USER'S MANUAL

RTVC3P

This document contains the latest technical information about RTVC3P which is a micro-controller based KVAR controller. The product, RTVC3P is sophisticated electronic equipment and, the user is advised to read this User's Manual carefully before attempting to install or operate the equipment.

Trinity Energy Systems Pvt. Ltd.

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Introduction

The RTVC3P is the `intelligence' which controls the automatic system for correction of the power factor. RTVC3P is a KVAR based controller which controls capacitor banks optimally to achieve near unity power factor and also measures/calculates various electrical parameters. RTVC3P is meant for use in three phase four wire electrical system. It senses the power factor by taking the ratio of the true-rms KVA of the system, and the KW. For VAR sensing mode of action, the RTVC3P calculates the KVAR requirement of the system (VxIxsinϕ). For correct operation of the panel, however, there are some minimum system requirements to be met. Unless the various points in the system which are mentioned below are correctly setup, proper operation of the panel cannot be expected.

The Main features Available in this Model

- All readings are true RMS measurements
- 3P4W electrical system
- 128 x 64 graphical backlit LCD
- Energy output leds for KWh and KVAh for 1000 impulses
- Three phase Volts and Amps Display
- System power parameters Display
- Phase wise PF and Average PF Display
- Odd harmonic analysis up to 15th for all voltages and currents including histogram
- Total Harmonic Distortion(THD) for all voltages and currents
- Switching Time of control action is site selectable to 250mS, 500mS, 1 second and 2 seconds
- Main and capacitor CT ratio is site programmable
- PT ratio is site programmable
- RS485 MODBUS-RTU connectivity
- Dual set PF is site programmable

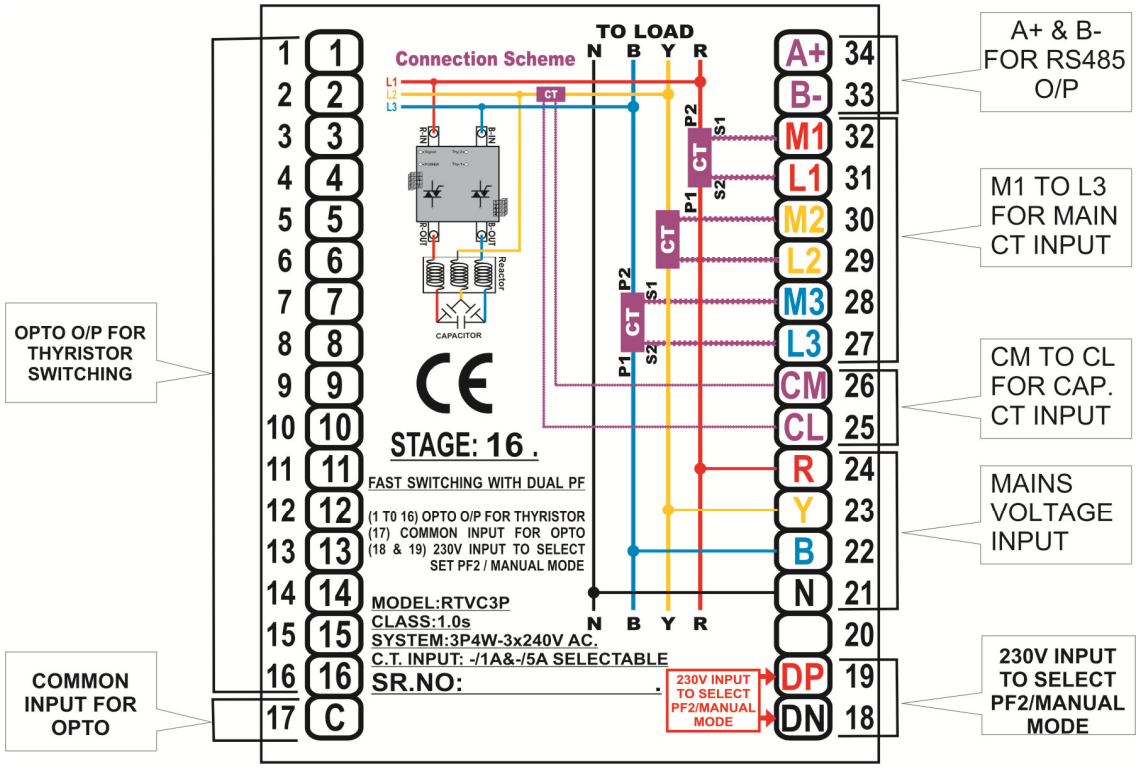
Technical Specifications

Parameters			
Type		**Name**	**Statistics**
INPUT		Supply	Three Phases and Neutral of a 3P4W system
		Voltage	Direct Voltage Input : Up to 280V L-N PT Ratio : Site Selectable Burden : 0.5VA
		Current	Secondary Current Input : 5A or 1A (Site Selectable) CT Ratio : Site Selectable Range of Reading : 5 – 5000A Burden : < 1.0VA Overload : 5A CT → 6A RMS Continuous 1A CT → 1.2A RMS Continuous
		Power Supply	Self powered from Mains
MEASUREMENT	True RMS Basic Parameters	Voltage (Volts L-N : VRN, VYN, VBN)	Accuracy : 0.5% of Reading
		Current (Amps IR, IY, IB)	Accuracy : 0.25% of Reading
		Line Frequency	45 to 55 Hz, Accuracy : 0.3% of Reading
	Power	Active Power (P)	Accuracy : 1% of Reading (For IPFI>0.5)
		Reactive Power (Q)	Accuracy : 1.5% of Reading (Between 0.5 Lag to 0.8 Lead)
		Apparent Power (S)	Accuracy : 1.0% of Reading
		Power Factor	For Individual phases and System Accuracy : 1.0% of Reading (I*PF*I≥0.5) Range of Reading : 0.05 to 1.00 Lag/Lead
	Energy	Total Active Energy (KWh)	Range of Reading : 0 to 9999999.9 Accuracy : class 1.0s as per IS13779
		Total Apparent Energy (KVAh)	Range of Reading : 0 to 9999999.9 Accuracy : 1.0% of Reading
	Power Quality	3rd to 15th Harmonics (Odd) for all voltages with THD	
		3rd to 15th Harmonics (Odd) for all currents with THD	
MISCELLANEOUS	Dimensions	Bezel	144 x 144 mm
		Panel Cutout	138 x 138 mm
		Depth of installation	55 mm
		Display	128 x 64 graphical backlit LCD
		Operating temp	10℃ to 50℃
		Weight	0.600 Kg (Approx)
		Min. Operating Current	VAR Mode : 0.4% of CT primary FIFO/SFIFO Mode : 2.0% of CT primary
		Calibration LED	Red Colour. 1000 impulses/Unit
	Comm.	RS485	Modbus-RTU protocol

Installation and Commissioning

To install and commission the unit, proceed the following instructions:

1. Push the unit into the Panel and mount it by using the clamps provided.



Back View (Connection Scheme) of Unit

2. Connect the three phases with the phase sequence being R-Y-B to the terminals marked R, Y and B respectively such as shown above Connection Scheme. Make sure that the three phases coming to the unit come through control fuses 1.0 Amp rating. This will protect the electronics inside from damage due to severe over voltages or phase faults in the system.
3. Connect the neutral wire to the terminal marked N.
4. Connect the two wires from the R-phase main CT to terminals marked M1 & L1 such that S1 from CT goes to M1 on the unit. Connect the two wires from the Y-phase main CT to terminals marked M2 & L2 such that S1 from CT goes to M2 on the unit. Connect the two wires from the B-phase main CT to terminals marked M3 & L3 such that S1 from CT goes to M3 on the unit.
5. Connect the two wires from capacitor CT to terminals marked CM & CL such that S1 from CT goes to CM on the unit.

6. Switch on the three phases supply. Unit will power on from these three phases supply and prompt such as “RTVC3P” for about 2 to 3 seconds.
7. First of all, user should program the following parameters of the unit: CT RATIO FOR MAIN CTs, CT RATIO FOR CAPACITOR CT, PT GAIN, STAGES, and SWITCHING TIME (CYCLE). Refer Operational Details in the next section. The proper operation of the relay can commence only after described parameters are defined.
8. Ensure that all capacitors are in the circuit i.e. all fuses link pushed in. Give Autosense (Refer Operational Details in the next section). RTVC3P will first display 'AUTOSENSING' and as it switches on one bank at a time and also, displays the bank size of every stage. After AUTOSENSING is completed, the unit will reset.
9. Now, the unit is ready for the control action as per selected switching time.

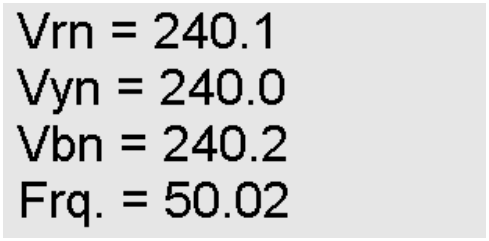
Operational Details

The KVAR based controller RTVC3P is a versatile unit, with all features needed to implement a robust PF maintenance system.

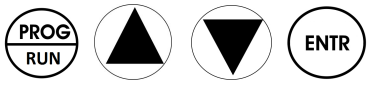
There are basically two modes of operation in RTVC3P.

1. Programming Mode
2. Run Mode

After supplying power, the unit will display the power on message; RTVC3P on screen and by default comes into Run mode as shown below.



The unit can now be operated by using the following keys for both the Programming Mode and Run mode:



Programming Mode

To make the RTVC3P suitable for most field conditions and different types of loads, some parameters have been made programmable. The following parameters can be programmed by the user:

1. Main CT Primary
2. Main CT Secondary
3. Capacitor CT Primary
4. Capacitor CT Secondary
5. PT Gain
6. Desired PF1 Setting
7. PF Controlling Mode
8. Switching Time
9. Capacitor Bank Stages
10. Meter Address
11. Baud rate
12. Reset Energy
13. Minimum Bank
14. Auto sense for Capacitors
15. Dual Mode
16. Desired PF2 Setting for Dual Mode

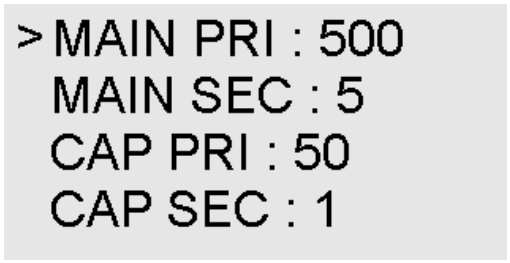
In Run mode, press PROG RUN key for about five seconds continuously, to enter into programming mode. Once enter into programming mode, 'P' starts blinking and shows below page.

1. Setting Main CT Primary, Main CT Secondary, Capacitor CT Primary and Capacitor CT Secondary

In order to get actual load current, Main CT primary and Main CT secondary should be set. In order to get actual capacitor current, capacitor CT primary and capacitor CT secondary should be set. Main and capacitor CT Primary can be set from 5 to 5000 A. Main and capacitor CT secondary can be set to 1A or 5A.

To set above parameters, proceed the following instructions.

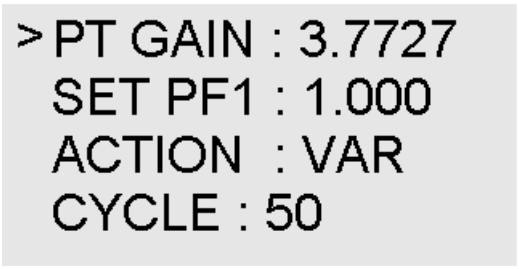
1. Once unit enters into programming mode such as steps described above, Meter shows arrow on Main CT Primary by default with the following page.



2. Press (ENTR) key which will start blinking arrow and the parameter can now be set by pressing ▲ and ▼ keys. Set the desired parameters and then press (ENTR) key to confirm the setting that will stop blinking arrow.
3. Press ▼ key to enter into next parameter, Main CT secondary and press (ENTR) key again which will start blinking arrow along with the parameter. Select desired Main CT secondary by pressing ▲ and ▼ as steps before and press (ENTR) key again to confirm.
4. Set Capacitor CT Primary and Capacitor CT Secondary also with the same steps described above.
5. If the setting is completed, press (PROG RUN) for about 5 seconds to enter into Run mode. Otherwise press ▼ key to set for next parameters such as before.

2. Setting PT Gain, Desired PF1, Mode of Control action and Switching Time (Cycle)

In the above Programming Mode, press ▼ key till the unit enters into the following display and then, set such parameters as steps before.



PT Gain

PT Gain is selectable from one of the following values: 1, 3.7727, 4.00, 6.2727, 30, 60, 100, 200, 300, 600 and 1200. The following table shows the values of PT Gain to be selected.

PT Primary	PT Secondary	PT Gain (PT ratio)
No multiplying factor		1
3300	110	30
6600	110	60
11000	110	100
22000	110	200
33000	110	300
66000	110	600
132000	110	1200
415	110	3.7727
440	110	4.00
690	110	6.2727

Desired PF1

The desired PF1 can be set to either Lead or Lag side according to your requirement. In case of FIFO or Straight FIFO (SFIFO) control action, the PF can be set in between 0.800 lag to 1.000. In case of VAR control action the PF can be set to either LAG or LEAD. In case of LAG, the PF could be set from 0.800 to 1.000. In case of LEAD, the PF could be set from 1.800 to 1.999. e.g., the PF to be set for 0.998 LEAD should be set as 1.998.

Mode of Control action

For PF correction, there are three types of Modes of Control Action such as VAR, FIFO and straight FIFO (SFIFO) which are also settable at site.
The unit has the provision to operate in multiple control action modes, each of which optimized for different industrial load types. The modes are as follows:
1.VAR 2.FIFO 3.Straight FIFO (SFIFO).
In VAR mode, the unit will take control action, based on the instantaneous KVAR requirement of the system. The control action is intelligent and the switching follows no set sequence. VAR mode requires Capacitor CT sensing and it is suitable where there are unequal banks.
In FIFO mode, the relay will take a control action, based on the Instantaneous PF of the system. The control action is PF based and the switching follows the older FIFO sequence. This sequence is suitable where the banks are equal sized.
In Straight FIFO (SFIFO) Mode, the relay will take control action, based on the instantaneous PF of the system. The control action is PF based and the switching follows from the first bank. This Sequence is suitable where the banks are equal sized and arranged in incremental order.

Switching Time (Cycle)

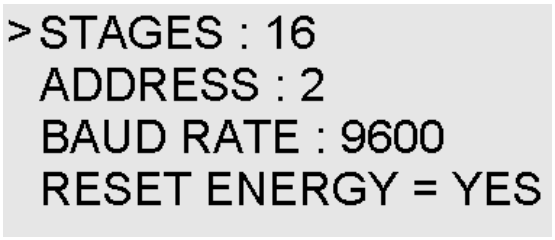
This is one type of digital delay for control action. Switching Time (Cycle) is selectable from one of the following values: 12, 25, 50 and 100. The following table is shown the delay of switching action.

Switching Time (Cycle)	Delay (Second)
12	0.25
25	0.50
50	1.00
100	2.00

RTVC3P is fast enough to sense load fluctuation and take action accordingly at programmed Switching Time (Cycle) but its fast switching performance totally depends on external factors like TSM & Capacitor bank discharge resistors. Needlessly selecting fast switching times for slow varying loads, without adequate attention to using correctly sized fast discharge resistors can cause control loop instability and PF may not be achieved.

3. Setting Capacitor Bank Stages, Meter Address, Baud rate and Reset Energy

In the above Programming Mode, press ▼ key till the unit enters into the following display and then, set such parameters as steps before.



Capacitor Bank Stages

RTVC3P supports up to 16 capacitor bank stages. For user's system requirement, the number of active stages can be selected from 2 to 16. This is helpful in cases where the meter has been purchased for higher number of stages but presently, fewer stages have been actually connected.

Meter Address

The Meter has RS485 port for external communication. RTVC3P supports MODBUS-RTU protocol on RS485 port. Each device on RS485 bus should have unique address for proper functionality. Meter Address value is programmable from 1 to 255.

Baud Rate

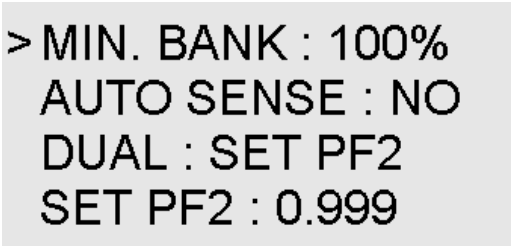
The baud rate for RS485 communication is programmable either 9600 or 19200.

Reset Energy

Energy reset is site programmable. Once reset energy is executed, its KWh KVAh and Average PF will be reset.

4. Setting Minimum Bank, Auto Sense for Capacitor Bank, Dual Mode and Desired PF2 for Dual Mode

In the above Programming Mode, press ▼ key till the unit enters into the following display and then, set such parameters as steps before.



Minimum Bank

Minimum Bank value can be set either to 100% or 75%. In VAR mode, RTVC3P will take control action if it finds that needed KVAR is larger than the smallest bank connected. e.g. if it finds that in order to achieve the desired PF, the system needs to add/remove 8 KVAR, but the smallest bank connected to system is 10 KVAR, it will not switch, if the minimum bank is set to 100%. If however it is set to 75%, it will take switching action as 75% of 10 KVAR is 7.5 KVAR.

Auto Sense for Capacitor Bank

When the Auto Sense is set to YES, the unit switches on all banks one by one. The bank size will also display as they get sensed one by one and the user therefore must be patient and wait for 3 to 4 minutes while the autosense is in progress. This process is vital for smooth operation of unit. Once all capacitor banks have been sensed, the meter will restart for control action.

NOTE: Before start auto sensing, set all programming mode parameters as required and enter in to Run Mode. Again enter into programming mode and start auto sensing.

Dual Mode

Dual mode can be set to either Manual or Dual Set PF2. Dual mode can be achieved by applying 230 VAC at DP and DN terminal.
If Dual Mode is set to Manual & 230VAC applied at DP and DN terminal, the control action is disabled and unit becomes just an indicator. This mode is indicated by blinking 'N' on Need_KVAR page in Run Mode.
If Dual Mode is set to Dual Set PF2 & 230VAC applied at DP and DN terminal, unit will start control action to achieve desired SET PF2 instead of SET PF1.

Desired PF2 for Dual Mode

The desired PF2 for Dual Mode can be set to either Lead or Lag side according to your requirement. In case of FIFO or Straight FIFO (SFIFO) control action, the PF can be set in between 0.800 lag to 1.000. In case of

VAR control action the PF can be set to either LAG or LEAD. In case of LAG, the PF could be set from 0.800 to 1.000. In case of LEAD, the PF could be set from 1.800 to 1.999. e.g., the PF to be set for 0.998 LEAD should be set as 1.998.

Run Mode

In the run mode, the various parameters measured by the meter are displayed on 128 x 64 graphical backlit LCD.

1. Run Mode Display Pages

Displays	Descriptions
Vrn = 240.1 Vyn = 240.0 Vbn = 240.2 Frq. = 50.02	The first page shows phase to neutral voltage of three phases (i.e., Vrn, Vyn and Vbn) in first line, second line and third line respectively. In case PT gain > 10.0, phase to neutral voltage readings will be converted to KV by dividing 1000 and it's indicated by KV on the display page. The last line shows Frequency (HZ).
Ir = 3.05 Iy = 3.45 Ib = 3.19 Icap = 3.72	The second page shows current of R-phase, Y-phase and B-phase (i.e., Ir, Iy and Ib) in first line, second line and third line respectively. The last line, 'Icap' shows capacitor current.
AvgPF = 0.999 PFr = 0.985 LG PFy = 0.990 LG PFb = 0.995 LG	The third page shows PF with LG/LD of three phases (i.e., R-phase, Y-phase and B-phase) in second line, third line and fourth line respectively. First line shows Average PF.
KW = 1.72 KVA = 1.70 KVAR = 0.41 PF = 0.999 LG	The fourth page shows Active Power (KW), Apparent Power (KVA) and Reactive power (KVAR) in first line, second line and third line respectively. In case KVA > 9999.0, all parameters converted into Mega by dividing 1000 and it's indicated by MW, MKVA and MKVAR on the display. The last line shows System PF with LG/LD.

KVAh =
148259.4
KWh =
147246.5

The fifth page shows Apparent Energy (KVAh) and Active Energy (KWh).

Cap_KVAR =
4.56
Need_KVAR =
10.05

The sixth page shows Capacitor KVAR and Need KVAR.

Vr Hrm[%]		9th	0.5
3rd	0.9	11th	0.4
5th	1.2	13th	1.1
7th	0.8	15th	0.6

The seventh, eighth and ninth pages shows up to 15th Odd Harmonics in percentage form of R-phase, Y-phase and B-phase volatge respectively.

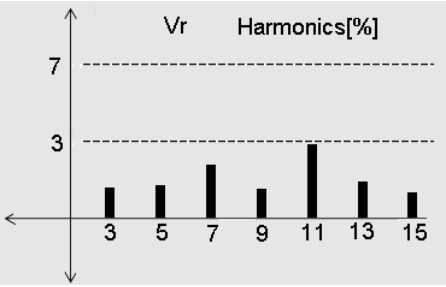
Ir Hrm[%]		9th	0.5
3rd	0.9	11th	0.4
5th	1.2	13th	1.1
7th	0.8	15th	0.6

The tenth, eleventh and twelfth pages shows up to 15th Odd Harmonics in percentage form of R-phase, Y-phase and B-phase current respectively.

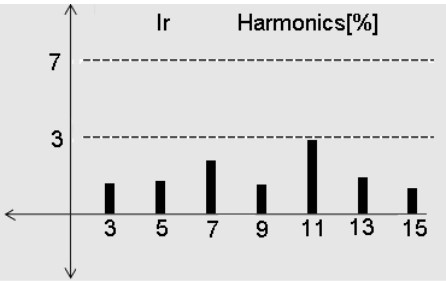
THD[%]

Vr	2.1	Ir	3.9
Vy	2.5	Iy	2.4
Vb	1.8	Ib	2.7

The thirteenth page shows Total Harmonics Distortion based on its waveform in percentage form for individual voltage and current of three phases.



The fourteenth, sixteenth and eighteenth pages show the histogram of up to 15th Odd Harmonics in percentage form of R-phase, Y-phase and B-phase volatge respectively.



The fifteenth, seventeenth and nineteenth pages show the histogram of up to 15th Odd Harmonics in percentage form of R-phase, Y-phase and B-phase current respectively.

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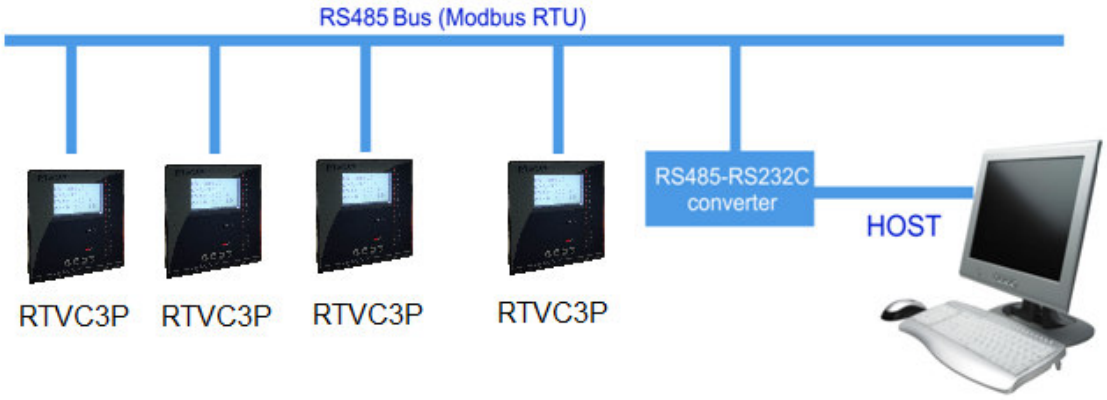
2. Resetting Average PF

The integrated average PF parameter shown in display page can be reset by pressing ▲ key in Run Mode for about 5 seconds continuously. The integrated average PF is basically the ratio of KWh & KVAh energy consumption. After reset its value will go to 1.000.

Communication



Modbus RTU on RS485 Port

In order to download live data for the various system parameters, user can use RS485 connecting to SCADA or EMS software. RTVC3P supports an RS485 port with MODBUS-RTU protocol. The station ID for every meter is site selectable. The data which can be read using MODBUS query # 3 (Read Holding Registers) is provided in an address map, with the applicable multiplication factors, vide ***Appendix.***

Communication line parameters: 9600 or 19200/8/N/1.

The register map is described below. All addresses are in decimal. If illegal address is sent in the query or the host tries to read more than 254 bytes of data in one query, exception message is generated. The parameters name, address and multiplication factor are mentioned in Appendix.

Appendix

ADDRESS	PARAMETER	MF	TYPE
200	Vr	x100	Unsigned long
202	Vy	x100	Unsigned long
204	Vb	x100	Unsigned long
206	Avg VLN	x100	Unsigned long
208	Vry	x100	Unsigned long
210	Vyb	x100	Unsigned long
212	Vbr	x100	Unsigned long
214	Avg VLL	x100	Unsigned long
216	Ir	x100	Unsigned long
218	Iy	x100	Unsigned long
220	Ib	x100	Unsigned long
222	Avg Amps	x100	Unsigned long
224	Capacitor Amps	x100	Unsigned long
226	Frequency	x100	Unsigned long

228	SysPF	x1000	Signed long
230	PF-r	x1000	Signed long
232	Pf-y	x1000	Signed long
234	PF-b	x1000	Signed long
236	SysKW	x100	Unsigned long
238	SysKVAR	x100	Unsigned long
240	SysKVA	x100	Unsigned long
242	KW-r	x100	Unsigned long
244	KW-y	x100	Unsigned long
246	KW-b	x100	Unsigned long
248	KVAR-r	x100	Unsigned long
250	KVAR-y	x100	Unsigned long
252	KVAR-b	x100	Unsigned long
254	KVA-r	x100	Unsigned long
256	KVA-y	x100	Unsigned long
258	KVA-b	x100	Unsigned long
260	SysKWh	x100	Unsigned long
262	SysKVAh	x100	Unsigned long
264	NeedKVAR	x100	Unsigned long
266	Set PF1	x1000	Unsigned long
268	Dual Status	x1	Unsigned long
270	Set Dual Mode	x1	Unsigned long
272	Set PF2	x1000	Unsigned long
274	Control Mode	x1	Unsigned long
276	Cycles	x1	Unsigned long
278	Stages	x1	Unsigned long
280	Relay Status	x1	Unsigned long
282	Bank1_Value	x100	Unsigned long
284	Bank2_Value	x100	Unsigned long
286	Bank3_Value	x100	Unsigned long
288	Bank4_Value	x100	Unsigned long
290	Bank5_Value	x100	Unsigned long
292	Bank6_Value	x100	Unsigned long
294	Bank7_Value	x100	Unsigned long
296	Bank8_Value	x100	Unsigned long
298	Bank9_Value	x100	Unsigned long
300	Bank10_Value	x100	Unsigned long
302	Bank11_Value	x100	Unsigned long
304	Bank12_Value	x100	Unsigned long
306	Bank13_Value	x100	Unsigned long
308	Bank14_Value	x100	Unsigned long
310	Bank15_Value	x100	Unsigned long
312	Bank16_Value	x100	Unsigned long
314	Vr-3rd Harmonic	x100	Unsigned long
316	Vr-5th Harmonic	x100	Unsigned long

318	Vr-7th Harmonic	x100	Unsigned long
320	Vr-9th Harmonic	x100	Unsigned long
322	Vr-11th Harmonic	x100	Unsigned long
324	Vr-13th Harmonic	x100	Unsigned long
326	Vr-15th Harmonic	x100	Unsigned long
328	Vr-THD	x100	Unsigned long
330	Ir-3rd Harmonic	x100	Unsigned long
332	Ir-5th Harmonic	x100	Unsigned long
334	Ir-7th Harmonic	x100	Unsigned long
336	Ir-9th Harmonic	x100	Unsigned long
338	Ir-11th Harmonic	x100	Unsigned long
340	Ir-13th Harmonic	x100	Unsigned long
342	Ir-15th Harmonic	x100	Unsigned long
344	Ir-THD	x100	Unsigned long
346	Vy-3rd Harmonic	x100	Unsigned long
348	Vy-5th Harmonic	x100	Unsigned long
350	Vy-7th Harmonic	x100	Unsigned long
352	Vy-9th Harmonic	x100	Unsigned long
354	Vy-11th Harmonic	x100	Unsigned long
356	Vy-13th Harmonic	x100	Unsigned long
358	Vy-15th Harmonic	x100	Unsigned long
360	Vy-THD	x100	Unsigned long
362	Iy-3rd Harmonic	x100	Unsigned long
364	Iy-5th Harmonic	x100	Unsigned long
366	Iy-7th Harmonic	x100	Unsigned long
368	Iy-9th Harmonic	x100	Unsigned long
370	Iy-11th Harmonic	x100	Unsigned long
372	Iy-13th Harmonic	x100	Unsigned long
374	Iy-15th Harmonic	x100	Unsigned long
376	Iy-THD	x100	Unsigned long
378	Vb-3rd Harmonic	x100	Unsigned long
380	Vb-5th Harmonic	x100	Unsigned long
382	Vb-7th Harmonic	x100	Unsigned long
384	Vb-9th Harmonic	x100	Unsigned long
386	Vb-11th Harmonic	x100	Unsigned long
388	Vb-13th Harmonic	x100	Unsigned long
390	Vb-15th Harmonic	x100	Unsigned long
392	Vb-THD	x100	Unsigned long
394	Ib-3rd Harmonic	x100	Unsigned long
396	Ib-5th Harmonic	x100	Unsigned long
398	Ib-7th Harmonic	x100	Unsigned long
400	Ib-9th Harmonic	x100	Unsigned long
402	Ib-11th Harmonic	x100	Unsigned long
404	Ib-13th Harmonic	x100	Unsigned long
406	Ib-15th Harmonic	x100	Unsigned long

408	Ib-THD	x100	Unsigned long
410	Current Direction	x1	Unsigned long

Defining Multiplication Factor

- PF has a MF of 1000. Thus, a PF value 0.985 LAG will send 985 for providing resolution. Now if PF value is 0.985 LEAD, it will send -985. Similarly KWH has a MF of 100. Thus, a KWH value of 148.63 will send as 14863.
- If an attempt is made to read some address other than the valid addresses, the exception response is sent.

Details of Parameters

Address 266(Set PF1)

Set PF1 has MF of 1000. Thus, a Set PF1 value 0.985 will send 985 for providing resolution. Now if Set PF1 value is 1.985 (0.985 LEAD), it will send 1985.

Address 268(Dual Status)

If input of Terminal DP and DN is 230 VAC, it will send 0 otherwise it will send 1.

Address 270(Set Dual Mode)

If Dual is selected to MANUAL, it will send 0. If Dual is selected to SET PF2, it will send 1.

Address 272(Set PF2 DUAL)

Set PF2 has MF of 1000. Thus, a Set PF2 value 0.985 will send 985 for providing resolution. Now if Set PF2 value is 1.985 (0.985 LEAD), it will send 1985.

Address 274(Control Mode)

If Mode of control action is selected to VAR, it will send 1. If Mode of control action is selected to FIFO, it will send 2. If Mode of control action is selected to SFIFO, it will send 3.

Address 280(Bank Status)

It will send data according to number of banks ON of unit. Need to convert this data in binary format. For example if BANK 1, 2, 5, 8, 11, 13, 15 and 16 is ON, it will send 54419. If we convert 54419 to binary, it will be 1101 0100 1001 0011. See below table for more details.

1	1	0	1	0	1	0	0	1	0	0	1	0	0	1	1
Bank 16	Bank 15	Bank 14	Bank 13	Bank 12	Bank 11	Bank 10	Bank 9	Bank 8	Bank 7	Bank 6	Bank 5	Bank 4	Bank 3	Bank 2	Bank 1
ON	ON	OFF	ON	OFF	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	ON	ON

Address 410(Current Direction)

It will indicate if any of three phases current is reversed. If current directions for all 3 phases are Ok then it will send 0 otherwise it will send data as shown on below table.

Phase Reversed	Data
R	1
Y	2
B	4
RY	3
YB	6
BR	5
RYB	7

Exception Code

In the event that the query from the HOST has no communication error, but there is some error in specifying the address of registers to be read, the meter returns an exception message. The format of the exception message will be as under:

Unit Address	0x83	Exception code	CRC	CRC

Exception Code can have only one value, 02: if the address is not a valid, start address or host has requested more than 254 bytes of data, this code is returned.

P.O No. : ……

Customer : ……

Sr. No. : ……

Result of Test : ……

Remarks : ……

Test engineer : ……

Date : ……