Solectria Renewables Modbus Level 6

For models SGI 500XT

Revision B

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1 Solectria Renewables Modbus Level 6

Introduction:
This manual explains the Modbus protocol in use for Solectria Renewable's inverters and equipment. This does not include the history of Modbus or the details regarding the creation of the protocols. It is expected that the person(s) reading this manual have a clear understanding of Modbus.
Each register/data point contains a raw 16-bit signed or unsigned number. The appropriate multiplier must be applied to each word to obtain the scaled representation. Each word is ordered {MSB, LSB}.

Registers can be read using Modbus function code three (3) and certain registers can be written with Modbus function code six (6). Offsets are as given. The equivalent Modicon register is also provided (Offset+40001).

1.1 Determine Modbus Level

Various Modbus levels are available on inverters produced by Solectria Renewables, depending on inverter model and firmware release. The Modbus level can be determined by performing a Modbus read (function 3) to Offset 38. All inverters implementing this particular Modbus level will return a value of six (6) for this register.

Modbus Level Supported

Modbus Offset:	38
Modicon Register:	40039
Type:	int16u
Write:	No
Data Value:	6
Description:	Indicates Modbus Level supported by a particular inverter.

1.2 Alarms

Critical Alarms

Modbus Offset: 15
Modicon Register: 40016
Type: int16u
Write: No
Memory Type: -
Data Value (Min/Max): 0/65535
Description: See Alarm Definitions Below -

Description	**Critical Alarms**		
Bit	**Detailed Alarm Description**	**AC Power Produced?**	**Site Visit Recommended?**
15	Reserved	-	-
14	Reserved	-	-
13	Reserved	-	-
12	Reserved	-	-
11	Reserved	-	-
10	Reserved	-	-
9	Open Phase Failure	No	No*
8	VAC Sense Circuit Failure	No	Yes
7	Ground Fault Failure	No	Yes
6	MOV Failure	Yes	Yes
5	AC Current Sensor Circuit Failure	No	Yes
4	Contactor Failure	No	Yes
3	Power Stage Desaturation	No	Yes
2	Power Stage Over Temperature	No	Yes
1	AC Contactor Opened	No	Yes
0	Temperature Sensor Failure	No	Yes

* Open phase alerts may be due to temporary grid disturbances not related to the Inverter. In case of open phase alerts that do not clear, a site visit is required to investigate.

Informative Alarms 1

Modbus Offset: 16
Modicon Register: 40017
Type: int16u
Write: No
Memory Type: -
Data Value (Min/Max): 0/65535
Description: See Alarm Definitions Below -

Description	**Informative Alarms 1**		
Bit	**Detailed Alarm Description**	**AC Power Produced?**	**Site Visit Recommended?**
15	Reserved	-	-
14	Waiting for Grid	-	-
13	AC Frequency High	No	No
12	AC Frequency Low	No	No
11	Fan Life Reached	Yes	Yes
10	Waiting for More DC Power	No	No
9	Waiting for Restart	No	No
8	Power Conversion De-Rated	Yes	No
7	Operation Outside MPPT	Yes	No
6	Low DC Power Condition	No	No
5	AC Voltage Critical High	No	No
4	AC Voltage High	No	No
3	AC Voltage Low	No	No
2	AC Voltage Critical Low	No	No
1	DC Voltage High	No	No
0	DC voltage Low	No	No

1.3 Metering

DC Voltage

Modbus Offset: 0
Modicon Register: 40001
Unit: V
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.1953125
Data Value (Min/Max): 0/3584
Scaled Value (Min/Max): 0/700
Description: Measured DC input voltage in Volts.

Apparent AC Power Output

Modbus Offset: 1
Modicon Register: 40002
Unit: VA
Type: int16s
Write: No
Memory Type: -
Multiplier: 19.5312500
Data Value (Min/Max): 0/29440
Scaled Value (Min/Max): 0/575000
Description: Measured apparent power output in VA

Real AC Power Output

Modbus Offset: 80
Modicon Register: 40081
Unit: W
Type: int16s
Write: No
Memory Type: -
Multiplier: 19.5312500
Data Value (Min/Max): 0/29440
Scaled Value (Min/Max): 0/575000
Description: Measured real power output in Watts

AC Grid Frequency

Modbus Offset: 2
Modicon Register: 40003
Unit: Hz
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.00610352
Data Value (Min/Max): 0/10322
Scaled Value (Min/Max): 0.0/63.0
Description: Measured grid frequency in Hz

L1-to-L2 AC Voltage

Modbus Offset: 4
Modicon Register: 40005
Unit: V
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.1953125
Data Value (Min/Max): 0/1167
Scaled Value (Min/Max): 0/228
Description: Line-to-line voltage between L1 and L2

L2-to-L3 AC Voltage

Modbus Offset: 5
Modicon Register: 40006
Unit: V
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.1953125
Data Value (Min/Max): 0/1167
Scaled Value (Min/Max): 0/228
Description: Line-to-line voltage between L2 and L3

L1-to-L3 AC Voltage

Modbus Offset: 6
Modicon Register: 40007
Unit: V
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.1953125
Data Value (Min/Max): 0/1167
Scaled Value (Min/Max): 0/228
Description: Line-to-line voltage between L1 and L3

Phase Sequence

Modbus Offset: 7
Modicon Register: 40008
Unit: -
Type: int16s
Write: No
Memory Type: -
Data Value (Min/Max): 0/2
Description: Phase sequence of 3 phase system.
0: Not Locked; 1:CW (ABC); 2:CCW (ACB)

Inverter Output Current Average

Modbus Offset: 93
Modicon Register: 40094
Unit: A
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.0976563
Data Value (Min/Max): 0/14920
Scaled Value (Min/Max): 0/1457
Description: Average output current of all three phases.

1.4 SolZone™

This group contains the measured PV zone currents. SolZone current measurement is an optional feature that may not be present on all units.

Zone 1-8 DC Current

Modbus Offset:	20-27
Modicon Register:	40021-40028
Unit:	A
Type:	int16s
Write:	No
Memory Type:	-
Multiplier:	0.1000000
Data Value (Min/Max):	0/2000
Scaled Value (Min/Max):	0/200
Description:	Measured PV zone currents in Amps. A value of 32768 (8000h) means that SolZone sensor is disconnected

Total Current All Zones

Modbus Offset:	28
Modicon Register:	40029
Unit:	A
Type:	int16s
Write:	No
Memory Type:	-
Multiplier:	0.1000000
Data Value (Min/Max):	0/16000
Scaled Value (Min/Max):	0/1600
Description:	Sum of PV zone currents. A value of 32768 (8000h) means that none of the SolZone sensors are connected

1.5 Energy

AC Energy MSW

Modbus Offset:	8
Modicon Register:	40009
Unit:	kWh
Type:	int16u
Write:	No
Memory Type:	-
Multiplier:	0.1000000
Data Value (Min/Max):	0/65535
Scaled Value (Min/Max):	0/6553
Description:	Total AC energy generated over inverter's lifetime. Cumulative Energy AC Energy=((MSW*65536) + LSW) * 0.1

AC Energy LSW

Modbus Offset:	9
Modicon Register:	40010
Unit:	kWh
Type:	int16u
Write:	No
Memory Type:	-
Multiplier:	0.1000000
Data Value (Min/Max):	0/65535
Scaled Value (Min/Max):	0/6553
Description:	Total AC energy generated over inverter's lifetime. Cumulative Energy AC Energy=((MSW*65536) + LSW) * 0.1

1.6 Historical Statistics

On-Grid Hours

Modbus Offset: 11
Modicon Register: 40012
Unit: hour
Type: int16u
Write: No
Memory Type: -
Multiplier: 1.0000000
Data Value (Min/Max): 0/65535
Scaled Value (Min/Max): 0/65535
Description: Total hours the inverter has been connected to the grid over its lifetime.

Fan On-Time Hours

Modbus Offset: 12
Modicon Register: 40013
Unit: hour
Type: int16u
Write: No
Memory Type: -
Multiplier: 1.0000000
Data Value (Min/Max): 0/65535
Scaled Value (Min/Max): 0/65535
Description: Total hours the fan has been in operation.

AC Contactor Cycles

Modbus Offset: 13
Modicon Register: 40014
Unit: -
Type: int16u
Write: No
Memory Type: -
Multiplier: 1.0000000
Data Value (Min/Max): 0/65535
Scaled Value (Min/Max): 0/65535
Description: Total number of contactor cycles (on/off) over the inverter lifetime.

1.7 AC Protection Settings

The AC Protection Setting contains the trip levels and time delay parameters for the AC protection functions.

WARNING: The line voltage and frequency protection functions are preset to conform to UL-1741 and IEEE-1547 standards. The inverter is capable of operating outside these limits, but changing the settings could invalidate the NRTL listing.

AC Over Voltage Setting

Modbus Offset:	40
Modicon Register:	40041
Unit:	V
Type:	int16s
Write:	Yes
Memory Type:	Parameter. Setting remembered next day.
Multiplier:	0.1953125
Value (min/max):	100% to 120% of the nominal voltage.
Default:	110% of the nominal voltage.
Description:	Voltage level that the line voltage feedback has to be above, for the time specified by 'AC Over Voltage Clearing time' (Offset 48) parameter for an 'AC Voltage High' fault (Offset 16, Bit 4) to occur.

AC Critical Over Voltage Setting

Modbus Offset:	41
Modicon Register:	40042
Unit:	V
Type:	int16s
Write:	Yes
Memory Type:	Parameter. Setting remembered next day.
Multiplier:	0.1953125
Value (min/max):	100% to 120% of the nominal voltage.
Default:	120% of the nominal voltage.
Description:	Voltage level that the line voltage feedback has to be above, for duration of 160ms for an 'AC Voltage Critical High' fault (Offset 16, Bit 5) to occur.

AC Reconnect Over Voltage Setting

Modbus Offset:	42
Modicon Register:	40043
Unit:	V
Type:	int16s
Write:	No
Memory Type:	Parameter. Setting remembered next day.
Multiplier:	0.1953125
Description:	Voltage level that the line voltage feedback has to be below, for the inverter to clear the 'AC Voltage High' fault (Offset 16, Bit 4) and reconnect to the grid.

AC Under Voltage Setting

Modbus Offset: 43
Modicon Register: 40044
Unit: V
Type: int16s
Write: Yes
Memory Type: Parameter. Setting remembered next day.
Multiplier: 0.1953125
Value (min/max): 50% to 100% of the nominal voltage.
Default: 88% of the nominal voltage
Description: Voltage level that the line voltage feedback has to be below, for the time specified by 'AC Under Voltage Clearing Time' (Offset 49) for an 'AC Voltage Low' fault (Offset 16, Bit 3) to occur.

AC Critical Under Voltage Setting

Modbus Offset: 44
Modicon Register: 40045
Unit: V
Type: int16s
Write: Yes
Memory Type: Parameter. Setting remembered next day.
Multiplier: 0.1953125
Value (min/max): 50% to 100% of the nominal voltage.
Default: 50% of the nominal voltage.
Description: Voltage level that the line voltage feedback has to be below, for 160ms duration for an 'AC Voltage Critical Low' fault (Offset 16, Bit 2) to occur.

AC Over Frequency Setting

Modbus Offset: 45
Modicon Register: 40046
Unit: Hz
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.00610352
Data Value: 9912
Scaled Value: 60.5
Default: 60.5 Hz
Description: Line frequency has to be above this value, for duration of 160ms for an 'AC Frequency High' (Offset 16, Bit 13) fault to occur.

AC Under Frequency Setting

Modbus Offset:	46
Modicon Register:	40047
Unit:	Hz
Type:	int16s
Write:	Yes
Memory Type:	Parameter. Setting remembered next day.
Multiplier:	0.00610352
Data Value (Min/Max):	9339/9798
Scaled Value (Min/Max):	57/59.8
Default:	59.3 Hz
Description:	Line frequency has to be below this value, for the time specified by 'AC Under Frequency Clearing Time' (Offset 50) parameter for an 'AC Frequency Low' (Offset 16, Bit 12) fault to occur.

AC Critical Under Frequency Setting

Modbus Offset:	47
Modicon Register:	40048
Unit:	Hz
Type:	int16s
Write:	No
Memory Type:	-
Multiplier:	0.00610352
Data Value (Min/Max):	9339
Scaled Value (Min/Max):	57
Default	57.0 Hz
Description:	Line frequency has to be below this value, for duration of 160ms for an 'AC Frequency Low' (Offset 16, Bit 12) fault to occur.

AC Over Voltage Clearing Time

Modbus Offset: 48
Modicon Register: 40049
Unit: sec
Type: int16s
Write: Yes
Memory Type: Parameter. Setting remembered next day.
Multiplier: 0.0100000
Data Value (Min/Max): 16/3000
Scaled Value (Min/Max): 0.16/30
Default: 1 second (scaled value =1, data value = 100)
Description: Duration that the line voltage feedback has to be above the level specified by the 'AC Over Voltage Setting' (Offset 40) for an 'AC Voltage High' fault (Offset 16, Bit 4) to occur.

AC Under Voltage Clearing Time

Modbus Offset: 49
Modicon Register: 40050
Unit: sec
Type: int16s
Write: Yes
Memory Type: Parameter. Setting remembered next day.
Multiplier: 0.0100000
Data Value (Min/Max): 16/3000
Scaled Value (Min/Max): 0.16/30
Default: 2 seconds (scaled value =2, data value = 200)
Description: Duration that the line voltage feedback has to be below the level specified by the 'AC Under Voltage Setting' (Offset 43) for an 'AC Voltage Low' (Offset 16, Bit 3) fault to occur.

AC Under Frequency Clearing Time

Modbus Offset: 50
Modicon Register: 40051
Unit: sec
Type: int16s
Write: Yes
Memory Type: Parameter. Setting remembered next day.
Multiplier: 0.0100000
Data Value (Min/Max): 16/30000
Scaled Value (Min/Max): 0.16/300
Default: 0.16 second (scaled value =0.16, data value = 16)
Description: Duration that the line frequency feedback has to be below the level specified by 'AC Under Frequency Setting' (Offset 46) for an 'AC Frequency Low' (Offset 16, Bit 12) fault to occur.

UL Fault Reconnect Wait Time Setting

Modbus Offset:	51
Modicon Register:	40052
Unit:	sec
Type:	int16s
Write:	Yes
Memory Type:	Parameter. Setting remembered next day.
Multiplier:	0.0100000
Data Value (Min/Max):	100/30000
Scaled Value (Min/Max):	1/300
Default:	300 seconds (scaled value =300, data value = 30000)
Description:	Duration the inverter remains disconnected from the grid after a protection fault is cleared.

Protection Fault Recovery Time Left

Modbus Offset:	113
Modicon Register:	40114
Unit:	sec
Type:	int16s
Write:	Yes
Memory Type:	Variable. Immediate effect, but is not remembered the next day.
Multiplier:	0.0100000
Data Value (Min/Max):	0/30000
Scaled Value (Min/Max):	0/300
Description:	Countdown for the inverter to reconnect to the grid after a protection fault is cleared. Countdown starts from 'UL Fault Reconnect Wait Time Setting' (Offset 51).

1.8 Power Control

Disable Power Remotely By Message

Modbus Offset:	112
Modicon Register:	40113
Unit:	-
Type:	int16s
Write:	Yes
Memory Type:	Variable. Immediate effect, but is not remembered the next day.
Multiplier:	-
Data Value (Min/Max):	0/1
Description:	When this register is set to 1 power output is disabled. A register value of '0' enables power output. This register resets to value '0' when the inverter is started.

1.9 Temperature Feedback

Internal Temperature 1

Modbus Offset: 84
Modicon Register: 40085
Unit: °C
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.0976563
Data Value (Min/Max): -410/1536
Scaled Value (Min/Max): -40/150
Description: Heat sink temperature of Power Stage 1

Internal Temperature 2

Modbus Offset: 87
Modicon Register: 40088
Unit: °C
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.0976563
Data Value (Min/Max): -410/1536
Scaled Value (Min/Max): -40/150
Description: Heat sink temperature of Power Stage 2

Internal Temperature 3

Modbus Offset: 90
Modicon Register: 40091
Unit: °C
Type: int16s
Write: No
Memory Type: -
Multiplier: 0.0976563
Data Value (Min/Max): -410/1536
Scaled Value (Min/Max): -40/150
Description: Heat sink temperature of Power Stage 3

1.10 Communications Settings

Network ID

Modbus Offset:	14
Modicon Register:	40015
Unit:	-
Type:	int16u
Write:	Yes
Memory Type:	Parameter. Setting remembered next day.
Multiplier:	-
Data Value (Min/Max):	1/16
Description:	Modbus ID of the Inverter.

1.11 Nameplate Information

Inverter Manufacturer Year and Month

Modbus Offset:	31
Modicon Register:	40032
Unit:	-
Type:	int16u
Write:	No
Memory Type:	-
Multiplier:	-
Description:	Inverter Serial Number appears as YYMMDD-##; this register is for YYMM in hex format

Inverter Manufacturer Day and Serial Number

Modbus Offset:	32
Modicon Register:	40033
Unit:	-
Type:	int16u
Write:	No
Memory Type:	-
Multiplier:	-
Description:	Inverter Serial Number appears as YYMMDD-##; this register is for DD## in hex format

2 Modbus Register Table

Register	Offset	Description	Group	Unit	Multiplier	Type	Write
40001	0	DC Voltage	Metering	V	0.1953125	int16s	No
40002	1	Apparent AC Power Output	Metering	VA	19.53125	int16s	No
40003	2	AC Grid Frequency	Metering	Hz	0.00610352	int16s	No
40005	4	L1-to-L2 AC Voltage	Metering	V	0.1953125	int16s	No
40006	5	L2-to-L3 AC Voltage	Metering	V	0.1953125	int16s	No
40007	6	L1-to-L3 AC Voltage	Metering	V	0.1953125	int16s	No
40008	7	Phase Sequence	Metering	-	-	int16s	No
40009	8	AC Energy MSW	Energy	kWh	0.1	int16u	No
40010	9	AC Energy LSW	Energy	kWh	0.1	int16u	No
40012	11	On-Grid Hours	Historical Stat	hour	1	int16u	No
40013	12	Fan On-Time Hours	Historical Stat	hour	1	int16u	No
40014	13	AC Contactor Cycles	Historical Stat	-	1	int16u	No
40015	14	Network ID	Communications	-	-	int16u	Yes
40016	15	Critical Alarms	Alarms	-	-	int16u	No
40017	16	Informative Alarms 1	Alarms	-	-	int16u	No
40021	20	Zone 1 DC Current	SolZone	A	0.1	int16s	No
40022	21	Zone 2 DC Current	SolZone	A	0.1	int16s	No
40023	22	Zone 3 DC Current	SolZone	A	0.1	int16s	No
40024	23	Zone 4 DC Current	SolZone	A	0.1	int16s	No
40025	24	Zone 5 DC Current	SolZone	A	0.1	int16s	No
40026	25	Zone 6 DC Current	SolZone	A	0.1	int16s	No
40027	26	Zone 7 DC Current	SolZone	A	0.1	int16s	No
40028	27	Zone 8 DC Current	SolZone	A	0.1	int16s	No
40029	28	Total DC Current all Zones	SolZone	A	0.1	int16s	No
40032	31	Inverter Mfg Year and Month	Nameplate Info	-	-	int16u	No
40033	32	Inverter Mfg Day and Serial Number	Nameplate Info	-	-	int16u	No
40039	38	Modbus Level Supported	Modbus Level	-	-	Int16u	No
40041	40	AC Over Voltage Setting	AC Protection	V	0.1953125	int16s	Yes
40042	41	AC Critical Over Voltage Setting	AC Protection	V	0.1953125	int16s	Yes
40043	42	AC Reconnect Over Voltage Setting	AC Protection	V	0.1953125	int16s	No
40044	43	AC Under Voltage Setting	AC Protection	V	0.1953125	int16s	Yes
40045	44	AC Critical Under Voltage Setting	AC Protection	V	0.1953125	int16s	Yes
40046	45	AC Over Frequency Setting	AC Protection	Hz	0.00610352	int16s	No
40047	46	AC Under Frequency Setting	AC Protection	Hz	0.00610352	int16s	Yes
40048	47	AC Critical Under Frequency Setting	AC Protection	Hz	0.00610352	int16s	No
40049	48	AC Over Voltage Clearing Time	AC Protection	sec	0.01	int16s	Yes
40050	49	AC Under Voltage Clearing Time	AC Protection	sec	0.01	int16s	Yes
40051	50	AC Under Frequency Clearing Time	AC Protection	sec	0.01	int16s	Yes
40052	51	UL Fault Reconnect Wait Time Setting	AC Protection	sec	0.01	int16s	Yes
40081	80	Real AC Power Output	Metering	W	19.53125	int16s	No
40085	84	Internal Temperature 1	Temperature	°C	0.0976563	int16s	No
40088	87	Internal Temperature 2	Temperature	°C	0.0976563	int16s	No
40091	90	Internal Temperature 3	Temperature	°C	0.0976563	int16s	No
40094	93	Inverter Output Current Average	Metering	A	0.0976563	int16s	No
40113	112	Disable Power Remotely By Message	Power Control	-	-	int16s	Yes
40114	113	Protection Fault Recovery Time Left	AC Protection	sec	0.01	int16s	Yes