Power Factor Controller
PFC 144-PFC 96

Interface Definition

Version D_12/18

CAUTION:

1. High voltage !

2. PFC 96;144 may only be used indoor !

3. Make sure that the discharge time set in controller matches capacitor discharge time !

Version D_12/18

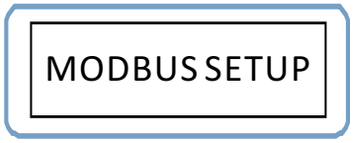
CONTENTS

Section 1 General

The Automatic Power Factor Controller is a modern control device of innovative design with a variety of functions.
The **PFC (96x96) has 4 or 6 or 8 relays** and **PFC (144 x 144) has 6 or 8 or 12 relays output**.
It is designed for a measuring voltage of 30...550VAC (L-N) or (L-L) and a auxiliary supply voltage of 110 to 550 VAC.
It features a user interface with a menu-driven display in plain text for maximum ease of operation. Straightforward symbols and alphanumeric displays combine maximum ease of handling with convenient presentation of results.
Display of various grid parameters, storage of various values and a test run option make it easy to analyze errors and monitor the system.

Section 2 Communication Parameter Selection :

Using Operating Manual enter into Advance Setup -> and Select Modbus Setup.



This menu allows user to set modbus related setup.
Press ENTER key to enter into modbus setup sub menus.
Pressing UP or DOWN key will scroll through submenus.

BAUD RATE : Press ENTER key to edit baud rate.
Press UP or DOWN key to get available options. Then pressing ENTER key will confirm newly changed values.
Value are settable as 4.8k, 9.6k, 19.2k, 38.4k, 57.6kbps.

PARITY : Press ENTER key to edit parity.
Press UP or DOWN key to get available options. Then pressing ENTER key will confirm newly changed parity.
parity are settable as none, even, odd.

STOP BITS : Press ENTER key to edit stop bits.
Press UP or DOWN key to get available options. Then pressing ENTER key will confirm newly changed values.
stop bits are settable as 1 or 2.

DEVICE ADDRESS : It allows to set RS 485 address for PFC.
Address are settable in range 1 to 247.
Press ENTER key to edit device address.
Pressing UP or DOWN key will increment or decrement digit value resp. Then pressing ENTER key will advance to next digit & confirm newly changed values.

Section 3 RS 485 (ModBus) Output :

The APFC 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. The screens should also be connected to the "Gnd" terminal. To avoid the possibility of loop currents, and 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 Meter is between 1 and 247 for 32 instruments. Broadcast Mode (address 0) is not allowed. The maximum latency time of an Meter 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 200ms of time to elapse before assuming that the Meter is not going to respond. If slave does not respond within 200 ms, Master can ignore the previous query and can issue fresh query to the slave.

Each byte in RTU mode has following format:

	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 and 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)

3.1 Accessing 3 X register for reading measured values:

Two consecutive 16 bit registers represent one parameter. Refer **TABLE 1** for the addresses of 3X registers (Parameters measured by the instruments). Each parameter is held in the 3X registers. Modbus Code 04 is used to access all parameters.

Example :

To read parameter ,

Line Voltage: Start address= 00 (Hex) Number of registers = 02

Note : Number of registers = Number of parameters x 2

Each Query for reading the data must be restricted to 40 parameters or less. Exceeding the 40 parameter limit will cause a ModBus exception code to be returned.

Query :

01 (Hex)	04 (Hex)	00 (Hex)	00(Hex)	00 (Hex)	02(Hex)	71 (Hex)	CB (Hex)
Device Address	Function Code	Start Address High	Start Address Low	Number of Registers Hi	Number of Registers Lo	CRC Low	CRC High

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: Line Voltage (240V)

Byte Count : Total number of data bytes received.

01 (Hex)	04 (Hex)	04 (Hex)	43 (Hex)	6E (Hex)	FB (Hex)	45 (Hex)	0D (Hex)	1E (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

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.)

TABLE 1 : 3 X register addresses (measured parameters)

Address Register	Parameter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30001	1	Line Voltage	00	00
30007	2	Line Current	00	06
30013	3	Active Power	00	0C
30019	4	Apparent Power	00	12
30025	5	Reactive Power	00	18
30031	6	Power Factor	00	1E
30037	7	Phase Angle	00	24
30071	8	Frequency	00	46
30073	9	Active Import Energy	00	48
30075	10	Active Export Energy	00	4A
30077	11	Inductive Reactive Energy	00	4C
30079	12	Capacitive Reactive Energy	00	4E
30081	13	Apparent Energy	00	50
30085	14	Active Import Demand	00	54
30087	15	Maximum Active Import Demand	00	56
30089	16	Active Export Demand	00	58
30091	17	Maximum Active Export Demand	00	5A
30093	18	Old Max Active Import Demand	00	5C
30095	19	Old Max Active Export Demand	00	5E
30097	20	Old Max Apparent Demand	00	60

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30099	21	Old Max Current Demand	00	62
30101	22	Apparent Demand	00	64
30103	23	Max Apparent Demand	00	66
30105	24	Current Demand	00	68
30107	25	Max Current Demand	00	6A
30109	26	Active Import Energy Overflow Count	00	6C
30113	27	Active Export Energy Overflow Count	00	70
30117	28	Reactive Ind(1) Energy Overflow Count	00	74
30121	29	Reactive Cap(2) Energy Overflow Count	00	78
30125	30	Apparent Energy Overflow Count	00	7C
30131	31	*RTC Hour minute (2 digit each)	00	82
30133	32	*RTC Date Month Year (2 digit each)	00	84
30135	33	System temperature	00	86
30145	34	Active Import Energy on update Rate	00	90
30147	35	Active Export Energy on update Rate	00	92
30149	36	Reactive Ind(1) Energy on update Rate	00	94
30151	37	Reactive Cap(2) Energy on update Rate	00	96

Note : - (1) Ind :- Inductive (2) Cap :- Capacitive

***Note** : - Optional RTC module available if APFC with RTC module
Ex :- IF value read at 30131 is 116 then it is 01 hrs. and 16 minutes.
whereas at 30133 is 11216 then it 1st of December 2016.

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30153	38	Apparent Energy on update Rate	00	98
30157	39	Active Imp[1] Energy OF[2]on update Rate	00	9C
30159	40	Active Exp[3] Energy Of[2]on update Rate	00	9E
30161	41	Reactive Ind[4] Energy OF[2]on update rate	00	A0
30163	42	Reactive Cap[5] Energy Of[2]on update rate	00	A2
30165	43	Apparent Energy OF[2]on update Rate	00	A4
30169	44	Old Active Imp[1] Energy OF[2]	00	A6
30171	45	Old Active Imp[1] Energy	00	A8
30173	46	Old Active Exp[3] Energy OF[2]	00	AC
30175	47	Old Active Exp[3] Energy	00	AE
30177	48	Old Reactive Imp[1] Energy OF[2]	00	B0
30179	49	Old Reactive Imp[1] Energy	00	B2
30181	50	Old Reactive Exp[3] Energy OF[2]	00	B4
30183	51	Old Reactive Exp[3] Energy	00	B6
30185	52	Old Apparent Energy OF[2]	00	B8

Note : - 1. Imp :- Import
2. OF :- OverFlow
3. Exp :- Export
4 Ind :- Inductive
5 Cap :- Capacitive

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30187	53	Old Apparent Energy	00	BA
30189	54	Maximum System Voltage	00	BC
30191	55	Maximum System Current	00	BE
30193	56	Maximum Active Import Power	00	C0
30195	57	Maximum Active Export Power	00	C2
30197	58	Maximum Inductive Reactive Power	00	C4
30199	59	Maximum Capacitive Reactive Power	00	C6
30201	60	Maximum Apparent Power	00	C8
30203	61	Maximum Voltage THD	00	CA
30205	62	Maximum Current THD	00	CC
30207	63	Maximum Frequency	00	CE
30209	64	Maximum Temperature	00	D0
30211	65	Minimum System Voltage	00	D2
30213	65	Minimum System Current	00	D4
30215	66	Minimum Frequency	00	D6
30217	67	Minimum Temperature	00	D8
30219	68	System Voltage THD %	00	DA
30221	69	System Current THD %	00	DC
30223	70	Old Run Hour	00	DE
30225	71	Old ON Hour	00	E0
30227	72	Run Hour	00	E2
30229	73	ON Hour	00	E4

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30231	74	Power Down Interruption Count	00	E6
30233	75	Power Down Interruption Time	00	E8
30235	76	Power Down Interruption Date	00	EA
30245	77	Difference to Power Factor	00	F4
30247	78	Capacitor Bank 1 KVAr value	00	F6
30249	79	Capacitor Bank 2 KVAr value	00	F8
30251	80	Capacitor Bank 3 KVAr value	00	FA
30253	81	Capacitor Bank 4 KVAr value	00	FC
30255	82	Capacitor Bank 5 KVAr value	00	FE
30257	83	Capacitor Bank 6 KVAr value	01	00
30259	84	Capacitor Bank 7 KVAr value	01	02
30261	85	Capacitor Bank 8 KVAr value	01	04
30263	86	Capacitor Bank 9 KVAr value	01	06
30265	87	Capacitor Bank 10 KVAr value	01	08
30267	88	Capacitor Bank 11 KVAr value	01	0A
30269	89	Capacitor Bank 12 KVAr value	01	0C
30271	90	Test Run Capacitor Bank 1 KVAr value	01	0E
30273	91	Test Run Capacitor Bank 2 KVAr value	01	10
30275	92	Test Run Capacitor Bank 3 KVAr value	01	12
30277	93	Test Run Capacitor Bank 4 KVAr value	01	14

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30279	94	Test Run Capacitor Bank 5 KVAr value	01	16
30281	95	Test Run Capacitor Bank 6 KVAr value	01	18
30283	96	Test Run Capacitor Bank 7 KVAr value	01	1A
30285	97	Test Run Capacitor Bank 8 KVAr value	01	1C
30287	98	Test Run Capacitor Bank 9 KVAr value	01	1E
30289	99	Test Run Capacitor Bank10 KVAr value	01	20
30291	100	Test Run Capacitor Bank 11 KVAr value	01	22
30293	101	Test Run Capacitor Bank 12 KVAr value	01	24
30295	102	Bank 1 No. of Switching operations	01	26
30297	103	Bank 2 No. of Switching operations	01	28
30299	104	Bank 3 No. of Switching operations	01	2A
30301	105	Bank 4 No. of Switching operations	01	2C
30303	106	Bank 5 No. of Switching operations	01	2E
30305	107	Bank 6 No. of Switching operations	01	30
30307	108	Bank 7 No. of Switching operations	01	32
30309	109	Bank 8 No. of Switching operations	01	34
30311	110	Bank 9 No. of Switching operations	01	36
30313	111	Bank 10 No. of Switching operations	01	38
30315	112	Bank 11 No. of Switching operations	01	3A
30317	113	Bank 12 No. of Switching operations	01	3C

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30321	114	2nd Line Voltage harmonic	01	40
30323	115	2nd Line Current harmonic	01	42
30325	116	3rd Line Voltage harmonic	01	44
30327	117	3rd Line Current harmonic	01	43
30329	118	4th Line Voltage harmonic	01	48
30331	119	4th Line Current harmonic	01	4A
30333	120	5th Line Voltage harmonic	01	4C
30335	121	5th Line Current harmonic	01	4E
30337	122	6th Line Voltage harmonic	01	50
30339	123	6th Line Current harmonic	01	52
30341	124	7th Line Voltage harmonic	01	54
30343	125	7th Line Current harmonic	01	56
30345	126	8th Line Voltage harmonic	01	58
30347	127	8th Line Current harmonic	01	5A
30349	128	9th Line Voltage harmonic	01	5C
30351	129	9th Line Current harmonic	01	5E
30353	130	10th Line Voltage harmonic	01	60
30355	131	10th Line Current harmonic	01	62
30357	132	11th Line Voltage harmonic	01	64
30359	133	11th Line Current harmonic	01	66

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30361	134	12th Line Voltage harmonic	01	68
30363	135	12th Line Current harmonic	01	6A
30365	136	13th Line Voltage harmonic	01	6C
30367	137	13th Line Current harmonic	01	6E
30369	138	14th Line Voltage harmonic	01	70
30371	139	14th Line Current harmonic	01	72
30373	140	15th Line Voltage harmonic	01	74
30375	141	15th Line Current harmonic	01	76
30377	142	16th Line Voltage harmonic	01	78
30379	143	16th Line Current harmonic	01	7A
30381	144	17th Line Voltage harmonic	01	7C
30383	145	17th Line Current harmonic	01	7E
30385	146	18th Line Voltage harmonic	01	80
30387	147	18th Line Current harmonic	01	82
30389	148	19th Line Voltage harmonic	01	84
30391	149	19th Line Current harmonic	01	86
30393	150	20th Line Voltage harmonic	01	88
30395	151	20th Line Current harmonic	01	8A
30397	152	21st Line Voltage harmonic	01	8C
30399	153	21st Line Current harmonic	01	8E

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30401	134	22nd Line Voltage harmonic	01	90
30403	135	22nd Line Current harmonic	01	92
30405	136	23rd Line Voltage harmonic	01	94
30407	137	23rd Line Current harmonic	01	96
30409	138	24th Line Voltage harmonic	01	98
30411	139	24th Line Current harmonic	01	9A
30413	140	25th Line Voltage harmonic	01	9C
30415	141	25th Line Current harmonic	01	9E
30417	142	26th Line Voltage harmonic	01	A0
30419	143	26th Line Current harmonic	01	A2
30421	144	27th Line Voltage harmonic	01	A4
30423	145	27th Line Current harmonic	01	A6
30425	146	28th Line Voltage harmonic	01	A8
30427	147	28th Line Current harmonic	01	AA
30429	148	29th Line Voltage harmonic	01	AC
30431	149	29th Line Current harmonic	01	AE
30433	150	30th Line Voltage harmonic	01	B0
30435	151	30th Line Current harmonic	01	B2
30437	152	31st Line Voltage harmonic	01	B4
30439	153	31st Line Current harmonic	01	B6

TABLE 1 : 3 X register addresses (continued...**)**

Address Register	Para-meter No.	Parameter	Modbus Start Address Hex	
			High Byte	Low Byte
30461	154	Capacitor1 Operation Time	01	CC
30463	155	Capacitor2 Operation Time	01	CE
30465	156	Capacitor3 Operation Time	01	D0
30467	157	Capacitor4 Operation Time	01	D2
30469	158	Capacitor5 Operation Time	01	D4
30471	159	Capacitor6 Operation Time	01	D6
30473	160	Capacitor7 Operation Time	01	D8
30475	161	Capacitor8 Operation Time	01	DA
30477	162	Capacitor9 Operation Time	01	DC
30479	163	Capacitor10 Operation Time	01	DE
30481	164	Capacitor11 Operation Time	01	E0
30483	165	Capacitor12 Operation Time	01	E2

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 2** for 4X Register addresses.

Example: Reading System Nominal Voltage = 240 V

Start address = 06 (Hex)
Number of registers = 02
Note: Number of registers = Number of Parameters x 2

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.)

Query :

Device Address	01 (Hex)
Function Code	03 (Hex)
Start Address High	00 (Hex)
Start Address Low	06 (Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02 (Hex)
CRC Low	24 (Hex)
CRC High	0A (Hex)

Response:
System Nominal Voltage

Device Address	01 (Hex)
Function Code	03 (Hex)
Byte Count	04 (Hex)
Data Register1 High Byte	43 (Hex)
Data Register1Low Byte	70 (Hex)
Data Register2 High Byte	00 (Hex)
Data Register2 Low Byte	00(Hex)
CRC Low	EE (Hex)
CRC High	6C (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 System Nominal Voltage

System Nominal Voltage : 240

Start address = 06 (Hex)
Number of registers = 02
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.)

Query: (Change System Nominal Voltage)

Device Address	01 (Hex)
Function Code	10 (Hex)
Starting Address Hi	00 (Hex)
Starting Address Lo	06(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
Byte Count	04 (Hex)
Data Register-1High Byte	44 (Hex)
Data Register-1 Low Byte	09(Hex)
Data Register-2 High Byte	80(Hex)
Data Register-2 Low Byte	00(Hex)
CRC Low	D6 (Hex)
CRC High	B7 (Hex)

Response:

Device Address	01 (Hex)
Function Code	10 (Hex)
Start Address High	00 (Hex)
Start Address Low	06(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
CRC Low	A1 (Hex)
CRC High	C9 (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 2 : 4 X register addresses

Address Register	Para-meter No.	Parameter	Read/ Write	Modbus Start Address Hex		Default Values
				High Byte	Low Byte	
40003	1	Demand Integration Time	R/WP	00	2	8
40005	2	Energy unit	R/WP	00	4	2
40007	3	System Nominal Voltage	R/WP	00	6	240
40011	4	System Type	R/WP	00	A	1
40015	5	Reset Parameters	R/WP	00	E	Table5
40019	6	RS 485 Setup Code	R/WP	00	12	5
40021	7	Device Address	R/WP	00	14	1
40023	8	RTC Minute	R/WP	00	16	-
40025	9	RTC hour	R/WP	00	18	-
40027	10	RTC Date	R/WP	00	1A	-
40029	11	RTC month	R/WP	00	1C	-
40031	12	RTC year	R/WP	00	1E	-
40035	13	CT primary	R/WP	00	22	1000
40039	14	Energy digit reset count	R/WP	00	26	8
40041	15	Register order	R/WP	00	28	0
40043	16	CT Secondary	R/WP	00	2A	5
40047	17	Protection Feature For editing	R/WP	00	2E	Table 4
40051	18	Alarm setpoint	R/WP	00	32	Table 4
40055	19	Alarm Restore Value	R/WP	00	36	Table 4

R:- Read, WP:- Write Protected

TABLE 2 : 4 X register addresses (continued...)

Address Register	Para-meter No.	Parameter	Read/ Write	Modbus Start Address Hex		Default Values
				High Byte	Low Byte	
40061	20	Relay Assignment	R/WP	00	3C	Table 4
40071	21	Basic Password	R/W	00	46	1
40073	22	PHASE I (Refer table 3)	R/WP	00	48	0
40075	23	PHASE V (Refer table 3)	R/WP	00	4A	0
40077	24	Display Scrolling	R/WP	00	4C	0
40081	25	Energy update rate on Modbus	R/WP	00	50	1
40083	26	Factory reset	R/WP	00	52	0
40085	27	LCD Backlit ON/OFF	R/WP	00	56	1
40093	28	Maximum switching kvar	R/WP	00	5C	25
40097	29	Serial Number	R	00	60	-
40099	30	Model Number	R	00	62	4000
40101	31	Version Number	R	00	64	-
40125	32	Capacitor switch On time	R/WP	00	7C	40
40127	33	Capacitor switch Off time	R/WP	00	7E	40
40129	34	Capacitor discharge time	R/WP	00	80	60
40133	35	Target power factor	R/WP	00	84	0.995
40135	36	No. of Cap bank selection	R/WP	00	86	8(1)
40139	37	Bank switching Threshold	R/WP	00	8A	66

Note : 1:- 4 or 6 or 8(for 96 X 96) and 6 or 8 or 12(for 144 X 144)

TABLE 2 : 4 X register addresses (continued...)

Address Register	Para-meter No.	Parameter	Read/ Write	Modbus Start Address Hex		Default Values
				High Byte	Low Byte	
40143	38	Capacitor Bank 1 KVAr Value	R/WP	00	8E	25
40145	39	Capacitor Bank 2 KVAr Value	R/WP	00	90	25
40147	40	Capacitor Bank 3 KVAr Value	R/WP	00	92	25
40149	41	Capacitor Bank 4 KVAr Value	R/WP	00	94	25
40151	42	Capacitor Bank 5 KVAr Value	R/WP	00	96	25
40153	43	Capacitor Bank 6 KVAr Value	R/WP	00	98	25
40155	44	Capacitor Bank 7 KVAr Value	R/WP	00	9A	25
40157	45	Capacitor Bank 8 KVAr Value	R/WP	00	9C	25
40159	46	Capacitor Bank 9 KVAr Value	R/WP	00	9E	25
40161	47	Capacitor Bank 10 KVAr Value	R/WP	00	A0	25
40163	48	Capacitor Bank 11 KVAr Value	R/WP	00	A2	25
40165	49	Capacitor Bank 12 KVAr Value	R/WP	00	A4	25
40193	50	C-Health Test Enable/Disable	R/WP	00	C0	0
40199	51	Switch Operation Warning Value	R/WP	00	C6	50000
40201	52	Capacitor Test Count	R/WP	00	C8	5
40203	53	LCD Contrast	R/WP	00	CA	4
40205	54	Advanced Password	R/WP	00	CC	1
40207	55	System Frequency	R/WP	00	CE	50
40211	56	Battery Low Warning	R/WP	00	D2	0
40235	57	Alarm Relay Status	R	00	8A	-

TABLE 3 : Network Configuration

PHASE I	Phase Current	PHASE V	Phase Voltage
0	IL1	0	L1 - N - 0^0
0	IL1	1	L1 - L2 - 30^0
0	IL1 (K < - > L)	2	L2 - N - 60^0
0	IL1	3	L3 - L2 - 90^0
0	IL1	4	L3 - N - 120^0
0	IL1	5	L3 - L1 - 150^0
0	IL1 (K < - > L)	6	L1 - N - 180^0
0	IL1 (K < - > L)	7	L1 - L2 - 210^0
0	IL1	8	L2 - N - 240^0
0	IL1	9	L2 - L3 - 270^0
0	IL1 (K < - > L)	10	L3 - N - 300^0
0	IL1 (K < - > L)	11	L3 - L1 - 330^0

PHASE I	Phase Current	PHASE V	Phase Voltage
1	IL2	0	L2 - N - 0^0
1	IL2	1	L2 - L3 - 30^0
1	IL2 (K < - > L)	2	L3 - N - 60^0
1	IL2	3	L1 - L3 - 90
1	IL2	4	L1 - N - 120^0
1	IL2	5	L1 - L2 - 150^0
1	IL2 (K < - > L)	6	L2 - N - 180^0
1	IL2 (K < - > L)	7	L2 - L3 - 210^0
1	IL2	8	L3 - N - 240^0
1	IL2	9	L3 - L1 - 270^0
1	IL2 (K < - > L)	10	L1 - N - 300^0
1	IL2 (K < - > L)	11	L1 - L2 - 330^0

TABLE 3 : Network Configuration (Continued...)

PHASE I	Phase Current	PHASE V	Phase Voltage
2	IL3	0	L3 - N - 0^0
2	IL3	1	L3 - L1 - 30^0
2	IL3 (K < - > L)	2	L1 - N - 60^0
2	IL3	3	L2 - L1 - 90^0
2	IL3	4	L2 - N - 120^0
2	IL3	5	L2 - L3 - 150^0
2	IL3 (K < - > L)	6	L3 - N - 180^0
2	IL3 (K < - > L)	7	L3 - L1 - 210^0
2	IL3	8	L1 - N - 240^0
2	IL3	9	L1 - L2 - 270^0
2	IL3 (K < - > L)	10	L2 - N - 300^0
2	IL3 (K < - > L)	11	L2 - L3 - 330^0

TABLE 4 : Alarm Default Values.

Select Feature for editing	Fault	Description	Default
0	Under Voltage	Enable Parameter (*)	Enable
		Trip Value	85%
		Trip Delay (*)	5 Sec
		Hysteresis (*)	3%
		Relay	Yes
1	Over Voltage	Enable Parameter (*)	Enable
		Trip Value	110%
		Trip Delay (*)	5 Sec
		Hysteresis (*)	2%
		Relay	Yes
2	Under Frequency/ Over Frequency	Enable Parameter	Disable
		Trip Value	6%
		Trip Delay (*)	5 Sec
		Hysteresis (*)	1%
		Relay	No
4	Under Current	Enable Parameter (*)	Enable
		Trip Value	2%
		Trip Delay (*)	5 Sec
		Hysteresis (*)	1%
		Relay	Yes

*Note : - Parameters are not editable, Factory set.

TABLE 4 : Alarm Default Values (Continued...)

Select Feature for editing	Fault	Description	Default
5	Over Current	Enable Parameter (*)	Enable
		Trip Value	110%
		Trip Delay (*)	5 Sec
		Hysteresis (*)	1%
		Relay	Yes
6	V THD	Enable Parameter (*)	Enable
		Trip Value	7%
		Trip Delay (*)	30 Sec
		Hysteresis (*)	2%
		Relay	Yes
7	I THD	Enable Parameter (*)	Enable
		Trip Value	50%
		Trip Delay (*)	30 Sec
		Hysteresis (*)	45%
		Relay	Yes
8	Temperature	Enable Parameter (*)	Enable
		Trip Value (*)	60^0 C
		Trip Delay (*)	10 Sec
		Hysteresis (*)	55^0 C
		Relay	Yes

*Note : - Parameters are not editable, Factory set.

TABLE 4 : Alarm Default Values(Continued...)

Select Feature for editing	Fault	Description	Default
9	Over Compensation	Enable Parameter (*)	Enable
		Trip Delay (*)	10 Sec
		Relay	Yes
10	Out of bank	Enable Parameter (*)	Enable
		Trip Delay (*)	10 Sec
		Relay	Yes

*Note : - Parameters are not editable, Factory set.

Table 5 : Explanation for 4 X register

Address Register	Parameter	Description
40003	Demand Integration Time	This parameter allows to set the period over which current and power readings are to be integrated.The Unit of displayed values is minutes. Time is settable as 8,15,20,30 min respectively. Writing any other value will return error.
40005	Energy unit	This parameter allows user to set energy in terms of Wh / kWh / MWh as per the requirement. Same is applicable to all types of energy. Write one of the following value to this address. Writing any other value will return error. 1: Wh 2: kWh 3: MWh
40007	System Nominal Voltage	This is the system rated voltage with respect to which the fault limits are defined. Value is settable from 50 to 550 VAC. Writing any other value will return error.
40011	System Type	This parameter is settable as 1 phase or 3 phase. Write one of the following value to this address. Writing any other value will return error. 0 : 1 Phase 1 : 3 Phase
40015	Reset Parameters	This parameter allows user to reset one out of several parameters.

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40015	Reset Parameters	Write one of the following value to this address. Writing any other value will return error. 1 : Reset Energy 2 : Reset Demand 3 : Reset Minimum Parameters value 4 : Reset Maximum Parameters value 5 : Reset Run hour / On hour 6 : Reset Power Down Interruption 7 : Reset all bank switching count 8 : Reset all bank operation time 10 : Reset all (Energy, Max, Min , Run hour, On hour parameters) 11 : Reset bank1 switching count 12 : Reset bank2 switching count 13 : Reset bank3 switching count 14 : Reset bank4 switching count 15 : Reset bank5 switching count 16 : Reset bank6 switching count 17 : Reset bank7 switching count 18 : Reset bank8 switching count 19 : Reset bank9 switching count 20 : Reset bank10 switching count 21 : Reset bank11 switching count 22 : Reset bank12 switching count 23 : Reset bank1 operation time 24 : Reset bank2 operation time 25 : Reset bank3 operation time

Table 5 : Explanation for 4 X register (continued...**)**

<table>
<tr><th>Address Register</th><th>Parameter</th><th>Description</th></tr>
<tr><td>40015</td><td>Reset Parameters</td><td>26 : Reset bank4 operation time
27 : Reset bank5 operation time
28 : Reset bank6 operation time
29 : Reset bank7 operation time
30 : Reset bank8 operation time
31 : Reset bank9 operation time
32 : Reset bank10 operation time
33 : Reset bank11 operation time
34 : Reset bank12 operation time</td></tr>
<tr><td>40019</td><td>RS 485 Setup Code</td><td>This address is used to set the baud rate, Parity, Number of stop bits. Write one of the following value to this address.
Writing any other value will return error.
<table>
<tr><th>Value</th><th>Baud Rate</th><th>Parity</th><th>Stop Bits</th></tr>
<tr><td>0</td><td>4800</td><td>None</td><td>1</td></tr>
<tr><td>1</td><td>4800</td><td>None</td><td>2</td></tr>
<tr><td>2</td><td>4800</td><td>Even</td><td>1</td></tr>
<tr><td>3</td><td>4800</td><td>Odd</td><td>1</td></tr>
<tr><td>4</td><td>9600</td><td>None</td><td>1</td></tr>
<tr><td>5</td><td>9600</td><td>None</td><td>2</td></tr>
<tr><td>6</td><td>9600</td><td>Even</td><td>1</td></tr>
<tr><td>7</td><td>9600</td><td>Odd</td><td>1</td></tr>
<tr><td>8</td><td>19200</td><td>None</td><td>1</td></tr>
<tr><td>9</td><td>19200</td><td>None</td><td>2</td></tr>
</table></td></tr>
</table>

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description			
40019	RS 485 Setup Code	Value	Baud Rate	Parity	Stop Bits
		10	19200	Even	1
		11	19200	Odd	1
		12	38400	None	1
		13	38400	None	2
		14	38400	Even	1
		15	38400	Odd	1
		16	57600	None	1
		17	57600	None	2
		18	57600	Even	1
		19	57600	Odd	1
40021	Device Address	This parameter allows to set RS 485 address for APFC. Address are settable in range 1 to 247. Writing any other value will return error.			
40023	RTC Minute	This parameter allows to set RTC minute in range 0 to 59. Writing any other value will return error.			
40025	RTC hour	This parameter allows to set RTC hour in range 0 to 23. Writing any other value will return error.			
40027	RTC Date	This parameter allows to set RTC date in range 1 to 31. Writing any other value will return error.			

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40029	RTC Month	This parameter allows to set RTC Month in range 1 to 12. Writing any other value will return error.
40031	RTC year	This parameter allows to set RTC year in range 00 to 99 (i.e 2000 to 2099). Writing any other value will return error.
40035	CT primary	This parameter allows user to set Current transformer's primary value. Value is settable from 0001 to 9999 Amp.
40039	Energy digit Reset count	This parameter is used for setting maximum energy count after which energy will roll over to zero depending on setting of Wh, KWh & MWh. Count is settable in range 7 to 9.
40041	Register Order	Controls the receiving or sending order of instrument as normal or reversed order. In normal order, a floating point's Most Significant Byte is sent first. In reversed register mode LSB is sent first.
40043	CT Secondary	This parameter allows user to set Current transformer's secondary value. Value can be set as 1 or 5 Amp.
40047	Protection Feature for editing	This parameter allows user to select any one out of following parameters for editing as alarm output. 0 : Under Voltage 1 : Over Voltage 2 : Frequency 4 : Under Current 5 : Over Current 6 : V THD 7 : I THD 8 : Temperature 9 : Over Compensation 10 : Out of bank

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40051	Alarm setpoint	This parameter allows user to set tripping point of one out of several parameters. Under Voltage : 75 To 90% Over Voltage : 105 To 115% Frequency Fault : 2 To 10% Under Current : 1 To 3% Of CT Primary Over Current : 60 To 120% Of CT Primary Voltage THD : 1 To 25% Current THD : 1 To 99%
40055	Alarm Restore value	This parameter is not editable. Please refer table 4 for details.
40061	Relay Assignment	This parameter allows user to assign relay to fault parameter. Write one of the following value to this address. Writing any other value will return error. 0 : No Relay 1 : Yes
40071	Basic Password	Password protection can be enabled to prevent unauthorized access to basic setting's sub-menues. This parameter allows user to set password in range 0000 to 9999.Writing any other value will return error. (Ref pg. 43) Applied to parameter under basic settings
40073	Phase I	This parameter allows user to set phase current input. Please refer table 3 for details. Writing any other value will return error.

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40075	Phase V	This parameter allows user to set phase voltage input. Please refer table 3 for details. Writing any other value will return error.
40077	Display Scrolling	This parameter allows user to enable / disable screen scrolling. Write one of the following value to this address. Writing any other value will return error. 0 : Disable 1 : Enable
40081	Energy update rate on Modbus	This parameter allows user to set energy update rate in minute. Time is settable in range 1 to 60 minute. Writing any other value will return error.
40083	Factory Reset	This parameter resets all setting parameter values to factory default values. Writing 100 will perform reset of demand , energy , on hour, run hour , etc. capacitor parameters are not reset.
40085	LCD Backlit ON/OFF	This parameter allows user to ON / OFF LCD backlight. If backlight is set to off mode, APFC unit will switch off backlight after 30 Sec. During editing period backlight will get switch on & remained ON for next 30 Sec. Write one of the following value to this address. Writing any other value will return error. 0 : Off 1 : On

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40093	Maximum switching kvar	This menu allows user to set maximum capacitor bank kVAr switching value. The settable range is from minimum set capacitor bank value upto the sum of total capacitor banks value. Increments in steps of minimum capacitor bank value.
40125	Capacitor switch ON time	This parameter is the SWITCH-IN time of individual capacitor bank. Switch In time Value is settable from 10 to 1800 Sec. Writing any other value will return error.
40127	Capacitor switch Off time	This parameter is the SWITCH-OFF time of individual capacitor bank. Switch off time Value is settable from 10 to 1800 Sec. Writing any other value will return error.
40129	Capacitor discharge time	This parameter is the discharge time of individual capacitor bank. discharge time Value is settable from 60 to 1800 Sec.
40133	Target power factor	This parameter is the target power factor of system. Value is settable from +0.8 to 1 (INDUCTIVE) and from -0.8 to 1 (CAPACITIVE).
40135	No. of Cap Bank selection	This parameter allows user to set banks from 1 to 12 depending on model.

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40139	Bank switching Threshold	Threshold for switching ON / OFF next stage. It should not be change in normal case! Threshold value is editable in range 30 to 100%. Writing any other value will return error.
40143	Capacitor bank 1 kVAr	This parameter allows user to set bank 1 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Writing any other value will return error.
40145	Capacitor bank 2 kVAr	This parameter allows user to set bank 2 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Writing any other value will return error.
40147	Capacitor bank 3 kVAr	This parameter allows user to set bank 3 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Writing any other value will return error.
40149	Capacitor bank 4 kVAr	This parameter allows user to set bank 4 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Writing any other value will return error.

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40151	Capacitor bank 5 kVAr	This parameter allows user to set bank 5 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Note: - Parameter is editable if APFC with 6 or 8 or 12 Relay outputs. Writing any other value will return error.
40153	Capacitor bank 6 kVAr	This parameter allows user to set bank 6 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Note: - Parameter is editable if APFC with 6 or 8 or 12 Relay outputs. Writing any other value will return error.
40155	Capacitor bank 7 kVAr	This parameter allows user to set bank 7 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Writing any other value will return error. Note: - Parameter is editable if APFC with 8 or 12 Relay outputs.
40157	Capacitor bank 8 kVAr	This parameter allows user to set bank 8 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Writing any other value will return error. Note: - Parameter is editable if APFC with 8 or 12 Relay outputs.

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40159	Capacitor bank 9 kVAr	This parameter allows user to set bank 9 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Note: - Parameter is editable if APFC with 12 Relay outputs. Writing any other value will return error.
40161	Capacitor bank 10 kVAr	This parameter allows user to set bank 10 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Note: - Parameter is editable if APFC with 12 Relay outputs. Writing any other value will return error.
40163	Capacitor bank 11 kVAr	This parameter allows user to set bank 11 kVAr value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Writing any other value will return error. Note: - Parameter is editable if APFC with 12 Relay outputs.
40165	Capacitor bank 12 kVAr	This parameter allows user to set bank 12 kvar value in range 1 to 255 kVAr. Increments in steps of 0.5 kVAr. Writing any other value will return error. Note: - Parameter is editable if APFC with 12 Relay outputs.

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40193	C(Capacitor)-health test	This parameter allows user to enable OR disable Capacitor health test. Write one of the following value to this address. 0 : Disable 1 : Enable Writing any other value will return error.
40199	Switch Operation Warning Count	After an output has performed this number of switching operations a warning message is displayed. switching operation warning count is editable in range 10000 to 255000. warning will get disappear if user resets switching operation count. Writing any other value will return error.
40201	Capacitor Health Test Count	This parameter is programable in range 5 to 9. when at least this number of successive measurement is resulted in fault in the capacitor power, Capacitor fault message will appear on display. Writing any other value will return error.
40203	LCD Contrast	This parameter allows user to set LCD contrast. It is settable in range 1 to 9. Writing any other value will return error.

Table 5 : Explanation for 4 X register (continued...**)**

Address Register	Parameter	Description
40205	Advanced Password	Password protection can be enabled to prevent unauthorized access to advanced setting's submenues. This parameter allows user to set password in range 0000 to 9999.Advanced Password Writing any other value will return error. (Ref pg. 43 Notes) Applied to parameter under advanced settings
40207	System Frequency	This parameter allows user to set system frequency as 50 or 60 Hz. Writing any other value will return an error.
40211	Battery Low Warning	This parameter allows user to enable or disable Battery Low Warning (Only applicable for RTC Module). Write one of the following values to this address: 0 : Disable 1 : Enable Writing any other value will return an error.

Notes on password Location value

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.

3.3 User Assignable Modbus Registers :

There are 20 user assignable registers in the address range of 0x200 (30513) to 0x226 (30551) for 3X registers (**see TABLE 6**) and address range of 0x1E00 (47681) to 0x1E26 (47719) for 4X registers (**see TABLE 7**).

Any of the parameter addresses (3X register addresses **TABLE 1** and 4X register addresses **TABLE 2**) 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 0x200 to 0x226 (or 0x1E00 to 0x1E26) are specified in 4X Register 0x200 to 0x213. (**see TABLE 7**)

TABLE 6 : User Assignable 3X Data Registers

Address (Register)	Assignable Register	Modbus Start Address (Hex)	
		High Byte	Low Byte
30513	Assignable Reg 1	02	00
30515	Assignable Reg 2	02	02
30517	Assignable Reg 3	02	04
30519	Assignable Reg 4	02	06
30521	Assignable Reg 5	02	08
30523	Assignable Reg 6	02	0A
30525	Assignable Reg 7	02	0C
30527	Assignable Reg 8	02	0E
30529	Assignable Reg 9	02	10
30531	Assignable Reg 10	02	12
30533	Assignable Reg 11	02	14
30535	Assignable Reg 12	02	16
30537	Assignable Reg 13	02	18
30539	Assignable Reg 14	02	1A
30541	Assignable Reg 15	02	1C
30543	Assignable Reg 16	02	1E
30545	Assignable Reg 17	02	20
30547	Assignable Reg 18	02	22
30549	Assignable Reg 19	02	24
30551	Assignable Reg 20	02	26

TABLE 7 : User Assignable mapping register (4X registers)

Address (Register)	Mapping Register	Modbus Start Address (Hex)	
		High Byte	Low Byte
40513	Mapped Add for register #0x0200	02	00
40514	Mapped Add for register #0x0202	02	01
40515	Mapped Add for register #0x0204	02	02

TABLE 7 : Continued...

40516	Mapped Add for register #0x0206	02	03
40517	Mapped Add for register #0x0208	02	04
40518	Mapped Add for register #0x020A	02	05
40519	Mapped Add for register #0x020C	02	06
40520	Mapped Add for register #0x020E	02	07
40521	Mapped Add for register #0x0210	02	08
40522	Mapped Add for register #0x0212	02	09
40523	Mapped Add for register #0x0214	02	0A
40524	Mapped Add for register #0x0216	02	0B
40527	Mapped Add for register #0x0218	02	0C
40528	Mapped Add for register #0x021A	02	0D
40529	Mapped Add for register #0x021C	02	0E
40530	Mapped Add for register #0x021E	02	0F
40531	Mapped Add for register #0x0220	02	10
40532	Mapped Add for register #0x0222	02	11
40533	Mapped Add for register #0x0224	02	12
40534	Mapped Add for register #0x0226	02	13

Assigning parameter to User Assignable Registers:

To access the Voltage (3X address 0x0002) and Power Factor (3X address 0x001E) through user assignable register assign these addresses to 4x register (TABLE 7) 0x0200 and 0x0201 respectively .

Assigning Query :

Device Address	01 (Hex)
Function Code	10 (Hex)
Starting Address Hi	02 (Hex)
Starting Address Lo	00 (Hex)
Number of Registers Hi	00 (Hex)*
Number of Registers Lo	02(Hex)*
Byte Count	04 (Hex)

Data Register-1High Byte	00 (Hex)	Voltage* (3X Address 0x0001)
Data Register-1 Low Byte	01 (Hex)	
Data Register-2 High Byte	00 (Hex)	Power Factor * (3X Address 0x001E)
Data Register-2 Low Byte	1E (Hex)	
CRC Low	CB (Hex)	
CRC High	07 (Hex)	

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

Response :

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

Reading Parameter data through User Assignable Registers:

In assigning query Voltage & Power Factor parameters were assigned to 0x0200 & 0x0201 (TABLE 7) which will point to user assignable 3x registers 0x0200 and 0x0202 (TABLE 6).
So to read Voltage and Power Factor data reading query should be as below.

Query:

Device Address	01 (Hex)
Function Code	04 (Hex)
Start Address High	02 (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 User assignable register.
Start Address low :Least significant 8 bits of starting address of User assignable register.

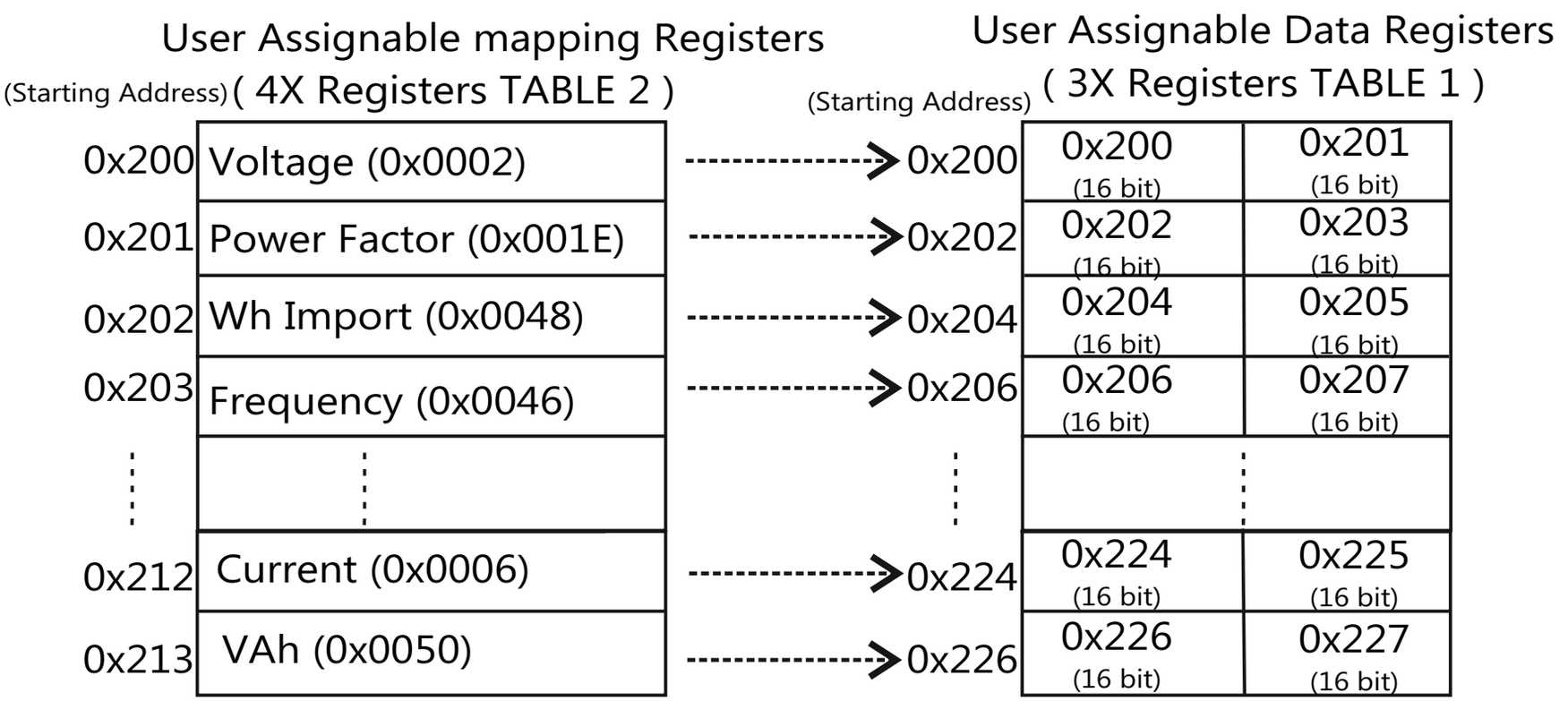
Number of register Hi : Most significant 8 bits of Number of registers requested.
Number of register Lo : Least significant 8 bits of Number of registers requested.

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

Response : (Volt = 219.30 / Power Factor = 1.0)

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	3F (Hex)
Data Register-3 Low Byte	80 (Hex)
Data Register-4 High Byte	00 (Hex)
Data Register-4 Low Byte	00 (Hex)
CRC Low	79 (Hex)
CRC High	3F (Hex)

The data shown above in Data Register 1 and Data Register 2 represent Volt = 219.30 and the data shown in Data Register 3 and Data Register 4 represent Power Factor = 1.0

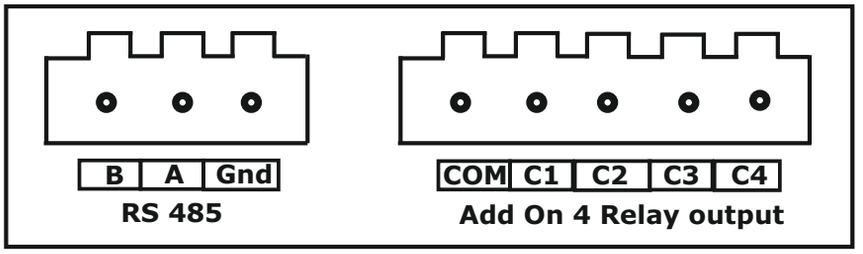


To get the data through User Assignable Register go through the following steps:

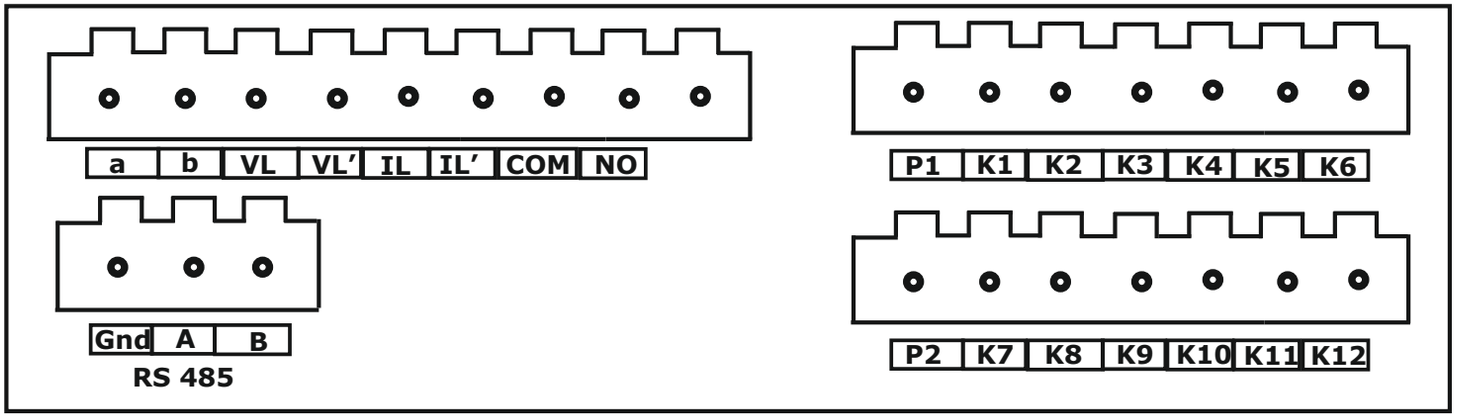
1) Assign starting addresses(**TABLE 1**) of parameters of interest to "User assignable mapping registers" in a sequence in which they are to be accessed (see section "**Assigning Parameter to User Assignable Registers"**).
2) Once the parameters are mapped, data can be acquired by using "User assignable data register" Starting address . i.e to access data of Voltage2, Power factor1,Wh import, Frequency send query with starting address 0x200 with number of register 8 or individually parameters can be accessed. For example, if current1 is to be accessed use starting address 0x212.
   (See section **Reading Parameter data through User Assignable Registers).**

Section 4 Connection for Optional RS 485

1. RS 485 with Add on 4 Relay Output (PFC 96)



2. RS 485 + 6 Relay Output (PFC 144)



NOTE