power Wh	R	[-32768, 32767]	0.1kWh	Signed int. Inverter Grid port energy
63	Total Active Power (Wh) low word	R	[0,0xFFFFFFFF]	0.1kWh	Signed int. Inverter Grid port energy
	Total Active Power (Wh) high word				
79	Grid frequency	R	[0,9999]	0.01Hz	
90	DC/DC Transformer temperature	R	[0,3000]	0.1°C	
91	IGBT Heat Sink temperature	R	[0,3000]	0.1°C	-56.2°C indicated as 438 0°C indicated as 1000 50.5 °C indicated as 1505
103	Fault information word 1	R	[0,65535]		See "Fault Table" at the end of the document for values Uses bit flags, 64 separate bits One bit for each fault
104	Fault information word 2	R	[0,65535]		
105	Fault information word 3	R	[0,65535]		
106	Fault information word 4	R	[0,65535]		
107	Corrected Batt Capacity	R	[0,1000]	1AH	100 is 100AH
108	Daily PV Power (Wh)	R	[0,65535]	0.1kWh	
109	Dc voltage 1	R	[0,65535]	0.1V	
110	Dc current 1	R	[0,65535]	0.1A	
111	Dc voltage 2	R	[0,65535]	0.1V	
112	Dc current 2	R	[0,65535]	0.1A	

Real-Time Data					
Addr.	Register Name	R/W	Data Range	Units	Description
150	Grid side voltage L1-N	R		0.1V	
151	Grid side voltage L2-N	R		0.1V	
152	Grid side voltage L1-L2	R		0.1V	
153	Voltage at middle side of relay L1-L2	R		0.1V	
154	Inverter output voltage L1-N	R		0.1V	
155	Inverter output voltage L2-N	R		0.1V	
156	Inverter output voltage L1-L2	R		0.1V	
157	Load voltage L1	R		0.1V	
158	Load voltage L2	R		0.1V	
160	Grid side current L1	R		0.01A	Signed int
161	Grid side current L2	R		0.01A	Signed int
162	Grid external Limiter current L1	R		0.01A	Signed int
163	Grid external Limiter current L2	R		0.01A	Signed int
164	Inverter output current L1	R		0.01A	Signed int
165	Inverter output current L2	R		0.01A	Signed int
166	Gen or AC Coupled power input	R		1W	As load output: Output P is positive As AC input: Input P is negative
167	Grid side L1 power	R		1W	Signed int
168	Grid side L2 power	R		1W	Signed int
169	Total power of grid side L1-L2	R		1W	Signed int > 0 BUY < 0 SELL
170	Grid external Limter1 power (CT1)	R		1W	Signed int
171	Grid external Limter2 power (CT2)	R		1W	Signed int
172	Grid external Total Power	R		1W	Signed int
173	Inverter outputs L1 power	R		1W	Signed int
174	Inverter outputs L2 power	R		1W	Signed int
175	Inverter output Total power	R		1W	Signed int
176	Load side L1 power	R		1W	Signed int
177	Load side L2 power	R		1W	Signed int
178	Load side Total power	R		1W	Signed int
179	Load current L1	R		0.01A	Signed int
180	Load current L2	R		0.01A	Signed int
181	Gen Port Voltage L1-L2	R			
182	Battery temperature	R	[0,3000]	0.1°C	Real value of offset + 1000 1200 is 20.0 °C
183	Battery voltage	R		0.01V	4100 mark of 41.0 V
184	Battery capacity SOC	R	[0,100]	1%	

186	PV1 input power	R		1W	
187	PV2 input power	R		1W	
190	Battery output power	R		1W	Signed int
191	Battery output current	R		0.01A	Signed int
192	Load frequency	R		0.01Hz	
193	Inverter output frequency	R		0.01Hz	
194	Grid side relay status	R			1 is Open (Disconnect) 2 is Closed
195	Generator side relay status	R			Low 4 indicates the state of generator relay 0 Open 1 Closed 2 No Connection 3 Closed when Generator is on.
196	Generator relay Frequency	R		0.01Hz	

Fault Table			
Value	Fault Code	Fault	
Bit 7	F08	GFDI_Relay_Failure	
Bit 12	F13	Grid_Mode_changed	Can happen when not using batteries or if Grid Input settings are changed. This is a notification, NOT a fault.
Bit 13	F14	DC_OverCurr_Fault	
Bit 14	F15	SW_AC_OverCurr_Fault	Usually caused by Loads being too large for the inverter. If off-grid, the battery discharge amps programmed too low. Overloads can result in F15, F18, F20, or F26.
Bit 15	F16	GFCI_Failure	Ground fault. Check PV+ or PV- wiring (which must be ungrounded). Exposed PV conductors + rain can also cause. Check that neutral line and Ground is not double bonded (which is common with portable generators).
Bit 17	F18	HW_Ac_OverCurr_Fault	Overloaded the Load Output, reduce loads. Wiring Short on the AC Side can also cause this error. Overloads can result in F15, F18, F20, or F26.
Bit 19	F20	Tz_Dc_OverCurr_Fault	Usually caused by DC current from battery that are too large (ex: 4 Ton AC Unit). Overloads can result in F15, F18, F20, or F26.
Bit 21	F22	Tz_EmergStop_Fault	Contact Sol-Ark.com
Bit 22	F23	Tz_GFCI_OC_Fault	PV Ground fault. Check PV+ or PV- wiring (which must be ungrounded or damage can occur). Typically caused by pinched PV wire grounding the PV+ or PV-. Grounded PV wire can cause F20, F23 or F26.
Bit 23	F24	DC_Insulation_ISO_Fault	Exposed PV conductor combined with moisture is faulting (can cause F16, F24, F26).
Bit 25	F26	BusUnbalance_Fault	Too much load one leg (L1 or L2) Vs the other leg or DC loads on the AC output when off-grid. Grounded PV wire can cause F20, F23 or F26.
Bit 28	F29	Parallel_Fault	One or more Paralleled systems have error,
Bit 32	F33	AC_OverCurr_Fault	

Bit 33	F34	AC_Overload_Fault	
Bit 40	F41	AC_WU_OverVolt_Fault	Contact Sol-Ark.com
Bit 42	F43	AC_VW_OverVolt_Fault	
Bit 44	F45	AC_UV_OverVolt_Fault	Grid under voltage causes disconnect. This will self-reset when grid stabilizes.
Bit 45	F46	Parallel_Aux_Fault	Cannot communicate with other parallel systems. Check Master = 1, Slaves are 2-9, ethernet cables are connected.
Bit 46	F47	AC_OverFreq_Fault	Grid over Frequency (common in power outages) causes disconnect. Will self-reset when grid stabilizes.
Bit 47	F48	AC_UnderFreq_Fault	Grid under Frequency (common in power outages) causes disconnect. Will self-reset when grid stabilizes.
Bit 54	F55	DC_VoltHigh_Fault	PV maybe higher than 500V. Battery voltage should not be above 59V or 63V (depending on model).
Bit 55	F56	DC_VoltLow_Fault	Batteries are overly discharged or Lithium BMS has shutdown.
Bit 57	F58	AC_U_GridCurr_High_Fault	
Bit 60	F61	Button_Manual_OFF	
Bit 61	F62	AC_B_InductCurr_High_Fault	
Bit 62	F63	Arc_Fault	Can be a bad PV connector/connection. And sometimes a false alarm due to powerful lightning storms.
Bit 63	F64	Heatsink_HighTemp_Fault	Check the built-in fans are running, ambient temp may be to high