

LUMEL

SPC5
REVERSE POWER CONTROLLER



SERVICE MANUAL
INTERFACE

Installation & Operating Instructions

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1. Introduction

This instrument is a panel mounted 96 x 96mm DIN Quadratic Digital metering system for controlling upto 20 Solar Inverters of Radius APV-S make. The instrument is available in two models* : With Generator Sense and Without Generator Sense. The instrument prevents the excess solar power generated by inverters from getting fed back to the grid / generator. The instrument does this by measuring the important electrical parameters like AC voltage, AC Current, Frequency, Active Power, Active Energy at the grid / generator and monitoring the power from solar inverter(s). The instrument integrates accurate measurement (All Voltage & Current measurements are True RMS upto 31st Harmonic) with 320x240 Pixels touch screen TFT LCD display. This instrument can be configured and programmed at site for the following:
PT Primary, PT Secondary, CT Primary, CT Secondary (5A or1A).

The front panel has a 3.5" Touch Screen through which the user can move across the available measurement readings of the Grid / Generator, Solar and Load and configure the product settings.

An operation via standard RS485 is possible. Through this interface, all the above mentioned parameters can be configured and programmed. For bus service it is essential that device address, baud rate and parity should be configured properly.

This document specifies only the interface between a master device and this instrument for electrical variable through MODBUS over RS485.

***Note : The Generator parameters and settings related to Generator referred to in this booklet are available for the instrument with Generator Sense only.**

2. Communication Parameter Selection :

After entering in the "COMMUNICATION PARAMETERS" and then "DATA RS485", the list of following parameters will be displayed :

2.1 RS485 ADDRESS

2.2 RS485 BAUD RATE

2.3 RS485 PARITY

2.1 RS 485 Address Setting

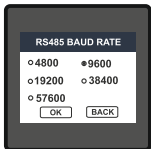


This screen allows the user to set RS485 address parameter for the instrument for Data RS485 port for user to access data from instrument.

The range of allowable address is 1 to 247.

If value outside the range is entered, it will display "INVALID VALUE" followed by the correct range of parameter.

2.2 RS 485 Baud Rate



This screen allows the user to set Baud Rate for Data RS 485 port. Five options: 4800, 9600, 19200, 38400 & 57600 Bauds are displayed on screen. Touching radio button in front of particular option will select that option pressing ok will conform the option.

2.3 RS 485 Parity & Stop bit Selection



This screen allows the user to set Parity & number of stop bits for Data RS485 port. Four options:

NO PARITY WITH ONE STOP BIT,
NO PARITY WITH TWO STOP BITS,
EVEN PARITY WITH ONE STOP BIT,
ODD PARITY WITH ONE STOP BIT are displayed on screen.

Touching radio button in front of particular option will select that option.

3. RS 485 (ModBus) Output :

This instrument supports MODBUS (RS485) RTU protocol (2-wire).

Connection should be made using twisted pair shielded cable. All "A" and "B" connections are daisy chained together. To avoid the possibility of loop currents, an Earth connection should be made at one point on the network. Loop (ring) topology does not require any termination load. Line topology may or may not require terminating loads depending on the type and length of cable used.

The impedance of the termination load should match the impedance of the cable and be at both ends of the line. The cable should be terminated at each end with a 120 ohm (1/4 Watt min.) resistor.

RS 485 network supports maximum length of 1.2km. Including the Master, a maximum of 32 instruments can be connected in RS485 network. The permissible address range for the instrument is between 1 and 247 for 32 instruments. Broadcast Mode (address 0) is not allowed.

The maximum latency time for the instrument is 200ms i.e. this is the amount of time that can pass before the first response character is output.

After sending any query through software (of the Master), it must allow 300ms of time to elapse before assuming that the Meter is not going to respond. If slave does not respond within 300ms, Master can ignore the previous query and can issue fresh query to the slave.

Each byte in RTU mode has following format:

RTU Coding System	8-bit binary, hexadecimal 0-9, A-F 2 hexadecimal characters contained in each 8-bit field of the message
Format of Data Bytes	4 bytes (32 bits) per parameter. Floating point format (to IEEE 754) Most significant byte first (Alternative least significant byte first)
Error Checking Bytes	2 byte Cyclical Redundancy Check (CRC)
Byte format	1 start bit, 8 data bits, least significant bit sent first 1 bit for even/odd parity 1 stop bit if parity is used; 1 or 2 bits if no parity

Communication Baud Rate is user selectable from the front panel between 4800,9600,19200,38400,57600 bps.

Function code :

03	Read Holding Registers	Read content of read /write location (4X)
04	Read input Registers	Read content of read only location (3X)
16	Presets Multiple Registers	Set the content of read / write locations (4X)

Exception Cases : An exception code will be generated when Meter receives ModBus query with valid parity & error check but which contains some other error (e.g. Attempt to set floating point variable to an invalid value)
The response generated will be "Function code" ORED with HEX (80H). The exception codes are listed below

01	Illegal function	The function code is not supported by Meter
02	Illegal Data Address	Attempt to access an invalid address or an attempt to read or write part of a floating point value
03	Illegal Data Value	Attempt to set a floating point variable to an invalid value

3.1 Accessing 3X and 4X register for reading measured values:

Two consecutive 16 bit registers represent one parameter. Refer **TABLE 1** for the addresses of 3X and 4X registers used for parameters measured by the instrument. Each parameter is held in the 3X as well as 4X registers. Modbus Code 04 and 03 are used to access all parameters in 3X and 4X registers respectively.

Example :

To read parameter,

Grid / Generator Voltage2 from 3X: Start address= 00 02 Number of registers = 02

Grid / Generator Watt Sum from 4X: Start address= 00 34 Number of registers = 02

Note : Number of registers = Number of parameters x 2

Each Query for reading the data must be restricted to 20 parameters or less. Exceeding the 20 parameter limit will cause a ModBus exception code to be returned.

Query for 3X read:

01 (Hex)	04 (Hex)	00 (Hex)	02(Hex)	00 (Hex)	02(Hex)	30 (Hex)	0A (Hex)
Device Address	Function Code	Start Address High	Start Address Low	Number of Registers Hi	Number of Registers Lo	CRC Low	CRC High

3X Response: Grid / Generator Voltage 2 (219.254V)

01 (Hex)	04 (Hex)	04 (Hex)	43 (Hex)	5B (Hex)	41 (Hex)	21 (Hex)	6F (Hex)	9B (Hex)
Device Address	Function Code	Byte Count	Data Register1 High Byte	Data Register1 Low Byte	Data Register2 High Byte	Data Register2 Low Byte	CRC Low	CRC High

Byte Count : Total number of data bytes received.

Query for 4X read:

01 (Hex)	03 (Hex)	00 (Hex)	34(Hex)	00 (Hex)	02(Hex)	E0 (Hex)	C9 (Hex)
Device Address	Function Code	Start Address High	Start Address Low	Number of Registers Hi	Number of Registers Lo	CRC Low	CRC High

4X Response: Grid / Generator Watt Sum (2000 W)

01 (Hex)	03 (Hex)	04 (Hex)	44 (Hex)	FA (Hex)	00 (Hex)	00 (Hex)	CE (Hex)	F2 (Hex)
Device Address	Function Code	Byte Count	Data Register1 High Byte	Data Register1 Low Byte	Data Register2 High Byte	Data Register2 Low Byte	CRC Low	CRC High

Byte count : No.of Bytes Demanded by user in query.

Start Address High : Most significant 8 bits of starting address of the parameter requested.

Start Address low : Least significant 8 bits of starting address of the parameter requested.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit registers represent one parameter.)

TABLE 1 : 3 X and 4 X register addresses for measured parameters

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30001	40001	1	Grid / Generator V1	00	00	00	00
30003	40003	2	Grid / Generator V2	00	02	00	02
30005	40005	3	Grid / Generator V3	00	04	00	04
30007	40007	4	Grid / Generator I1	00	06	00	06
30009	40009	5	Grid / Generator I2	00	08	00	08
30011	40011	6	Grid / Generator I3	00	0A	00	0A
30043	40043	22	Grid / Generator Volt Avg	00	2A	00	2A
30047	40047	24	Grid / Generator Current Avg	00	2E	00	2E
30053	40053	27	Grid / Generator Watt Sum	00	34	00	34
30071	40071	36	Grid / Generator Frequency	00	46	00	46
30075	40075	38	Grid Wh import	00	4A	00	4A
30077	40077	39	Grid Wh export	00	4C	00	4C
30079	40079	40	Generator Wh import	00	4E	00	4E
30081	40081	41	Generator Wh export	00	50	00	50
30113	40113	57	Grid Wh import Overflow count	00	70	00	70
30115	40115	58	Grid Wh import	00	72	00	72
30117	40117	59	Grid Wh export Overflow count	00	74	00	74
30119	40119	60	Grid Wh export	00	76	00	76
30121	40121	61	Generator Wh import Overflow count	00	78	00	78
30123	40123	62	Generator Wh import	00	7A	00	7A
30125	40125	63	Generator Wh export Overflow count	00	7C	00	7C
30127	40127	64	Generator Wh export	00	7E	00	7E
30147	40147	74	Grid Wh import on update rate	00	92	00	92
30149	40149	75	Grid Wh export on update rate	00	94	00	94
30151	40151	76	Generator Wh import on update rate	00	96	00	96
30153	40153	77	Generator Wh export on update rate	00	98	00	98
30155	40157	79	Grid Wh import OFC on update rate	00	9C	00	9C
30159	40159	80	Grid Wh export OFC on update rate	00	9E	00	9E
30161	40161	81	Generator Wh imp OFC on update rate	00	A0	00	A0
30163	40163	82	Generator Wh exp OFC on update rate	00	A2	00	A2

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30201	40201	101	Grid / Generator V12	00	C8	00	C8
30203	40203	102	Grid / Generator V23	00	CA	00	CA
30205	40205	103	Grid / Generator V31	00	CC	00	CC
30207	40207	104	Grid / Generator VTHD-R	00	CE	00	CE
30209	40209	105	Grid / Generator VTHD-Y	00	D0	00	D0
30211	40211	106	Grid / Generator VTHD-B	00	D2	00	D2
30213	40213	107	Grid / Generator ITHD-R	00	D4	00	D4
30215	40215	108	Grid / Generator ITHD-Y	00	D6	00	D6
30217	40217	109	Grid / Generator ITHD-B	00	D8	00	D8
30219	40219	110	Grid / Generator V-THD	00	DA	00	DA
30221	40221	111	Grid / Generator I-THD	00	DC	00	DC
30225	40225	113	Grid / Generator Neutral Current	00	E0	00	E0
30229	40229	115	Auxiliary Supply On Hour	00	E4	00	E4
30231	40231	116	Auxiliary Supply No. of interrupts	00	E6	00	E6
30267	40267	134	Relay Output status *	01	0A	01	0A
30333	40333	167	Grid / Gen. Phase Reversal Indication *	01	4C	01	4C
30369	40369	185	Total Inverter Capacity	01	70	01	70
30371	40371	186	Total Inverter Power	01	72	01	72
30375	40375	188	Grid / Generator Power	01	76	01	76
30377	40377	189	Grid / Generator Minimum Power	01	78	01	78
30379	40379	190	Generator Status (0-Active, 1-Inactive)*	01	7A	01	7A
30381	40381	191	Inverter Fault Indicate (0 - Fault absent)*	01	7C	01	7C
30385	40385	193	Inverter Target Power (%)	01	80	01	80
30387	40387	194	Load Power	01	82	01	82

*Note : 1. Relay Output Status shows whether relay is Energized or De-energized.

1 :- Relay Energized 0 :- Relay De-energized

2. Load Phase Reversal Indication :

1:- Correct Sequence 2:- Sequence Reverse 3:- Input Absent 4:- Sequence Error

3. Generator Status indicates the Gensense status of the add-on card,

4. 'Inverter Fault Indicate' : 1 :- either inverter disconnection or excess reverse power flow in case Generator is sensed 2 :- inverter disconnection with instrument when Grid is present (Gen. not sensed).

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30401	40401	201	VR Harmonic-1	01	90	01	90
30403	40403	202	IR Harmonic-1	01	92	01	92
30405	40405	203	VR Harmonic-2	01	94	01	94
30407	40407	204	IR Harmonic-2	01	96	01	96
30409	40409	205	VR Harmonic-3	01	98	01	98
30411	40411	206	IR Harmonic-3	01	9A	01	9A
30413	40413	207	VR Harmonic-4	01	9C	01	9C
30415	40415	208	IR Harmonic-4	01	9E	01	9E
30417	40417	209	VR Harmonic-5	01	A0	01	A0
30419	40419	210	IR Harmonic-5	01	A2	01	A2
30421	40421	211	VR Harmonic-6	01	A4	01	A4
30423	40423	212	IR Harmonic-6	01	A6	01	A6
30425	40425	213	VR Harmonic-7	01	A8	01	A8
30427	40427	214	IR Harmonic-7	01	AA	01	AA
30429	40429	215	VR Harmonic-8	01	AC	01	AC
30431	40431	216	IR Harmonic-8	01	AE	01	AE
30433	40433	217	VR Harmonic-9	01	B0	01	B0
30435	40435	218	IR Harmonic-9	01	B2	01	B2
30437	40437	219	VR Harmonic-10	01	B4	01	B4
30439	40439	220	IR Harmonic-10	01	B6	01	B6
30441	40441	221	VR Harmonic-11	01	B8	01	B8
30443	40443	222	IR Harmonic-11	01	BA	01	BA
30445	40445	223	VR Harmonic-12	01	BC	01	BC
30447	40447	224	IR Harmonic-12	01	BE	01	BE
30449	40449	225	VR Harmonic-13	01	C0	01	C0
30451	40451	226	IR Harmonic-13	01	C2	01	C2
30453	40453	227	VR Harmonic-14	01	C4	01	C4
30455	40455	228	IR Harmonic-14	01	C6	01	C6
30457	40457	229	VR Harmonic-15	01	C8	01	C8
30459	40459	230	IR Harmonic-15	01	CA	01	CA

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30461	40461	231	VR Harmonic-16	01	CC	01	CC
30463	40463	232	IR Harmonic-16	01	CE	01	CE
30465	40465	233	VR Harmonic-17	01	D0	01	D0
30467	40467	234	IR Harmonic-17	01	D2	01	D2
30469	40469	235	VR Harmonic-18	01	D4	01	D4
30471	40471	236	IR Harmonic-18	01	D6	01	D6
30473	40473	237	VR Harmonic-19	01	D8	01	D8
30475	40475	238	IR Harmonic-19	01	DA	01	DA
30477	40477	239	VR Harmonic-20	01	DC	01	DC
30479	40479	240	IR Harmonic-20	01	DE	01	DE
30481	40481	241	VR Harmonic-21	01	E0	01	E0
30483	40483	242	IR Harmonic-21	01	E2	01	E2
30485	40485	243	VR Harmonic-22	01	E4	01	E4
30487	40487	244	IR Harmonic-22	01	E6	01	E6
30489	40489	245	VR Harmonic-23	01	E8	01	E8
30491	40491	246	IR Harmonic-23	01	EA	01	EA
30493	40493	247	VR Harmonic-24	01	EC	01	EC
30495	40495	248	IR Harmonic-24	01	EE	01	EE
30497	40497	249	VR Harmonic-25	01	F0	01	F0
30499	40499	250	IR Harmonic-25	01	F2	01	F2
30501	40501	251	VR Harmonic-26	01	F4	01	F4
30503	40503	252	IR Harmonic-26	01	F6	01	F6
30505	40505	253	VR Harmonic-27	01	F8	01	F8
30507	40507	254	IR Harmonic-27	01	FA	01	FA
30509	40509	255	VR Harmonic-28	01	FC	01	FC
30511	40511	256	IR Harmonic-28	01	FE	01	FE
30513	40513	257	VR Harmonic-29	02	00	02	00
30515	40515	258	IR Harmonic-29	02	02	02	02
30517	40517	259	VR Harmonic-30	02	04	02	04
30519	40519	260	IR Harmonic-30	02	06	02	06

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30521	40521	261	VR Harmonic-31	02	08	02	08
30523	40523	262	IR Harmonic-31	02	0A	02	0A
30525	40525	263	Reserved	02	0C	02	0C
30527	40527	264	Reserved	02	0E	02	0E
30529	40529	265	VY Harmonic-1	02	10	02	10
30531	40531	266	IY Harmonic-1	02	12	02	12
30533	40533	267	VY Harmonic-2	02	14	02	14
30535	40535	268	IY Harmonic-2	02	16	02	16
30537	40537	269	VY Harmonic-3	02	18	02	18
30539	40539	270	IY Harmonic-3	02	1A	02	1A
30541	40541	271	VY Harmonic-4	02	1C	02	1C
30543	40543	272	IY Harmonic-4	02	1E	02	1E
30545	40545	273	VY Harmonic-5	02	20	02	20
30547	40547	274	IY Harmonic-5	02	22	02	22
30549	40549	275	VY Harmonic-6	02	24	02	24
30551	40551	276	IY Harmonic-6	02	26	02	26
30553	40553	277	VY Harmonic-7	02	28	02	28
30555	40555	278	IY Harmonic-7	02	2A	02	2A
30557	40557	279	VY Harmonic-8	02	2C	02	2C
30559	40559	280	IY Harmonic-8	02	2E	02	2E
30561	40561	281	VY Harmonic-9	02	30	02	30
30563	40563	282	IY Harmonic-9	02	32	02	32
30565	40565	283	VY Harmonic-10	02	34	02	34
30567	40567	284	IY Harmonic-10	02	36	02	36
30569	40569	285	VY Harmonic-11	02	38	02	38
30571	40571	286	IY Harmonic-11	02	3A	02	3A
30573	40573	287	VY Harmonic-12	02	3C	02	3C
30575	40575	288	IY Harmonic-12	02	3E	02	3E
30577	40577	289	VY Harmonic-13	02	40	02	40
30579	40579	290	IY Harmonic-13	02	42	02	42

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30581	40581	295	VY Harmonic-14	02	44	02	44
30583	40583	296	IY Harmonic-14	02	46	02	46
30585	40585	297	VY Harmonic-15	02	48	02	48
30587	40587	298	IY Harmonic-15	02	4A	02	4A
30589	40589	299	VY Harmonic-16	02	4C	02	4C
30591	40591	300	IY Harmonic-16	02	4E	02	4E
30593	40593	301	VY Harmonic-17	02	50	02	50
30595	40595	302	IY Harmonic-17	02	52	02	52
30597	40597	303	VY Harmonic-18	02	54	02	54
30599	40599	304	IY Harmonic-18	02	56	02	56
30601	40601	305	VY Harmonic-19	02	58	02	58
30603	40603	306	IY Harmonic-19	02	5A	02	5A
30605	40605	307	VY Harmonic-20	02	5C	02	5C
30607	40607	308	IY Harmonic-20	02	5E	02	5E
30609	40609	309	VY Harmonic-21	02	60	02	60
30611	40611	310	IY Harmonic-21	02	62	02	62
30613	40613	311	VY Harmonic-22	02	64	02	64
30615	40615	312	IY Harmonic-22	02	66	02	66
30617	40617	313	VY Harmonic-23	02	68	02	68
30619	40619	314	IY Harmonic-23	02	6A	02	6A
30621	40621	315	VY Harmonic-24	02	6C	02	6C
30623	40623	316	IY Harmonic-24	02	6E	02	6E
30625	40625	317	VY Harmonic-25	02	70	02	70
30627	40627	318	IY Harmonic-25	02	72	02	72
30629	40629	319	VY Harmonic-26	02	74	02	74
30631	40631	320	IY Harmonic-26	02	76	02	76
30633	40633	291	VY Harmonic-27	02	78	02	78
30635	40635	292	IY Harmonic-27	02	7A	02	7A
30637	40637	293	VY Harmonic-28	02	7C	02	7C
30639	40639	294	IY Harmonic-28	02	7E	02	7E

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30641	40641	321	VY Harmonic-29	02	80	02	80
30643	40643	322	IY Harmonic-29	02	82	02	82
30645	40645	323	VY Harmonic-30	02	84	02	84
30647	40647	324	IY Harmonic-30	02	86	02	86
30649	40649	325	VY Harmonic-31	02	88	02	88
30651	40651	326	IY Harmonic-31	02	8A	02	8A
30653	40653	327	Reserved	02	8C	02	8C
30655	40655	328	Reserved	02	8E	02	8E
30657	40657	329	VB Harmonic-1	02	90	02	90
30659	40659	330	IB Harmonic-1	02	92	02	92
30661	40661	331	VB Harmonic-2	02	94	02	94
30663	40663	332	IB Harmonic-2	02	96	02	96
30665	40665	333	VB Harmonic-3	02	98	02	98
30667	40667	334	IB Harmonic-3	02	9A	02	9A
30669	40669	335	VB Harmonic-4	02	9C	02	9C
30671	40671	336	IB Harmonic-4	02	9E	02	9E
30673	40673	337	VB Harmonic-5	02	A0	02	A0
30675	40675	338	IB Harmonic-5	02	A2	02	A2
30677	40677	339	VB Harmonic-6	02	A4	02	A4
30679	40679	340	IB Harmonic-6	02	A6	02	A6
30681	40681	341	VB Harmonic-7	02	A8	02	A8
30683	40683	342	IB Harmonic-7	02	AA	02	AA
30685	40685	343	VB Harmonic-8	02	AC	02	AC
30687	40687	344	IB Harmonic-8	02	AE	02	AE
30689	40689	345	VB Harmonic-9	02	B0	02	B0
30691	40691	346	IB Harmonic-9	02	B2	02	B2
30693	40693	347	VB Harmonic-10	02	B4	02	B4
30695	40695	348	IB Harmonic-10	02	B6	02	B6
30697	40697	349	VB Harmonic-11	02	B8	02	B8
30699	40699	350	IB Harmonic-11	02	BA	02	BA

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30701	40701	351	VB Harmonic-12	02	BC	02	BC
30703	40703	352	IB Harmonic-12	02	BE	02	BE
30705	40705	353	VB Harmonic-13	02	C0	02	C0
30707	40707	354	IB Harmonic-13	02	C2	02	C2
30709	40709	355	VB Harmonic-14	02	C4	02	C4
30711	40711	356	IB Harmonic-14	02	C6	02	C6
30713	40713	357	VB Harmonic-15	02	C8	02	C8
30715	40715	358	IB Harmonic-15	02	CA	02	CA
30717	40717	359	VB Harmonic-16	02	CC	02	CC
30719	40719	360	IB Harmonic-16	02	CE	02	CE
30721	40721	361	VB Harmonic-17	02	D0	02	D0
30723	40723	362	IB Harmonic-17	02	D2	02	D2
30725	40725	363	VB Harmonic-18	02	D4	02	D4
30727	40727	364	IB Harmonic-18	02	D6	02	D6
30729	40729	365	VB Harmonic-19	02	D8	02	D8
30731	40731	366	IB Harmonic-19	02	DA	02	DA
30733	40733	367	VB Harmonic-20	02	DC	02	DC
30735	40735	368	IB Harmonic-20	02	DE	02	DE
30737	40737	369	VB Harmonic-21	02	E0	02	E0
30739	40739	370	IB Harmonic-21	02	E2	02	E2
30741	40741	371	VB Harmonic-22	02	E4	02	E4
30743	40743	372	IB Harmonic-22	02	E6	02	E6
30745	40745	373	VB Harmonic-23	02	E8	02	E8
30747	40747	374	IB Harmonic-23	02	EA	02	EA
30749	40749	375	VB Harmonic-24	02	EC	02	EC
30751	40751	376	IB Harmonic-24	02	EE	02	EE
30753	40753	377	VB Harmonic-25	02	F0	02	F0
30755	40755	378	IB Harmonic-25	02	F2	02	F2
30757	40757	379	VB Harmonic-26	02	F4	02	F4
30759	40759	380	IB Harmonic-26	02	F6	02	F6

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
30761	40761	381	VB Harmonic-27	02	F8	02	F8
30763	40763	382	IB Harmonic-27	02	FA	02	FA
30765	40765	383	VB Harmonic-28	02	FC	02	FC
30767	40767	384	IB Harmonic-28	02	FE	02	FE
30769	40769	385	VB Harmonic-29	03	00	03	00
30771	40771	386	IB Harmonic-29	03	02	03	02
30773	40773	387	VB Harmonic-30	03	04	03	04
30775	40775	388	IB Harmonic-30	03	06	03	06
30777	40777	389	VB Harmonic-31	03	08	03	08
30779	40779	390	IB Harmonic-31	03	0A	03	0A
30781	40781	391	Reserved	03	0C	03	0C
30783	40783	392	Reserved	03	0E	03	0E
32001	42001	401	Inverter 1 Capacity	07	D0	07	D0
32003	42003	402	Inverter 1 Power	07	D2	07	D2
32005	42005	403	Inverter 1 Corrected power	07	D4	07	D4
32007	42007	404	Inverter 1 Connection Status	07	D6	07	D6
32009	42009	405	Reserved	07	D8	07	D8
32011	42011	406	Inverter 2 Capacity	07	DA	07	DA
32013	42013	407	Inverter 2 Power	07	DC	07	DC
32015	42015	408	Inverter 2 Corrected power	07	DE	07	DE
32017	42017	409	Inverter 2 Connection Status	07	E0	07	E0
32019	42019	410	Reserved	07	E2	07	E2
32021	42021	411	Inverter 3 Capacity	07	E4	07	E4
32023	42023	412	Inverter 3 Power	07	E6	07	E6
32025	42025	413	Inverter 3 Corrected power	07	E8	07	E8
32027	42027	414	Inverter 3 Connection Status	07	EA	07	EA
32029	42029	415	Reserved	07	EC	07	EC
32031	42031	416	Inverter 4 Capacity	07	EE	07	EE
32033	42033	417	Inverter 4 Power	07	F0	07	F0
32035	42035	418	Inverter 4 Corrected power	07	F2	07	F2

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
32037	42037	419	Inverter 4 Connection Status	07	F4	07	F4
32039	42039	420	Reserved	07	F6	07	F6
32041	42041	421	Inverter 5 Capacity	07	F8	07	F8
32043	42043	422	Inverter 5 Power	07	FA	07	FA
32045	42045	423	Inverter 5 Corrected power	07	FC	07	FC
32047	42047	424	Inverter 5 Connection Status	07	FE	07	FE
32049	42049	425	Reserved	08	00	08	00
32051	42051	426	Inverter 6 Capacity	08	02	08	02
32053	42053	427	Inverter 6 Power	08	04	08	04
32055	42055	428	Inverter 6 Corrected power	08	06	08	06
32057	42057	429	Inverter 6 Connection Status	08	08	08	08
32059	42059	430	Reserved	08	0A	08	0A
32061	42061	431	Inverter 7 Capacity	08	0C	08	0C
32063	42063	432	Inverter 7 Power	08	0E	08	0E
32065	42065	433	Inverter 7 Corrected power	08	10	08	10
32067	42067	434	Inverter 7 Connection Status	08	12	08	12
32069	42069	435	Reserved	08	14	08	14
32071	42071	436	Inverter 8 Capacity	08	16	08	16
32073	42073	437	Inverter 8 Power	08	18	08	18
32075	42075	438	Inverter 8 Corrected power	08	1A	08	1A
32077	42077	439	Inverter 8 Connection Status	08	1C	08	1C
32079	42079	440	Reserved	08	1E	08	1E
32081	42081	441	Inverter 9 Capacity	08	20	08	20
32083	42083	442	Inverter 9 Power	08	22	08	22
32085	42085	443	Inverter 9 Corrected power	08	24	08	24
32087	42087	444	Inverter 9 Connection Status	08	26	08	26
32089	42089	445	Reserved	08	28	08	28
32091	42091	446	Inverter 10 Capacity	08	2A	08	2A
32093	42093	447	Inverter 10 Power	08	2C	08	2C
32095	42095	448	Inverter 10 Corrected power	08	2E	08	2E

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
32097	42097	449	Inverter 10 Connection Status	08	30	08	30
32099	42099	450	Reserved	08	32	08	32
32101	42101	451	Inverter 11 Capacity	08	34	08	34
32103	42103	452	Inverter 11 Power	08	36	08	36
32105	42105	453	Inverter 11 Corrected power	08	38	08	38
32107	42107	454	Inverter 11 Connection Status	08	3A	08	3A
32109	42109	455	Reserved	08	3C	08	3C
32111	42111	456	Inverter 12 Capacity	08	3E	08	3E
32113	42113	457	Inverter 12 Power	08	40	08	40
32115	42115	458	Inverter 12 Corrected power	08	42	08	42
32117	42117	459	Inverter 12 Connection Status	08	44	08	44
32119	42119	460	Reserved	08	46	08	46
32121	42121	461	Inverter 13 Capacity	08	48	08	48
32123	42123	462	Inverter 13 Power	08	4A	08	4A
32125	42125	463	Inverter 13 Corrected power	08	4C	08	4C
32127	42127	464	Inverter 13 Connection Status	08	4E	08	4E
32129	42129	465	Reserved	08	50	08	50
32131	42131	466	Inverter 14 Capacity	08	52	08	52
32133	42133	467	Inverter 14 Power	08	54	08	54
32135	42135	468	Inverter 14 Corrected power	08	56	08	56
32137	42137	469	Inverter 14 Connection Status	08	58	08	58
32139	42139	470	Reserved	08	5A	08	5A
32141	42141	471	Inverter 15 Capacity	08	5C	08	5C
32143	42143	472	Inverter 15 Power	08	5E	08	5E
32145	42145	473	Inverter 15 Corrected power	08	60	08	60
32147	42147	474	Inverter 15 Connection Status	08	62	08	62
32149	42149	475	Reserved	08	64	08	64
32151	42151	476	Inverter 16 Capacity	08	66	08	66
32153	42153	477	Inverter 16 Power	08	68	08	68
32155	42155	478	Inverter 16 Corrected power	08	6A	08	6A

TABLE 1 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Start Address Hex 3X		Start Address Hex 4X	
				High Byte	Low Byte	High Byte	Low Byte
32157	42157	479	Inverter 16 Connection Status	08	6C	08	6C
32159	42159	480	Reserved	08	6E	08	6E
32161	42161	481	Inverter 17 Capacity	08	70	08	70
32163	42163	482	Inverter 17 Power	08	72	08	72
32165	42165	483	Inverter 17 Corrected power	08	74	08	74
32167	42167	484	Inverter 17 Connection Status	08	76	08	76
32169	42169	485	Reserved	08	78	08	78
32171	42171	486	Inverter 18 Capacity	08	7A	08	7A
32173	42173	487	Inverter 18 Power	08	7C	08	7C
32175	42175	488	Inverter 18 Corrected power	08	7E	08	7E
32177	42177	489	Inverter 18 Connection Status	08	80	08	80
32179	42179	490	Reserved	08	82	08	82
32181	42181	491	Inverter 19 Capacity	08	84	08	84
32183	42183	492	Inverter 19 Power	08	86	08	86
32185	42185	493	Inverter 19 Corrected power	08	88	08	88
32187	42187	494	Inverter 19 Connection Status	08	8A	08	8A
32189	42189	495	Reserved	08	8C	08	8C
32191	42191	496	Inverter 20 Capacity	08	8E	08	8E
32193	42193	497	Inverter 20 Power	08	90	08	90
32195	42195	498	Inverter 20 Corrected power	08	92	08	92
32197	42197	499	Inverter 20 Connection Status	08	94	08	94
32199	42199	500	Reserved	08	96	08	96

Note : 1. The individual harmonics, i.e. parameters from 201 to 392 correspond to the Grid/ Generator.

2. The inverter Connection Status (Para. no. 404, 409, & so on) indicate the following:

0 :- Active

1 :- Timeout

2:- Illegal Response

3 :- CRC Mismatch

4 :- Address Mismatch

TABLE 2 : 3X and 4X register addresses for 32-bit Integer Energy

Address (3X)	Address (4X)	Parameter	Start Address Hex 3X		Start Address Hex 4X	
			Hi Byte	Lo Byte	Hi Byte	Lo Byte
30803	40803	Grid Active Energy Import	03	22	03	22
30805	40805	Grid Active Energy Export	03	24	03	24
30807	40807	Generator Active Energy Import	03	26	03	26
30809	40809	Generator Active Energy Export	03	28	03	28
30815	40815	Grid Active Energy Import Overflow Count	03	2E	03	2E
30817	40817	Grid Active Energy Export Overflow Count	03	30	03	30
30819	40819	Generator Active Energy Import Overflow Count	03	32	03	32
30821	40821	Generator Active Energy Export Overflow Count	03	34	03	34
30827	40827	Grid Active Energy Import on time*	03	3A	03	3A
30829	40829	Grid Active Energy Export on time*	03	3C	03	3C
30831	40831	Generator Active Energy Import on time*	03	3E	03	3E
30833	40833	Generator Active Energy Export on time*	03	40	03	40
30839	40839	Grid Active Energy Import Overflow Count on time*	03	46	03	46
30841	40841	Grid Active Energy Export Overflow Count on time*	03	48	03	48
30843	40843	Generator Active Energy Import Overflow Count on time*	03	4A	03	4A
30845	40845	Generator Active Energy Export Overflow Count on time*	03	4C	03	4C

***Note:**

1. The values are updated depending on energy update rate which is settable by user. For example, if user sets update rate 15 min, then the values on these registers (marked with *) will get updated in every 15 min.

3.2 Accessing 4 X register for Reading & Writing Settings:

Each setting is held in the 4X registers. ModBus code 03 is used to read the current setting & code 16 is used to write/change the setting. Refer **TABLE 3** for 4X Register addresses.

Example: Reading Energy Resolution / unit

Energy Resolution / unit: Start address = 1774 (Hex)

Number of registers = 02

Note: Number of registers = Number of Parameters x 2

Query :

Device Address	01 (Hex)
Function Code	03 (Hex)
Start Address High	17 (Hex)
Start Address Low	74 (Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02 (Hex)
CRC Low	E4 (Hex)
CRC High	09 (Hex)

Start Address High : Most significant 8 bits of starting address of the parameter requested.

Start Address low : Least significant 8 bits of starting address of the parameter requested.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

(Note : Two consecutive 16 bit register represent one parameter.)

Response: Energy Resolution / unit (Mega watt = 3)

Device Address	01 (Hex)
Function Code	03 (Hex)
Byte Count	04 (Hex)
Data Register1 High Byte	40 (Hex)
Data Register1Low Byte	40 (Hex)
Data Register2 High Byte	00 (Hex)
Data Register2 Low Byte	00 (Hex)
CRC Low	EE (Hex)
CRC High	27 (Hex)

Byte Count : Total number of data bytes received.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit register represent one parameter.)

Example : Writing Energy Resolution / unit

Energy Resolution / unit : Start address = 1774 (Hex)
Number of registers = 02

Query:(Change Energy Resolution / unit to kilo watt = 2)

Device Address	01 (Hex)
Function Code	10 (Hex)
Starting Address Hi	17 (Hex)
Starting Address Lo	74(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
Byte Count	04 (Hex)
Data Register-1High Byte	40 (Hex)
Data Register-1 Low Byte	00(Hex)
Data Register-2 High Byte	00(Hex)
Data Register-2 Low Byte	00(Hex)
CRC Low	66 (Hex)
CRC High	10 (Hex)

Byte Count : Total number of data bytes received.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit register represent one parameter.)

Response:

Device Address	01 (Hex)
Function Code	10 (Hex)
Start Address High	17 (Hex)
Start Address Low	74(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
CRC Low	61 (Hex)
CRC High	CA (Hex)

Start Address High : Most significant 8 bits of starting address of the parameter requested.

Start Address low : Least significant 8 bits of starting address of the parameter requested.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

(Note : Two consecutive 16 bit register represent one parameter.)

3.3 Accessing 4 X register for Long Energy Reading & Writing

For setting Energy start count in long energy format following Query format should be used. For writing energy start count first send query to unlock the parameter

Query:(Query For Unlock to enter Grid Active Energy Import)

Device Address	01 (Hex)
Function Code	10 (Hex)
Starting Address Hi	03(Hex)
Starting Address Lo	22(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
Byte Count	04 (Hex)
Data Register-1High Byte	00 (Hex)
Data Register-1 Low Byte	00(Hex)
Data Register-2 High Byte	00(Hex)
Data Register-2 Low Byte	01(Hex)
CRC Low	66 (Hex)
CRC High	10 (Hex)

Byte Count : Total number of data bytes transmitted.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit register represent one parameter.)

Response:

Device Address	01 (Hex)
Function Code	10 (Hex)
Start Address High	03 (Hex)
Start Address Low	22(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
CRC Low	61 (Hex)
CRC High	CA (Hex)

Start Address High : Most significant 8 bits of starting address of the parameter requested.

Start Address low : Least significant 8 bits of starting address of the parameter requested.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

Once the unlock Query is send, send query for writing Energy start count.

For Example: Query for writing energy start count of 999999999 for Grid Active Energy Import

Note: Refer TABLE 5 for energy parameter selection.

Query:(Query to enter Grid Active Energy Import)

Device Address	01 (Hex)
Function Code	10 (Hex)
Starting Address Hi	03(Hex)
Starting Address Lo	22(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
Byte Count	04 (Hex)
Data Register-1High Byte	3B (Hex)
Data Register-1 Low Byte	9A(Hex)
Data Register-2 High Byte	C9(Hex)
Data Register-2 Low Byte	FF(Hex)
CRC Low	66 (Hex)
CRC High	10 (Hex)

Byte Count : Total number of data bytes received.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit register represent one parameter.)

Value(3B,9A,C9,FF) represents 999999999.

Response:

Device Address	01 (Hex)
Function Code	10 (Hex)
Start Address High	03 (Hex)
Start Address Low	22(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
CRC Low	61 (Hex)
CRC High	CA (Hex)

Start Address High : Most significant 8 bits of starting address of the parameter requested.

Start Address low : Least significant 8 bits of starting address of the parameter requested.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

(Note : Two consecutive 16 bit register represent one parameter.)

TABLE 3 : 4 X register addresses

Address (Register)	Parameter No.	Parameter	Read/ Write	Modbus Start Addr. Hex		Default Value
				High Byte	Low Byte	
46003	1	----		17	72	
46005	2	Energy Resolution / unit	R/Wp	17	74	2
46011	5	Grid/ Generator System type	R	17	7A	3
46013	6	---		17	7C	
46015	7	Reset Parameters	R/Wp	17	7E	0
46017	8	---		17	80	
46019	9	RS485 Inverter setup code	R/Wp	17	82	4
46021	10	---		17	84	
46023	11	---		17	86	
46029	14	---		17	8C	
46031	15	---		17	8E	
46033	16	Grid / Gen. PT primary	R/Wp	17	90	415
46035	17	Grid / Gen. CT primary	R/Wp	17	92	5
46039	19	Energy digit reset count	R/Wp	17	96	8
46041	20	---		17	98	
46043	21	Grid / Gen. CT Secondary	R/Wp	17	9A	5
46045	22	Grid / Gen. PT Secondary	R/Wp	17	9C	415
46047	23	Relay Mode	R/Wp	17	9E	1
46049	24	---		17	A0	
46051	25	---		17	A2	
46053	26	---		17	A4	
46055	27	Inverter-Grid Relay ON delay	R/Wp	17	A6	45
46057	28	Inverter-Grid Relay OFF delay	R/Wp	17	A8	45
46059	29	Inverter-Grid Relay Configuration	R/Wp	17	AA	0
46061	30	Relay Manual ON/ OFF	R/Wp	17	AC	0
46063	31	Generator Reverse Power Threshold	R/Wp	17	AE	-
46065	32	----		17	B0	
46067	33	Inverter-Generator Relay ON delay	R/Wp	17	B2	45
46069	34	Inverter-Generator Relay OFF delay	R/Wp	17	B4	45

TABLE 3 : continued...

Address (Register)	Parameter No.	Parameter	Read/ Write	Modbus Start Addr. Hex		Default Value
				High Byte	Low Byte	
46071	35	Password	R/Wp	17	B6	0000
46073	36	---		17	B8	
46075	37	Inverter-Generator Relay Configuration	R/Wp	17	BA	0
46077	38	---		17	BC	
46079	39	Grid / Gen. 30mA Noise cutoff	R/Wp	17	BE	0
46081	40	Update rate on MODBUS	R/Wp	17	C0	15
46083	41	Factory Reset Mode	R/Wp	17	C2	0
46087	43	Grid/ Generator Frequency selection	R/Wp	17	C6	50
46089	44	--		17	C8	
46091	45	Energy Para Select	R/Wp	17	CA	0
46093	46	Enter Energy Start Count	R/Wp	17	CC	0
46095	47	--		17	CE	
46097	48	--		17	D0	
46099	49	--	R/Wp	17	D2	
46101	50	Inverter Power ON Delay	R/Wp	17	D4	600
46129	64	--		17	F0	
46131	65	--		17	F2	
46133	66	Brightness	R/Wp	17	F4	42
46135	67	Contrast	R/Wp	17	F6	9
46159	79	Red Color Code of Phase1	R/Wp	18	0E	160
46161	80	Green Color Code of Phase1	R/Wp	18	10	82
46163	81	Blue Color Code of Phase1	R/Wp	18	12	45
46165	82	Red Color Code of Phase2	R/Wp	18	14	0
46167	83	Green Color Code of Phase2	R/Wp	18	16	0
46169	84	Blue Color Code of Phase2	R/Wp	18	18	0
46171	85	Red Color Code of Phase3	R/Wp	18	1A	128
46173	86	Green Color Code of Phase3	R/Wp	18	1C	128
46175	87	Blue Color Code of Phase3	R/Wp	18	1E	128
46177	88	--	-	18	20	-

TABLE 3 : continued...

Address (Register)	Parameter No.	Parameter	Read/ Write	Modbus Start Addr. Hex		Default Value
				High Byte	Low Byte	
46181	90	Version no.	R	18	24	-
46183	91	--		18	26	
46185	92	--		18	28	
46267	133	--		18	7A	
46269	134	--		18	7C	
46271	135	--		18	7E	
46273	136	RS485 Inverter delay between polls	R/Wp	18	80	30000
46275	137	RS485 Inverter timeout duration	R/Wp	18	82	5000
46277	138	--		18	84	
46279	139	Grid Minimum Power	R/Wp	18	86	1
46281	140	Manual Power to Inverter En / Dis	R/Wp	18	88	0
46283	141	Manual Power to Inverter Value	R/Wp	18	8A	100
46285	142	Number of Inverters	R/Wp	18	8C	1
46287	143	Inverter 1 address	R/Wp	18	8E	1
46289	144	Inverter 2 address	R/Wp	18	90	2
46291	145	Inverter 3 address	R/Wp	18	92	3
46293	146	Inverter 4 address	R/Wp	18	94	4
46295	147	Inverter 5 address	R/Wp	18	96	5
46297	148	Inverter 6 address	R/Wp	18	98	6
46299	149	Inverter 7 address	R/Wp	18	9A	7
46301	150	Inverter 8 address	R/Wp	18	9C	8
46303	151	Inverter 9 address	R/Wp	18	9E	9
46305	152	Inverter 10 address	R/Wp	18	A0	10
46307	153	Inverter 11 address	R/Wp	18	A2	11
46309	154	Inverter 12 address	R/Wp	18	A4	12
46311	155	Inverter 13 address	R/Wp	18	A6	13
46313	156	Inverter 14 address	R/Wp	18	A8	14
46315	157	Inverter 15 address	R/Wp	18	AA	15
46317	158	Inverter 16 address	R/Wp	18	AC	16
46319	159	Inverter 17 address	R/Wp	18	AE	17
46321	160	Inverter 18 address	R/Wp	18	B0	18

TABLE 3 : continued...

Address (Register)	Parameter No.	Parameter	Read/ Write	Modbus Start Addr. Hex		Default Value
				High Byte	Low Byte	
46323	161	Inverter 19 address	R/Wp	18	B2	19
46325	162	Inverter 20 address	R/Wp	18	B4	20
46327	163	RS485 Data setup code	R/Wp	18	B6	4
46329	164	RS485 Data Device address	R/Wp	18	B8	1
46331	165	Solar Power reference	R/Wp	18	BA	3
46333	166	Generator Minimum Power	R/Wp	18	BC	-
46335	167	---		18	BE	
46337	168	---		18	C0	
46339	169	---		18	C2	
46375	187	Inv 1 Panel Capacity	R/Wp	18	E6	0
46377	188	Inv 2 Panel Capacity	R/Wp	18	E8	0
46379	189	Inv 3 Panel Capacity	R/Wp	18	EA	0
46381	190	Inv 4 Panel Capacity	R/Wp	18	EC	0
46383	191	Inv 5 Panel Capacity	R/Wp	18	EE	0
46385	192	Inv 6 Panel Capacity	R/Wp	18	F0	0
46387	193	Inv 7 Panel Capacity	R/Wp	18	F2	0
46389	194	Inv 8 Panel Capacity	R/Wp	18	F4	0
46391	195	Inv 9 Panel Capacity	R/Wp	18	F6	0
46393	196	Inv 10 Panel Capacity	R/Wp	18	F8	0
46395	197	Inv 11 Panel Capacity	R/Wp	18	FA	0
46397	198	Inv 12 Panel Capacity	R/Wp	18	FC	0
46399	199	Inv 13 Panel Capacity	R/Wp	18	FE	0
46401	200	Inv 14 Panel Capacity	R/Wp	18	00	0
46403	201	Inv 15 Panel Capacity	R/Wp	19	02	0
46405	202	Inv 16 Panel Capacity	R/Wp	19	04	0
46407	203	Inv 17 Panel Capacity	R/Wp	19	06	0
46409	204	Inv 18 Panel Capacity	R/Wp	19	08	0
46411	205	Inv 19 Panel Capacity	R/Wp	19	0A	0
46413	206	Inv 20 Panel Capacity	R/Wp	19	0C	0

NOTE: Wp - Write protected , R - Read only , R/Wp - Read & Write protected

Explanation for 4 X register :

NOTE: Writing any invalid values (non-applicable values) to any of the following locations will result in modbus error.

Address	Parameter	Description
46003	---	---
46005	Energy Resolution	This address is used to set energy output in Wh, kWh & MWh. Write one of the following value to this address. 1: Energy in Wh. 2: Energy in KWh. 3: Energy in MWh.
46011	Grid / Generator System Type	This address is used to read the System type of Grid / Generator connections. The value at this address is fixed at 3. 3: 3 Phase 4 Wire.
46013	---	---
46015	Reset Parameters	This address is used to reset different parameters of the Grid / Generator. Write specific value to this register to reset the corresponding parameter. Following are the values to reset various data. 1: Energy Reset 5: Aux On hour Reset 6: Aux Interruptions Reset 7: Reset All of above
46017	---	---
46019	RS485 Inverter Set-up Code	This address is used to set the baud rate, Parity and Number of stop bits for communication with inverters. Refer to TABLE 4 for details.
46021	---	---
46023	---	---
40029	---	---

Address	Parameter	Description
40031	---	---
46033	Grid / Gen. PT Primary	This address allows the user to set PT Primary value (in terms of VL-L) of Grid / Generator connections. The settable range is 100 VL-L to 692.8 kVL-L & also depends on the per phase 666.6MVA Restriction of power combined with CT primary.
46035	Grid / Gen. CT Primary	This address allows the user to set CT Primary value of Grid / Generator connections. The settable range is 1 to 9999. It also depends on the per phase 666.6 MVA Restriction of power combined with PT primary.
46039	Energy Digit Reset Count	This address is used to set Energy Digit Reset Count value. Energy count can be configured to reset in between 7 to 9.
46041	---	---
46043	Grid / Gen. CT secondary	This address is used to read and write the CT secondary value of Grid / Generator connections. Write one of the following values to this address. 1: 1A CT secondary 5: 5A CT secondary
46045	Grid / Gen. PT secondary	This address is used to read and write the PT secondary value of Grid / Generator connections. The settable range is 100-600VLL.
46047	Protection Relay Mode	This address is used to select the Relay operation as Automatic / Manual / Disable. Write one of the following values to this address. 1: Automatic 2: Manual 3: Disable.
46049	---	---
46051	---	---

Address	Parameter	Description
46053	---	---
46055	Inverter-Grid Relay ON Delay	This address is used to set the ON delay in seconds in range of 1 to 9999 when Grid is connected.
46057	Inverter-Grid Relay OFF Delay	This address is used to set the OFF delay in seconds in range of 1 to 9999 when Grid is connected.
46059	Inverter-Grid Relay Config.	This address is used to set the Configuration for Relay when Grid is connected. Two options are available: 0 : Energized 1 : De-Energized
46061	Relay Manual ON/ OFF	This address is used to manually turn ON/ OFF the Relay : 0 : Relay Manually OFF 1 : Relay Manually ON Caution : In this mode, the relay would not take any action on fault condition.
46063	Generator Reverse Power Threshold	This address is used to set the threshold of reverse power flow for Inverter-Generator connection. The valid range is 500-500000 watts. The default value depends on 'Generator Minimum Power' as: 'Inverter-Gen. Relay Threshold' = 'Gen. Min. Power' x1000.0 / 7
46065	---	---
46067	Inverter-Gen. Relay ON Delay	This address is used to set the ON delay in seconds in range of 1 to 9999 when Generator is connected.
46069	Inverter-Gen. Relay OFF Delay	This address is used to set the OFF delay in seconds in range of 1 to 9999 when Generator is connected.
46071	Password	This address is used to set & reset the password. Valid Range of Password can be set is 0000 - 9999 . 1) If password lock is present & if this location is read it will return zero . 2) If Password lock is absent & if this location is read it will return One . 3) If password lock is present & to disable this lock first send valid password to this location then write "0000" to this location 4) If password lock is present & to modify 4X parameter first send valid password to this location so that 4X parameter will be accessible for modification. 5) If for in any of the above case invalid password is send then meter will return exceptional error 2.

Address	Parameter	Description
46073	---	---
46075	Inverter-Gen. Relay Config.	This address is used to set the Configuration for Relay when Generator is connected. Two options are available: 0 : Energized 1 : De-Energized
46077	---	---
46079	Grid / Gen. 30mA Noise cutoff	This address is used to activate or de-activate the 30 mA noise current elimination (from Grid/ Generator). Write 0 : Deactivate 30 (Decimal): Activate
46081	Energy Update Rate	This address is used to specify update rate of energy measured from Grid/ Generator in corresponding 3X registers. The valid values for update rate are from 1 to 60 min.
46083	Factory Reset	This address allows the user to reset the instrument to factory settings. Refer the Default Values in TABLE 3 for factory settings. Write 5555 at this address to reset the instrument.
46087	Grid/ Gen. Frequency Selection	This address is used to set the frequency of the input. Write 50 : For 50 Hz input 60 : For 60Hz input
46089	---	---
46091	Energy Parameter Selection	This address is used to select the parameter whose start count (initial value) is to be set. Refer TABLE 5 .
46093	Energy Start Count	This address is used to set the start count of the parameter selected in address 46091. The start count of the parameter should be in the range specified in TABLE 5 .
46095	---	---

Address	Parameter	Description
46097	---	---
46099	---	---
46101	Inverter Power ON Delay	This address allows to read or set the time after Inverter Power ON for which the relay will be disabled. The valid range is from 10 to 9999 seconds. Default value is 600 seconds.
46129	---	---
46131	---	---
46133	Brightness	This address allows to read or set the value of brightness of display LCD. The valid range is from 2 to 85. Default value is 42.
46135	Contrast	This address allows to read or set the value of contrast of display LCD. The valid range is from 6 to 23. Default value is 9.
46137 to 46157	---	---
46159 to 46175	RGB Color Code for L1, L2, L3	This addresses allow to read or set the value of Red, Green, Blue component of color used to display phase 1, phase 2, phase 3 parameters respectively. Default value for phase 1:160, 82, 45; phase 2 : 0, 0, 0 and phase 3 : 128, 128, 128. The valid range is 0 to 255.
46181	Version Number	This address is read only and displays the version number of the meter.
46183	---	---
46185	---	---
46267	---	---
46269	---	---

Address	Parameter	Description
46271	---	---
46273	RS485 Inverter Delay between Polls	The address is used to set the delay between polls sent to the inverters for writing the corrections. Valid range is 10000 - 60000 msec.
46275	RS485 Inverter Timeout Duration	This address is used to set the timeout duration for the modbus connected to the inverters. Valid range is 200 - 60000 msec.
46277	---	---
46279	Grid Minimum Power	This address is used to set the minimum power to be consumed from the grid. Valid range is -2000 to 2000 kilo watts.
46281	Manual Inverter Power En/ Dis	This address is used to enable the setting of Manual Inverter Power Value. Two options are: 0 : Disable (default) 1: Enable.
46283	Manual Inverter Power Value	This address is used to set the manual output Power of the Inverters in percent of corresponding capacities. The value can be set only if the Manual Inverter Power (46281) is enabled. Valid range is 0 - 100% and default value is 100%.
46285	Number of Inverters	This address is used to set the total number of inverters connected to the device. The valid range is 1 - 20 inverters.
46287 - 46325	Inverter Addresses	These addresses are used to set the unique addresses of all the inverters connected to the device. Valid range is 1 to 247.
46327	RS 485 Data Setup Code	This address is used to set the baud rate, Parity and Number of stop bits for communication with device. Refer to TABLE 4 for details.
46329	RS485 Data Device Address	This address is used to set the address of the device to access the modbus parameters.
46331	Solar Power Reference	This address is used to set the reference for Generated Inverter Power in the 'SOLAR POWER GENERATION' measurement screen of SOLAR parameters of the device. The options available are : 1.: Based on Inverter Capacity 2 : Based on Panel Capacity 3.: Based on Minimum of Inverter Capacity and Panel Capacity.

Address	Parameter	Description
46333	Generator Minimum Power	This address is used to set the minimum power to be consumed from the generator. Valid range is 0 - 1000 kilo watts. The default value depends on PT Primary and CT Primary values as : 'Generator Min. Power' = PT Pri * CT Pri * Root(3) * 0.7/1000.0
46335	---	---
46337	---	---
46339	---	---
46341	---	---
46375 - 46413	Inverter PV Capacity	These addresses are used to set the capacity of PV connected to individual inverters. Valid range is 0 to 200 kW.

NOTE: Changing PT/CT ratio, Energy Output (Energy Resolution), Energy Digit Reset Count will reset the energy.

TABLE 4 : RS 485 Set-up Code

Baud Rate	Parity	Stop Bit	Decimal value
4800	NONE	01	0
4800	NONE	02	1
4800	EVEN	01	2
4800	ODD	01	3
9600	NONE	01	4
9600	NONE	02	5
9600	EVEN	01	6
9600	ODD	01	7
19200	NONE	01	8
19200	NONE	02	9
19200	EVEN	01	10
19200	ODD	01	11
38400	NONE	01	12
38400	NONE	02	13
38400	EVEN	01	14
38400	ODD	01	15
57600	NONE	01	16
57600	NONE	02	17
57600	EVEN	01	18
57600	ODD	01	19

NOTE : Codes not listed in the table above may give rise to unpredictable results including loss of communication. Exercise caution when attempting to change mode via direct Modbus writes.

TABLE 5: Energy Parameter Selection and Start Count

Parameter Number	Parameter	Range
2	Grid Import Active Energy Start Count	1 to 999999999
3	Grid Export Active Energy Start Count	1 to 999999999
4	Generator Import Active Energy Start Count	1 to 999999999
5	Generator Export Active Energy Start Count	1 to 999999999
8	Grid Import Active Energy Overflow Start Count	1 to 999999
9	Grid Export Active Energy Overflow Start Count	1 to 999999
10	Generator Import Active Energy Overflow Start Count	1 to 999999
11	Generator Export Active Energy Overflow Start Count	1 to 999999

TABLE 6 : Measurement Parameters

Measured Parameters	Units of Measurement
Grid / Generator Average Voltage	Volts
Grid / Generator Average Current	Amps
Grid / Generator Voltage VL1-N	Volts
Grid / Generator Voltage VL2-N	Volts
Grid / Generator Voltage VL3-N	Volts
Grid / Generator Voltage VL1-L2	Volts
Grid / Generator Voltage VL2-L3	Volts
Grid / Generator Voltage VL3-L1	Volts
Grid / Generator Current L1	Amps
Grid / Generator Current L2	Amps
Grid / Generator Current L3	Amps
Grid / Generator Neutral Current	Amps
Grid / Generator Frequency	Hz
Grid / Generator Active Power	Kwatts
Grid & Gen. Active Import Energy (8 Digit resolution)	kWh

TABLE 6 : Continued...

Measured Parameters	Units of Measurement
Grid & Gen. Active Export Energy (8 Digit resolution)	kWh
Inverter Capacity (Individual & Total)	W
Inverter Power (Individual & Total)	W
Inverter Target Power (%)	%
Load Power	W
Individual Inverter Connection Status	—
Grid / Generator Individual Harmonics V	%
Grid / Generator Individual Harmonics I	%
Auxiliary Supply On Hour	Hours
Auxiliary Supply Number of Interruptions	Counts
Grid / Generator Phase Reversal Indication	—
Grid / Generator V1 THD*	%
Grid / Generator V2 THD*	%
Grid / Generator V3 THD*	%
Grid / Generator I1 THD	%
Grid / Generator I2 THD	%
Grid / Generator I3 THD	%
Grid / Generator Average Voltage THD	%
Grid / Generator Average Current THD	%

***Note : THD Parameters are L-N.**

3.4 User Assignable Modbus Registers:

The Multifunction Instrument contains 20 user assignable registers in the address range of 0x400 (31025) to 0x426 (31065) for 3X registers (see TABLE 7) and address range of 0x400 (41025) to 0x426 (41065) for 4X registers (see TABLE 7).

Any of the parameter addresses (3X register addresses and 4X register addresses TABLE 1) accessible in the instrument can be mapped to these 20 user assignable registers.

Parameters (3X and 4X registers addresses) that reside in different locations may be accessed by the single request by re-mapping them to adjacent address in the user assignable registers area.

The actual address of the parameters (3X and 4X registers addresses) which are to be accessed via address 0x400 to 0x426 are specified in 4X Register 0x251C to 0x252F (see TABLE 8).

TABLE 7 : User Assignable 3X Data Registers

Address (3X)	Address (4X)	Assignable Register	Modbus Start Address (Hex)	
			High Byte	Low Byte
31025	41025	Assignable Reg 1	04	00
31027	41027	Assignable Reg 2	04	02
31029	41029	Assignable Reg 3	04	04
31031	41031	Assignable Reg 4	04	06
31033	41033	Assignable Reg 5	04	08
31035	41035	Assignable Reg 6	04	0A
31037	41037	Assignable Reg 7	04	0C
31039	41039	Assignable Reg 8	04	0E
31041	41041	Assignable Reg 9	04	10
31043	41043	Assignable Reg 10	04	12
31045	41045	Assignable Reg 11	04	14
31047	41047	Assignable Reg 12	04	16
31049	41049	Assignable Reg 13	04	18
31051	41051	Assignable Reg 14	04	1A
31053	41053	Assignable Reg 15	04	1C
31055	41055	Assignable Reg 16	04	1E
31057	41057	Assignable Reg 17	04	20
31059	41059	Assignable Reg 18	04	22
31061	41061	Assignable Reg 19	04	24
31063	41063	Assignable Reg 20	04	26

TABLE 8 : User Assignable Mapping Register (4X registers)

Address (4X)	Assignable Register	Modbus Start Address (Hex)	
		High Byte	Low Byte
49501	Mapped Add for register #0x0400	25	1C
49502	Mapped Add for register #0x0402	25	1D
49503	Mapped Add for register #0x0404	25	1E
49504	Mapped Add for register #0x0406	25	1F
49505	Mapped Add for register #0x0408	25	20
49506	Mapped Add for register #0x040A	25	21
49507	Mapped Add for register #0x040C	25	22
49508	Mapped Add for register #0x040E	25	23
49509	Mapped Add for register #0x0410	25	24
49510	Mapped Add for register #0x0412	25	25
49511	Mapped Add for register #0x0414	25	26
49512	Mapped Add for register #0x0416	25	27
49513	Mapped Add for register #0x0418	25	28
49514	Mapped Add for register #0x041A	25	29
49515	Mapped Add for register #0x041C	25	2A
49516	Mapped Add for register #0x041E	25	2B
49517	Mapped Add for register #0x0420	25	2C
49518	Mapped Add for register #0x0422	25	2D
49519	Mapped Add for register #0x0424	25	2E
49520	Mapped Add for register #0x0426	25	2F

Assigning parameter to User Assignable Registers:

To access the Grid/ Gen. Voltage2 (3X address 0x0002) and Grid Active Wh Export (3X address 0x004C) through user assignable register assign these addresses to 4x register (TABLE 8) 0x251C and 0x251D respectively.

Assigning Query:

Device Address	01 (Hex)
Function Code	10 (Hex)
Starting Address Hi	25 (Hex)
Starting Address Lo	1C (Hex)
Number of Registers Hi	00 (Hex)*
Number of Registers Lo	02(Hex)*
Byte Count	04 (Hex)
Data Register-1High Byte	00 (Hex)
Data Register-1 Low Byte	02 (Hex)
Data Register-2 High Byte	00 (Hex)
Data Register-2 Low Byte	4C (Hex)
CRC Low	CB (Hex)
CRC High	07 (Hex)

Grid/ Gen.
Voltage2 *
(3X Address
0x0002)

Grid Active Wh Exp*
(3X Address
0x004C)

Response :

Device Address	01 (Hex)
Function Code	10 (Hex)
Start Address High	25 (Hex)
Start Address Low	1C (Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02 (Hex)
CRC Low	40 (Hex)
CRC High	70 (Hex)

* Note : Parameters should be assigned in Multiple of two i.e. 2,4,6,8,.....20.

Reading Parameter data through User Assignable Registers:

In assigning query Grid / Gen. Voltage 2 & Grid Active Wh Export parameters were assigned to 0x251C & 0x251D (TABLE 8) which will point to user assignable 3x registers 0x400 and 0x402 (TABLE 7). So to read Grid / Gen. Voltage2 and Grid Active Wh Export data reading query should be as below.

Query:

Device Address	01 (Hex)
Function Code	04 (Hex)
Start Address High	04(Hex)
Start Address Low	00 (Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	04 (Hex)**
CRC Low	F0 (Hex)
CRC High	71 (Hex)

Start Address High : Most significant 8 bits of starting address of Userassignable register.

Start Address low :Least significant 8 bits of starting address of User assignable register.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

****Note** : Two consecutive 16 bit register represent one parameter. Since two parameters are requested four registers are required

Response : (Volt2 = 219.30 / Wh Export = 0.0)

Device Address	01 (Hex)
Function Code	04 (Hex)
Byte count	08 (Hex)
Data Register-1High Byte	43 (Hex)
Data Register-1 Low Byte	5B (Hex)
Data Register-2 High Byte	4E (Hex)
Data Register-2 Low Byte	04 (Hex)
Data Register-3 High Byte	00 (Hex)
Data Register-3 Low Byte	00 (Hex)
Data Register-4 High Byte	00 (Hex)
Data Register-4 Low Byte	00 (Hex)
CRC Low	79 (Hex)
CRC High	3F (Hex)

Grid / Gen.
Voltage 2
Data

Grid Active
Wh Exp.
Data

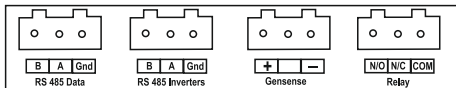
User Assignable mapping Registers (Starting Address) (4X Registers TABLE 8)		User Assignable Data Registers (Starting Address) (3X Registers TABLE 7)	
0x251C	Grid/Gen. Volt 2 (0x0002)	0x400 (16 bit)	0x401 (16 bit)
0x251D	Grid Wh Exp (0x004C)	0x402 (16 bit)	0x403 (16 bit)
0x251E	Gen. Wh Export (0x0050)	0x404 (16 bit)	0x405 (16 bit)
0x251F	Grid/Gen. Freq (0x0046)	0x406 (16 bit)	0x407 (16 bit)
⋮	⋮	⋮	⋮
0x252E	Grid/Gen. I 1 (0x0006)	0x424 (16 bit)	0x425 (16 bit)
0x252F	Grid/Gen. V12 (0x00C8)	0x426 (16 bit)	0x427 (16 bit)

To get the data through User Assignable Register go through the following steps:

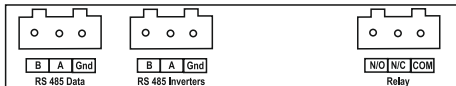
- 1) Assign starting addresses (TABLE 1) of parameters of interest to "User assignable mapping registers" in a sequence in which they are to be accessed (see Section "Assigning Parameter to User Assignable Registers" of Section 3.4).
- 2) Once the parameters are mapped, data can be acquired by using "User assignable data register" Starting address . i.e to access data of Grid / Generator Voltage2, Grid Wh Export, Generator Wh Export, Grid / Generator Frequency send query with starting address 0x0400 with number of register 8 or individually parameters can be accessed. For example, if Grid / Generator current1 is to be accessed use starting address 0x0424. (see Section Reading Parameter data through User Assignable Registers of Section 3.4).

4. Connection for Dual Modbus Addon Card (rear view of the instrument) :

Model With Gensense :



Model Without Gensense :





LUMEL S.A.

ul. Słubicka 4, 65-127 Zielona Góra, Poland
tel.: +48 68 45 75 100, fax +48 68 45 75 508
www.lumel.com.pl

Technical support:

tel.: (+48 68) 45 75 143, 45 75 141, 45 75 144, 45 75 140
e-mail: export@lumel.com.pl

Export department:

tel.: (+48 68) 45 75 130, 45 75 131, 45 75 132
e-mail: export@lumel.com.pl

Calibration & Attestation:

e-mail: laboratorium@lumel.com.pl