TDK

BR 5600 T

Operations Manual

Power factor controller for LV High-Speed Capacitor switching

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NOTE

Operations manual for BR 5600 T (16-step high speed transistor output controller) for LV high speed Capacitor switching.

This manual does not claim to cover all details or variations of the device or to consider all possible contingencies related to installation, operation, or maintenance.

If further information is desired or special problems arise that are not adequately covered for the buyer's purposes, the matter should be referred to our office.

The contents of this operations manual shall not become part of or modify any prior or existing agreement or relationship. The statements contained herein do not create any new warranties or modify any existing warranty.

1. High voltage!
2. BR 5600 T for indoor use only!

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ORDERING INFORMATION

BR 5600 T

B-Code: **B44066R5715A415**

Number of outputs: Total 18 Nos. Up to 16 for Capacitors & up to 3 Auxiliary usage
Number of inputs: 1 No. AC analog / Digital input for auxiliary functions.

Feedback voltage:

A. 3-phases 4 / 3 wire.
B. 2-phases 2 wire.
C. 1-phase 2 wire.

Load current feedback:

A. 3-CT (5Amp or 1Amp)
B. 2-CT (5Amp or 1Amp)
C. 1-CT (5Amp or 1Amp)

Capacitor current feedback:

A. 3-CT (5Amp or 1Amp)
B. 2-CT (5Amp or 1Amp)
C. 1-CT (5Amp or 1Amp)
D. No CT for capacitor current feedback.

Auxiliary power voltage:

A. AC Voltage 2 wire – 90V~ to 485V~
B. DC Voltage 2 wire – 100Vdc to 550Vdc

Usage Directive: Low Voltage (LV) Directive. (Below 1000V~)

Standards Compliance: CE & RoHS

Primary Function: Product is intended to function with LV or HV Electrical supply & distribution system. Function is for controlling the supply system Power Factor by high-speed switching of LV capacitor banks for fluctuating load conditions.

Secondary Function: Monitoring, Logging and Communicating the Electrical measured parameters.

Additional Function: Providing add-on protection. The product does not come under “Protection Relay” category / standards.

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FEATURES

- Accurate D-PF (Displacement Power Factor) correction by high-speed switching of Capacitor banks. Refined control of PF correction as per user requirements.
- Total 16nos. (sixteen) Capacitor banks control. Transistor output DC sourcing +12/+24Vdc commands for TSC (Thyristor Switched Capacitor control). Out of 16nos., 15 are regular steps control and 1 is Auxiliary output configurable. Outputs are short circuit protected.
- Capacitor Current measurement and Capacitor banks health monitoring through Current Transformers of either 5Amp or 1Amp ratings.
- Auxiliary input with AC voltage measurement. Highly useful feature when configured for Contactor actuator voltage health monitoring with protection tripping & avoiding chatter.
- Auxiliary outputs – Total 3nos. For various Alarm and Control functions. (User set functions). One Auxiliary output (AO3- transistor output) can be configured as Capacitor switching.
- Harmonics Measurement (Odd & Even) up to 31st harmonic. For measurement Voltage, measurement Current and capacitor Current. (THD-F%, THD-Value, TDD%).
- Four quadrant measurement – highly suitable for co-generation usages with solar or wind power.
- Accuracy for Reactive and Active Power & Energy of Class-2.0. This is as per accuracy standard IEC-62053 part 21 for Active (P), part 23 for Reactive (Q).
- Data Logging records for Faults / Events, Regular Intervals (user set time interval), Daily logs & Real Time (RT) data.
- Digital Communication two ports. One RS-232 for GPRS modem or Logged data download. Another RS-485 for MODBUS-RTU or MODBUS-ASCII or Logged data download.
- Wide range Voltage and Current measurement through Potential Transformers & Current Transformers.
- High reliability wide ranging Auxiliary Power Supply with AC or DC voltage input.
- PT-100 temperature sensing terminals for PF system temperature monitoring.
- Manual synchronization of Voltage & Current feedback. Without physical wiring connection change.
- Plug – Socket rear side terminals for reliability, easy maintenance, and manufacturing.
- Fire retardant material housing with IP-54 front side protection.
- Added functions: Easy Edit, Expert Edit, Individual Phase mitigation, High speed LV capacitor switching functionality etc. make versatile applicability.
- Volt-Amp feedback Vector position selection facility. Used when Voltage and Current sensing are carried out on different sides of the Transformer.
- Various measurement methods like 3-wattmeter / 2-wattmeter / Balanced Quadrature / Balanced In-phase. This is to suit the various applications and user requirements.

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SPECIFICATIONS

Function	Subfunction	Parameter	Condition	Minimum	Maximum
Measurement					
	Supply	Voltage (V) Sinusoidal	3-Phase & N – fund. 3-Phase (3-wire) – fund. 2-Phase – fund. 1-Phase & N – fund.	50V~ L-N 85V~ L-L 85V~ L-L 50V~ L-N	315V~ L-N 550V~ L-L 550V~ L-L 315V~ L-N
		Current (I) Sinusoidal	5 Amp IN: - fund. 1 Amp IN: - fund.	75mA(cl-2),5mA-min 200mA(cl-2),5mA-min	7.5 Amp 1.5 Amp
		Frequency	Frequency (Hz) (Fundamental Supply Voltage measurement of frequency)	47Hz (for 50Hz) 57Hz (for 60Hz) meas range 45Hz	53Hz (for 50Hz) 63Hz (for 60Hz) meas range 65Hz
		Power / Energy	IEC-62053 pt.21 & 23 4 quadrant measurement	5Amp range: Class 2: P & Q 1Amp range ≥200mA: Class 2 P & Q	
		Maximum Demand	S (VA) P (W) 1 min sliding window Window time user set.	Window time 5 - Minutes	Window time 60 - Minutes
		Harmonics	Voltage - L-L & L-N Current - per L (RYB) & N	Spectrum: 2nd to 31st Harmonic. For Voltage and Current.	
		VA Burden	Voltage at 550V~ L-L Voltage at 415V~ L-L Current at 7.5Amp~ S-CT Current at 5.0Amp~ S-CT Current at 1.0Amp~ S-CT	<1.13VA per ph., <3.40VA total 3-ph <0.65VA per ph., <1.95VA total 3-ph <1.0VA per ph., <3.0VA total 3-ph <0.5VA per ph., <1.5VA total 3-ph <0.05VA per ph., <0.15VA total 3-ph	
	Capacitor	Current	5 Amp IN: 1 Amp IN:	75mA(cl-2),25mA<0 15mA(cl-2),05mA<0	7.5 Amp 1.5 Amp
		Harmonics	Cap. Current - per Ph	2nd to 31st Harmonic	
		VA Burden	Current at 5.0Amp~ C-CT Current at 1.0Amp~ C-CT	<0.5VA per ph., <1.5VA total 3-ph <0.05VA per ph., <0.15VA total 3-ph	
		Bank VAR value	Fund. Voltage, Cap.Ampare & frequency normalized value.	% of capacitor current CT rating. Accuracy 3%: 10% to 150% C-CT rated Accuracy 10%: 2% to 10% C-CT rated	
Capacitor Control					
	PF Correction	Target PF	Displacement Power Factor setting	Inductive: 0.000	Capacitive: 0.000
		VAR margin	Smallest capacitor bank VAR … X	… X 1.1	… X 9.9
		Offset to target	% above the target PF setting	0%	100%
	ON/OFF control	Algorithm	Optimal value to target.	Single target PF with adjustable No action VAR tolerance band	
		Bank Utilization	**Limit** = (Number of switch ON / **C**) + (On duration in Minutes / **T**)	C = 01 (00 Disable) T = 01 (00 Disable)	C = 99 T = 99
		High Speed Pull-up Solid State switching	Group of 5 numbers (3-groups) + Transistor switched high speed on/off	Voltage: +10Vdc Amp: 0mA dc	Voltage: +24Vdc Amp:30mA dc(<2.5Vdrop) Current limit 32-40mA

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SPECIFICATIONS:

Function	Sub-function	Parameter	Condition	Minimum	Maximum
Auxiliary Supply					
	Voltage	AC supply	for energizing unit	90 V~	485 V~
		DC supply		100 V ⎓	550 V ⎓
	VA consumption	AC supply VA	90V~ : 485V~: metering	--	7.5 VA
			With full Control loading	--	15.0VA
		DC supply VA	100V ⎓ to 550V ⎓ metering	--	7.5 VA
			With full Control loading	--	15.0VA
Auxiliary Functions					
	Add-on Fault detection:	Actions	On exceeding the user set conditions	Indicative : Data Log : LDATA Capacitor Regular trip : NTRIP Capacitor Instant trip : INS-X	
		Recovery	Automatic Timer Reset Manual intervention Reset	Depending upon fault type. (Refer details in the further part of this document)	
	Auxiliary Input	Voltage~ Rating	AC supply(abs.max rating) AC measurement range Digital range	0V~ AC 68 Volt ~ 0(Zero):<3V~	300V~ AC 290 - Volt ~ 1(One):>68V~
	Auxiliary Output	NO contact	AO1 & AO2	5Amp Resistive / 0.5Amp Inductive Amp~ 250V~ voltage contact rating.	
		Transistor	AO3	High-Speed Pull-up switching +10Vdc to +24Vdc up to 30mA (<2.5V drop) with current limit. (32mA to 40mA current limit)	
Enclosure / Display / Keyboard / Connectors					
	Enclosure	Type	Fire retardant ABS grade		
		Dimensions	Front Face + depth Panel cutout dimensions	146 (H) x 146 (W) x 75 (D) mm 138 x 138 mm	
		Weight	Unpacked unit weight Packed unit weight	<0.9KG include mounting clamps <= 1.25 KG	
		IP Class	Front Facia: Back side - Inside Panel :	IP-54 IP-20	
	Display	LCD backlit	Yellow-Green with LED Backlit	16 Graphic Character X 2 Lines	
		Contrast/view	Adjust Min - Max 25 key presses	Left key: Lighter	Right key: Darker
	Keyboard	Isolated tact switch	7 - Key - User Friendly	Up, Down, Left, Right: 4 Navigation keys Enter: For value entering Selection: Mode & Parameter selection Save: Saving key	
	Connectors	Plug - Socket	Voltage Measuring Current (supply & cap) Measuring Output Control & Aux control Communication & Pt-100	7.62mm pitch-Pin type lugs tightening 5.08mm pitch-Screw lockable plug-socket 7.62mm pitch 3.81mm pitch	

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SPECIFICATIONS:

Function	Sub-function	Parameter	Condition	Minimum	Maximum
Communication & Data Logging					
	Comm.	RS-485	Protocol	MODBUS- (RTU & ASCII), PC App data D/L & U/L	
		RS-232	GPRS Modem & Data download	AT+ for MODEM, PC App data D/L & U/L	
	Data Logging	non-volatile memory	Interval Records: Event Records: Daily Records: User Settings Parameters:	As per user selected Communication mode & Data logging structure.	
	Date / Time Management	Real Time Clock. (RTC)	RTC maximum deviation.	±1-min in 30-days within op. temp. range	
		Power down time backup	Power down RTC Back-up time with Super-Capacitor usage.	30-days minimum back-up time range if temp. maintained within 10°C to 40°C ambient.	
Temperature sensing					
	Internal unit temperature	For Unit right functioning	Range within unit operating temperature	0°C	+65°C
	PT-100 temperature	For PF panel temperature	Range within the PF correction panel operating temperature.	0°C	+100°C
Environmental / Safety - Type tests					
	IEC61326-1	EMC	Electromagnetic Compatibility	Compliance	
		EMI	Electromagnetic Interference	Compliance	
	IEC61010-1	Safety Standards	Safety Standards with Low Voltage instruments directive (category III)	Compliance	
	RoHS	2002/95/EC RoHS 3.0	Regulation on Hazardous Substances usage.	Compliance	
	CE			Compliance	
	IEC60068-2	Dry Heat	Storage condition +70°C for 72Hrs.	Compliance	
		Cold Test	Storage condition -25°C for 72Hrs.	Compliance	
		Damp Heat Cyclic Test	Power-up condition At RH 93% +40°C & +25°C 12-12Hrs. cyclic 144Hrs.	Compliance	
	Temperature	Operating	Surrounding Ambient temperature	0°C	+60°C
		Storage	Surrounding Ambient temperature	-10°C	+70°C
	Humidity	RH%	Relative Humidity	10%RH	95%RH non-condensing

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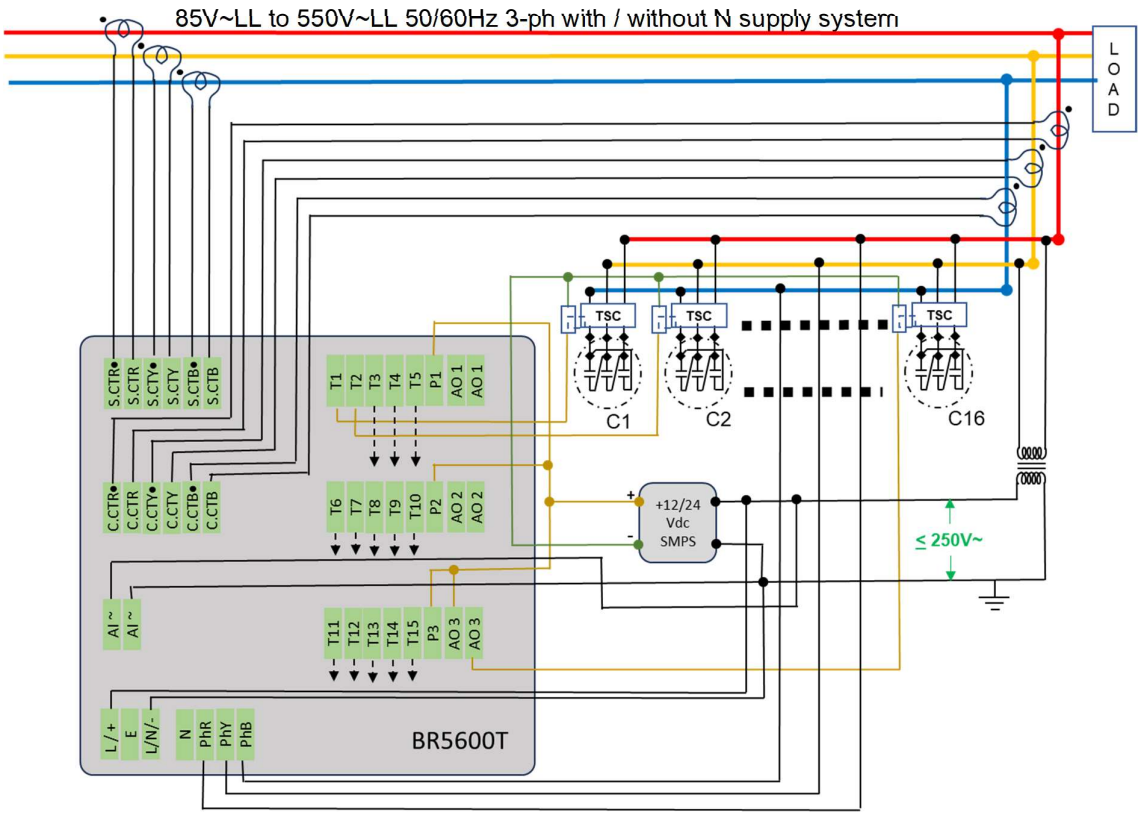
CONNECTIONS & WIRING

Typical Schemes:

1: 3-Wire Balanced Load connection to LV Auto-RTPFC system:



Applicability:

- ✓ For LV supply system ranging from 85V~LL to 550V~LL, 50Hz / 60Hz, 3-phases with or without Neutral connection.
- ✓ Usage of 3-phases Balance capacitors. Suitable for balanced load requirement.
- ✓ Capacitor switching TSC powered by +12/+24Vdc Power Supply with input 100V~ to 250V~.
- ✓ 3-Phases 3-Wire (without Neutral) Connection to Auto-RTPFC System.
- ✓ Need Auxiliary supply transformer for SMPS (Power Supply) voltage with secondary output voltage as per SMPS input rating. It should be minimum 100V~ and maximum 250V~ for typical SMPS unit.

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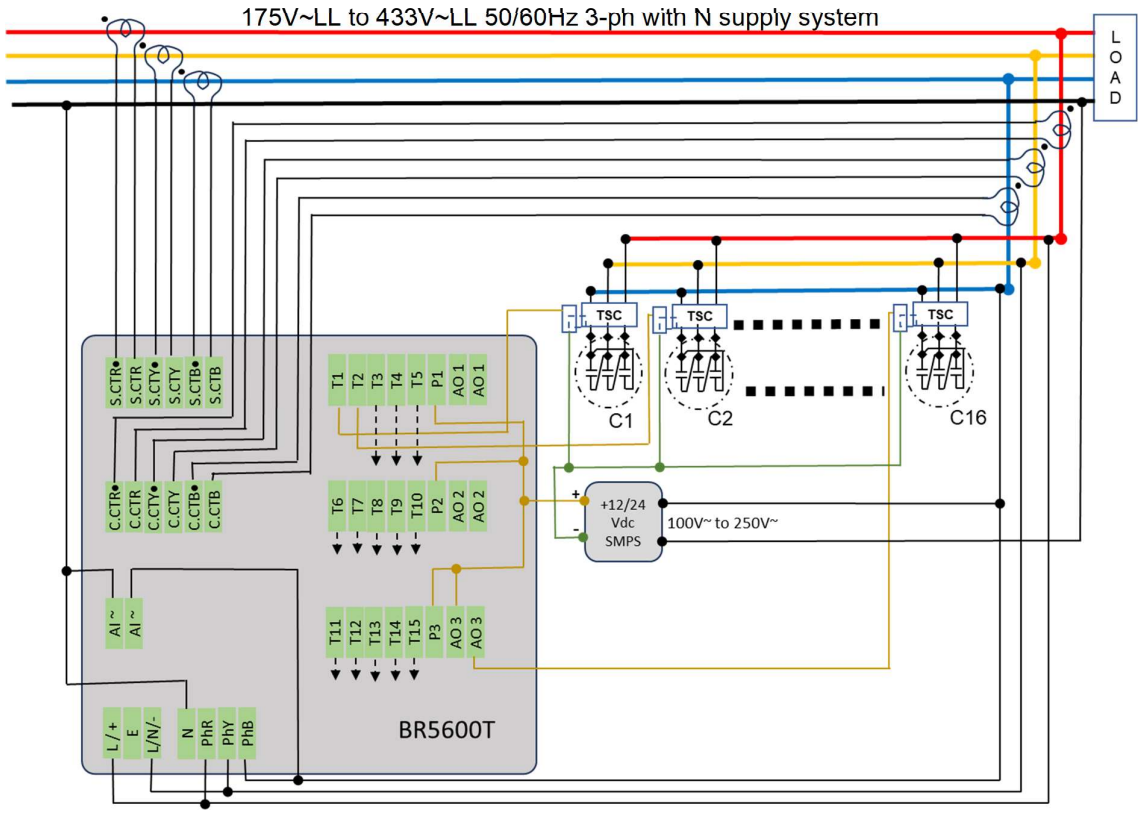
CONNECTIONS & WIRING:

2: 4-Wire Balanced Load with Neutral connection to LV Auto-RTPFC system:



Applicability:

- ✓ For LV supply system ranging from 175V~LL to 433V~LL, 50Hz / 60Hz, 3-phases with Neutral connection.
- ✓ Usage of 3-phases Balance capacitors. Suitable for balanced load fast switching requirement.
- ✓ Capacitor switching TSCs Operated by +12/+24Vdc supply from SMPS energized from 100V~ to 250V~. Note the usage restricted with supply system up to maximum 433V~LL and minimum 175V~LL, so that maximum LN voltage is 250V~ and minimum LN voltage is 100V~.
- ✓ 3-Phases 4-Wire (with Neutral) Connection to Auto-RTPFC System.
- ✓ Need a strong Neutral connection from supply system to Auto-RTPFC System. (To prevent Neutral floating issues)
- ✓ If control supply is provided through step down transformer (Limited between 100V~ to 250V~) for BR5600T Auxiliary supply and for Contactor's coil supply, then the supply system can be used for higher voltage up to 550V~LL value. (With usage of capacitors with right rated voltage)

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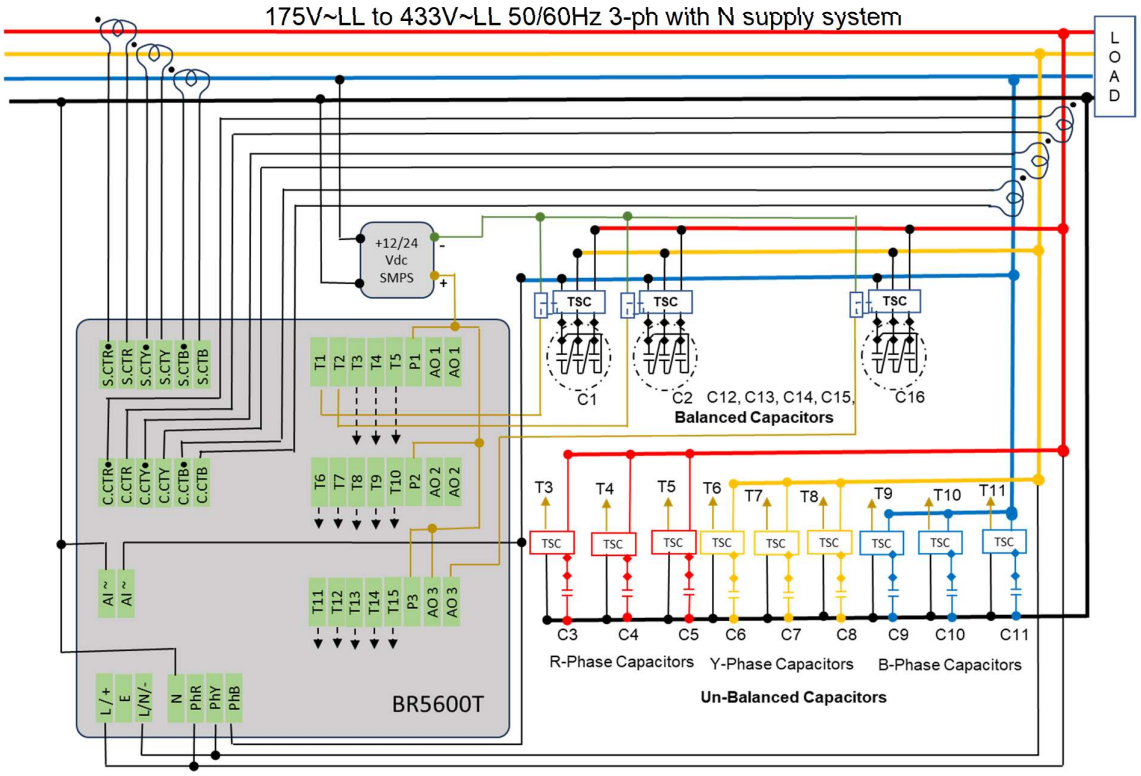
CONNECTIONS & WIRING:

3: 4-Wire Un-balanced Load with Neutral connection to LV Auto-PF system:

(Typical Scheme)



Applicability:

- ✓ For LV supply system ranging from 175V~LL to 433V~LL, 50Hz / 60Hz, 3-phases with Neutral connection.
- ✓ Usage of 3-phases Balance capacitors as well as 1-phase capacitors. Suitable for un-balanced load requirement.
- ✓ Capacitor switching TSCs (for 3-ph and 1-ph) controlled by +12/+24Vdc supply from SMPS whose input is ranging from 100V~ to 250V~. Note the usage restricted with supply system up to maximum 433V~LL and minimum 175V~LL, so that maximum LN voltage is 250V~ and minimum LN voltage is 100V~.
- ✓ 3-Phases 4-Wire (with Neutral) Connection to Auto-RTPFC System.
- ✓ Need a strong Neutral connection from supply system to Auto-RTPFC System. (To prevent Neutral floating issues)
- ✓ If control supply is by step down transformer (Limited to 250V~ max) to Auxiliary supply and for SMPS supply, then the supply system can be used for higher voltage up to 550V~LL value (with usage of capacitors with right rated voltage).

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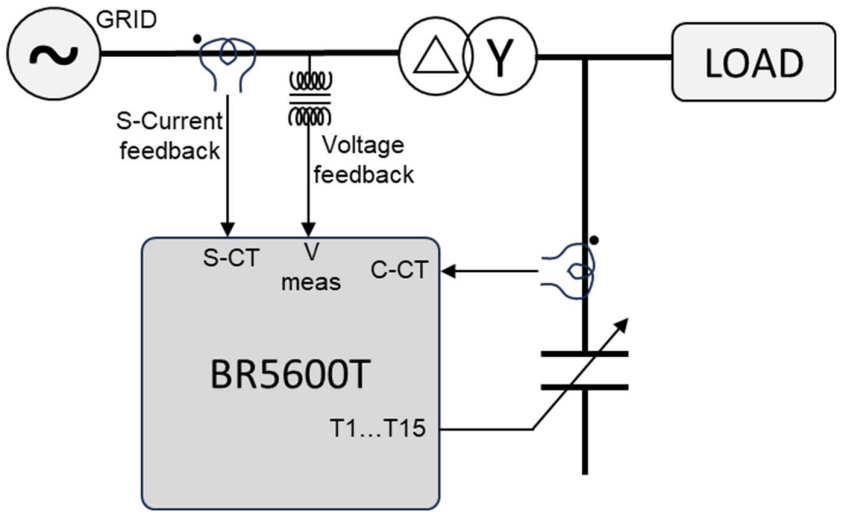
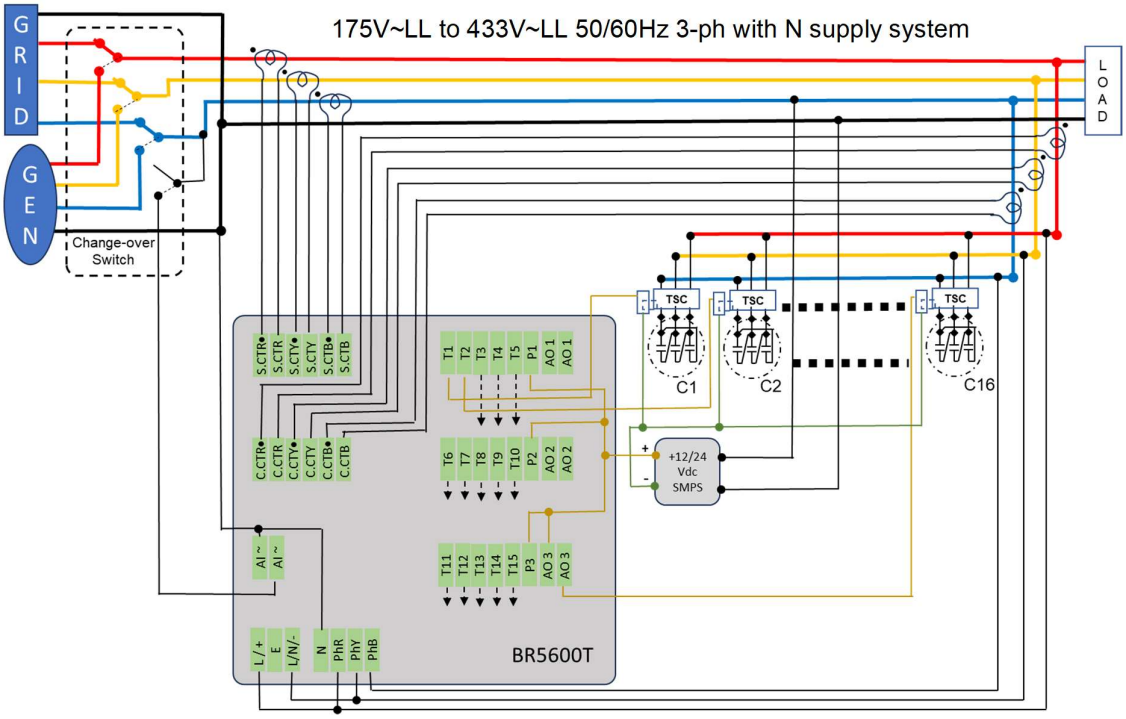
CONNECTIONS & WIRING:

4: HV Feedback–LV Capacitor Auto PF (Single line Diagram Schematic)



5: Grid & Generator Scheme (Dual PF control)



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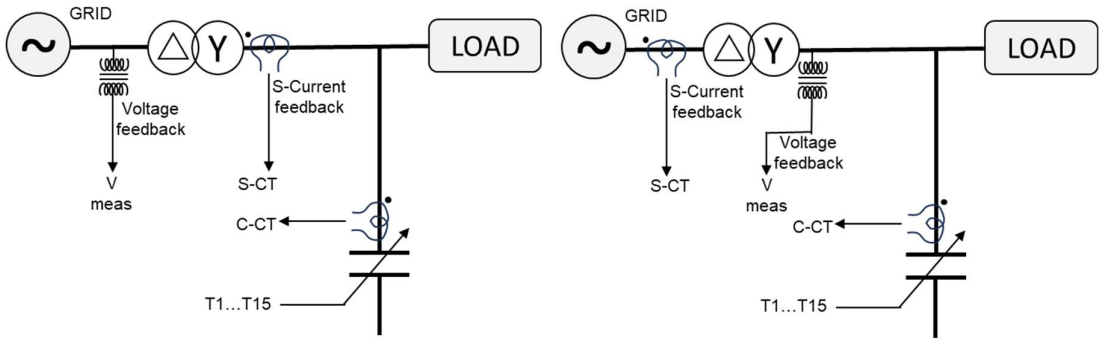
CONNECTIONS & WIRING:

6: <u>Voltage-Current feedback from HV-LV bus:</u> L(V)H(A) & H(V)L(A)

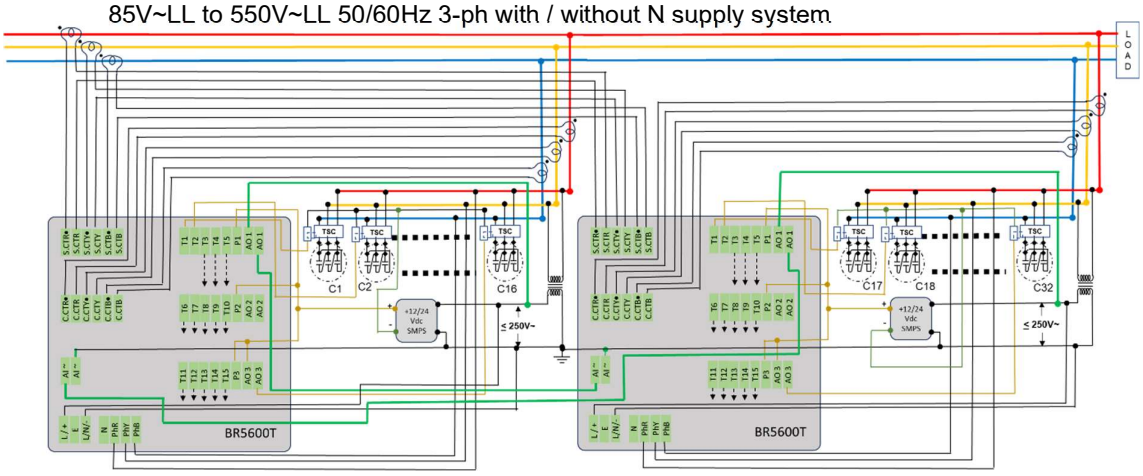
(Single line Diagram Schematic) – Adjustment by V-A Vector Group.



<u>L(V)H(A)</u> **<u>H(V)L(A)</u>**

7: <u>Extended Capacitor bank numbers Switching scheme</u>: (Usage of 2Nos PFC)

85V~LL to 550V~LL 50/60Hz 3-ph with / without N supply system



Master PF controller
Controlling Capacitor bank nos. 1 to 16.

Follower PF controller
Controlling Capacitor bank nos. 17 to 32.

<u>Applicability</u>:

- ✓ For higher number of Capacitor banks (steps). More than 16nos. Two numbers of BR5600T units are used with **Digital Input** and **Digital Output 1** connections as shown in the diagram.
- ✓ Capacitor Banks Controlled by Master and by Follower are recommended to be 1 to 1 matching. Even though this is not a mandatory requirement, the recommendation is for achieving better reactive power control. This is useful with KVAH billing reduction.
- ✓ Settings on BR5600T

  <u>Master</u>: <MODE EXPERT EDIT> <AUX I/O> <AUX I/P FUNCTION: 32S-MI
  <MODE EXPERT EDIT> <AUX I/O> <AUX O/P No.1: 32S-MO (auto set)

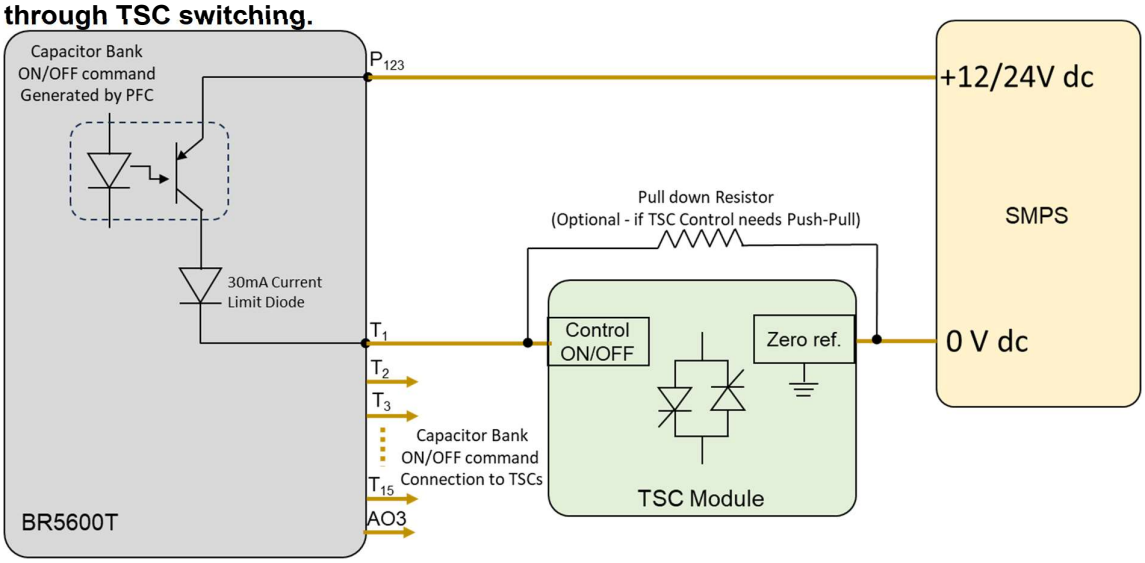
  <u>Follower</u>: <MODE EXPERT EDIT> <AUX I/O> <AUX I/P FUNCTION: 32S-FI
  <MODE EXPERT EDIT> <AUX I/O> <AUX O/P No.1: 32S-FO (auto set)

CONNECTIONS & WIRING:

Master & Follower controllers that are used with matching capacitor bank sizes, the Configurations and settings should be made identical except for Aux. I/O as specified hereabove.

- ✓ For LV supply system ranging from 85V~LL to 550V~LL, 50Hz / 60Hz, 3-phases with or without Neutral connection.
- ✓ Usage of 3-phases Balance capacitors. Suitable for balanced load requirement.
- ✓ Note the supply current measurement CTs (S-CT) for Master and Follower unit are in series connection.
- ✓ Capacitor switching TSC module supply or from SMPS has input from 100V~ to 250V~.
- ✓ 3-Phases 3-Wire (without Neutral) Connection to Auto-PF System.
- ✓ Need Auxiliary supply transformer for Aux input, Aux. supply and SMPS supply voltage with secondary output voltage should be minimum 100V~ and maximum 250V~.

Typical control wiring of the PFC output command for Capacitor bank ON/OFF control through TSC switching.



For RTPFC systems, the switching modules are TSC (Thyristor Switched Capacitors) for high-speed turn ON / OFF the capacitors.

Typical ON state current for TSC modules (good makes available in the market) is between 5mA dc to 15mA dc. The sourcing capacity of every step output of BR5600T is 30mA which is sufficient current capacity for even driving two number of TSCs through one command. Users are advised to confirm the TSC modules control command current sinking capacity to be adequate for usage.

The Control command Voltage for TSC ON is logic 1 = SMPS DC Voltage – (1.5 to 2.5Vdc)

The Optional pull-down resistor recommended in the circuit is for TSC control is needed with push pull input. The recommended value for resistance is 2.7 Kilo-Ohm for +12V SMPS supply and 5.6 Kilo-Ohm for +24V SMPS supply. Resistor wattage recommended is 0.5Watt.

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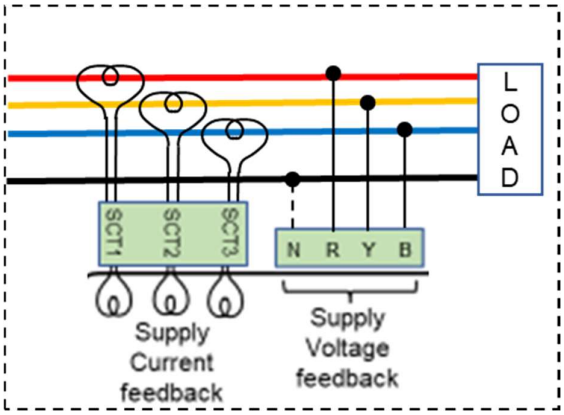
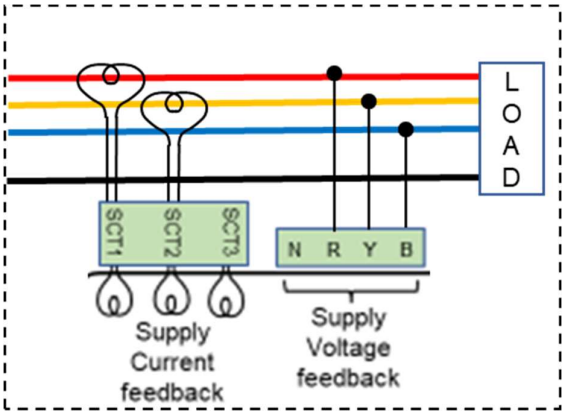
MEASUREMENT FEEDBACK CONFIGURATIONS

On LV supply system:

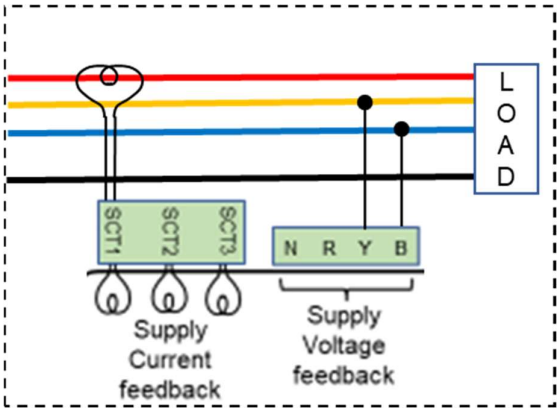
Configuration No. 1: 4/3-W / 3-CT



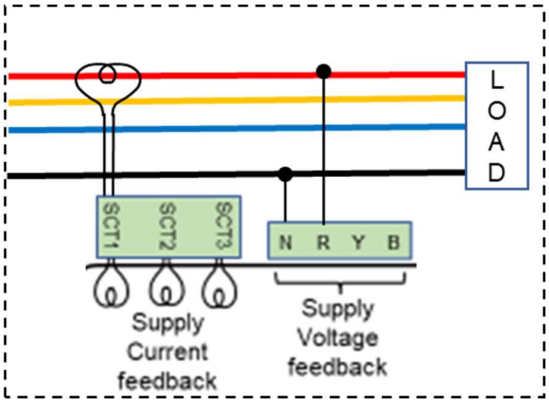
Configuration No. 2: 3-W / 2-CT



Configuration No. 3: 2-W (LL) / 1-CT



Configuration No.4: 2-W (LN) / 1-CT



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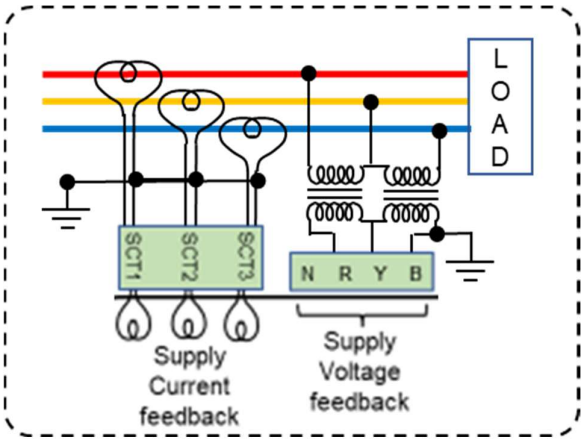
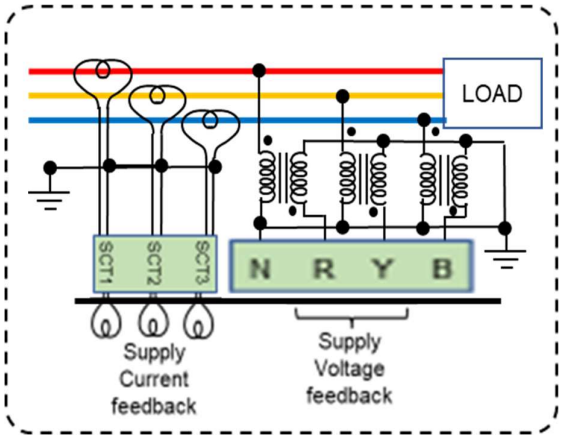
MEASUREMENT FEEDBACK CONFIGURATIONS:

On HV supply system:

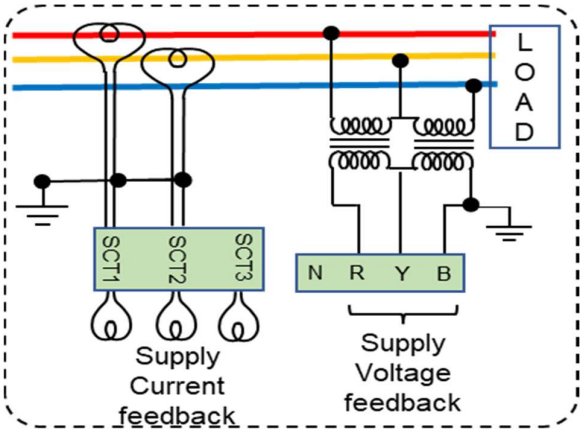
Configuration No. 1: 3-W / 3-CT



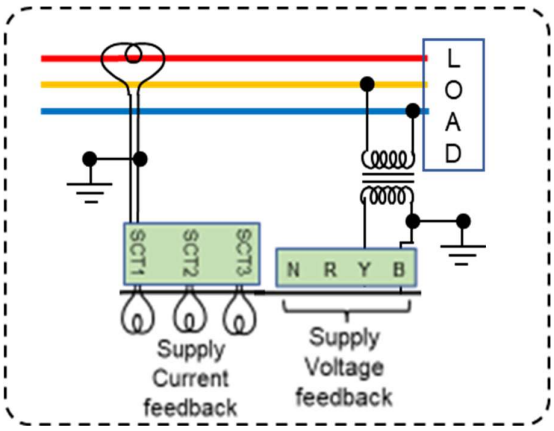
Configuration No. 1: 4-W / 3-CT



Configuration No. 2: 3-W / 2-CT



Configuration No. 3: 2-W / 1-CT



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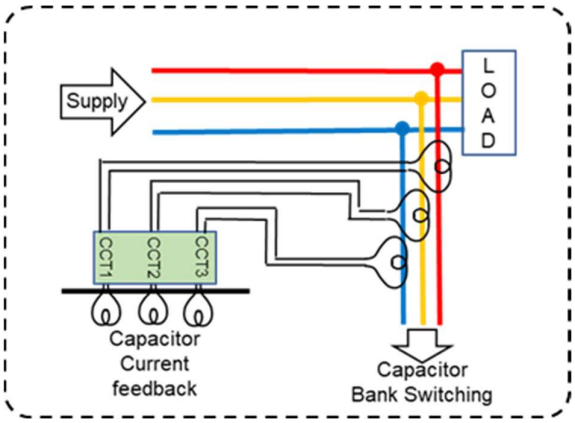
MEASUREMENT FEEDBACK CONFIGURATIONS:

Capacitor Current feedback Measurement Configurations:

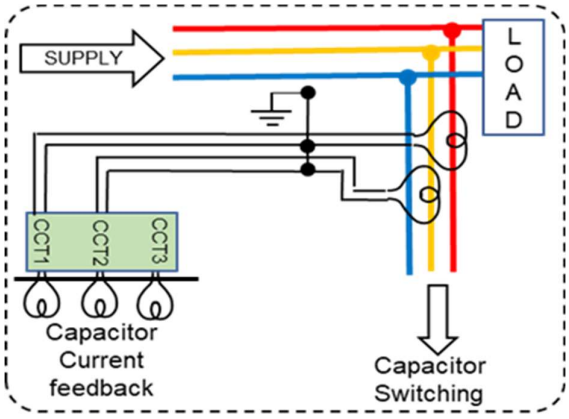
Capacitor Configuration No. 3

3-CT (individual phase mitigation)



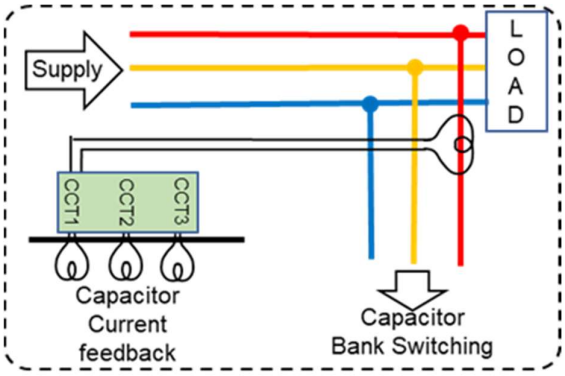
Capacitor Configuration No. 2

2-CT



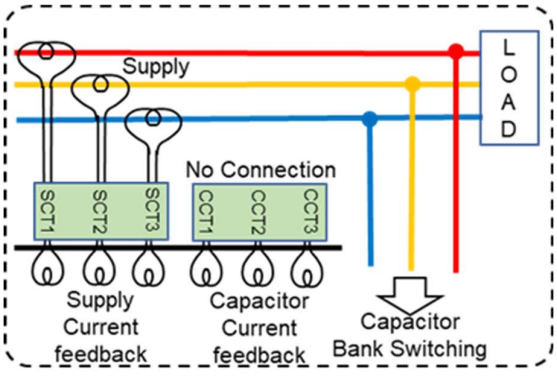
Capacitor Configuration No. 1

1-CT



Capacitor Configuration No. 0

No Current feedback



Note: In Cap. Config. No.0, the feedback Is from Supply current CTs. This is for Capacitor bank VAR monitoring action.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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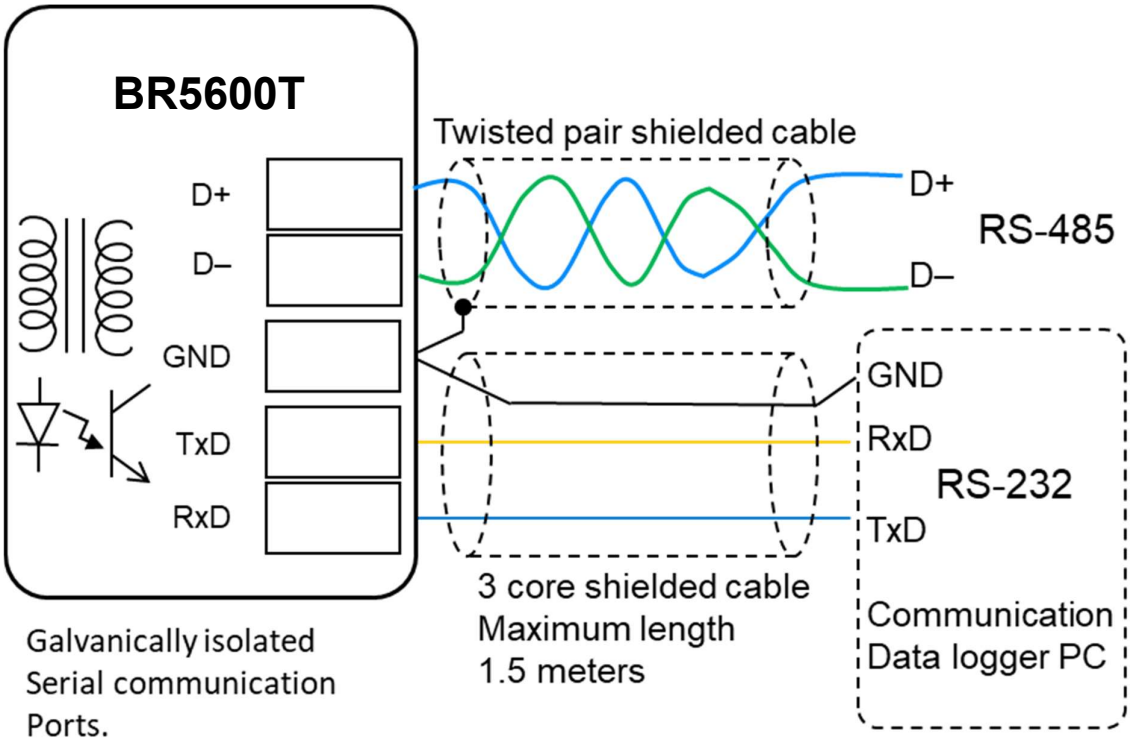
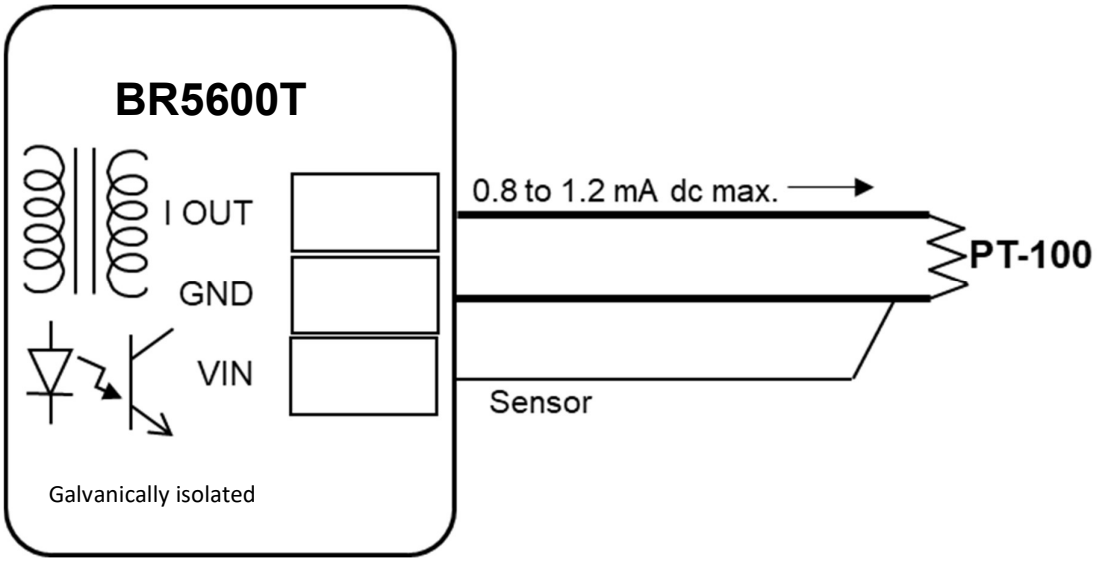
CONNECTIONS WITH COMMUNICATION PORTS & TEMPERATURE SENSING

Serial Communication Ports Connection:



Temperature sensor PT-100 connection:



BR 5600 T power factor controller for LV High-Speed Capacitor switching

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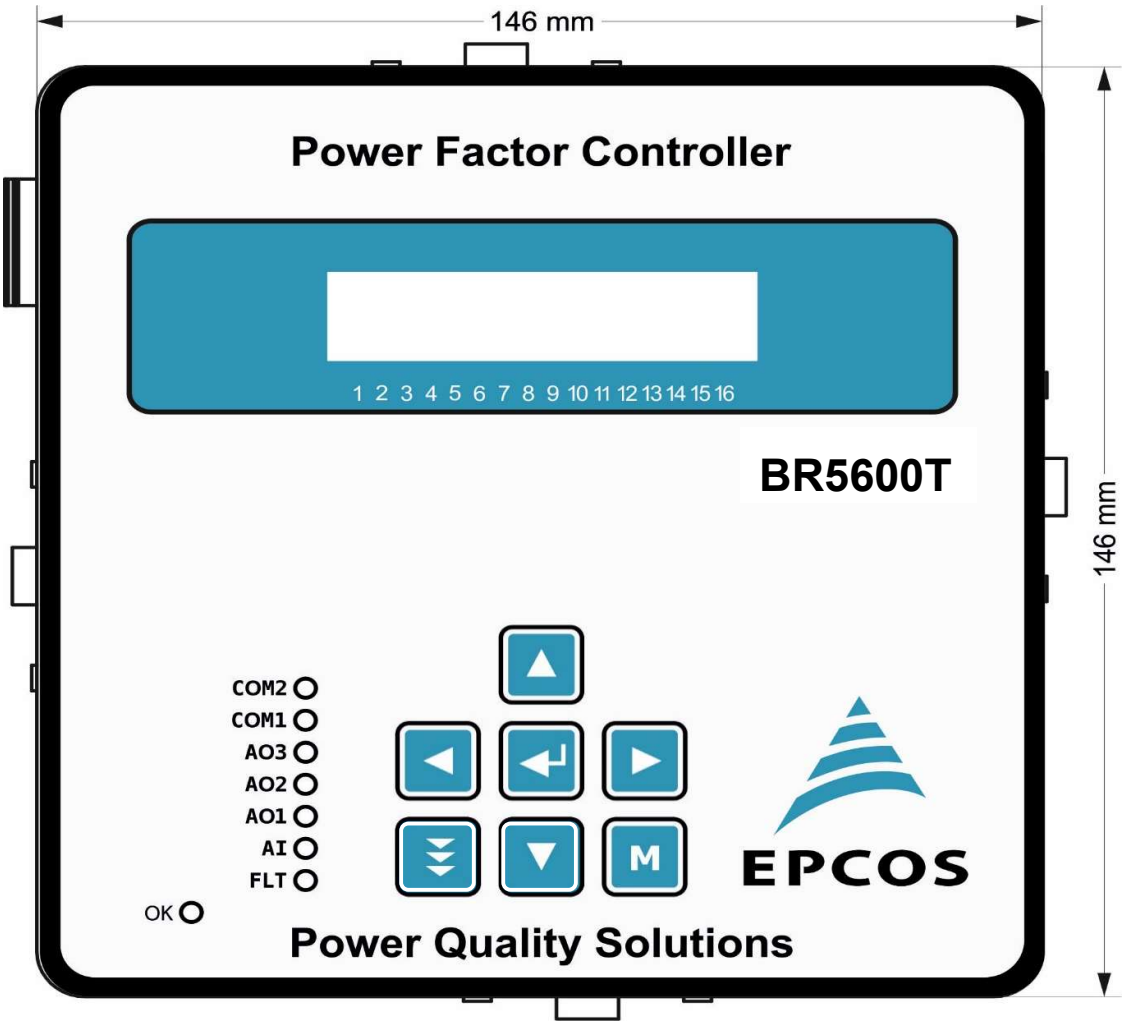
MECHANICALS

Front View:



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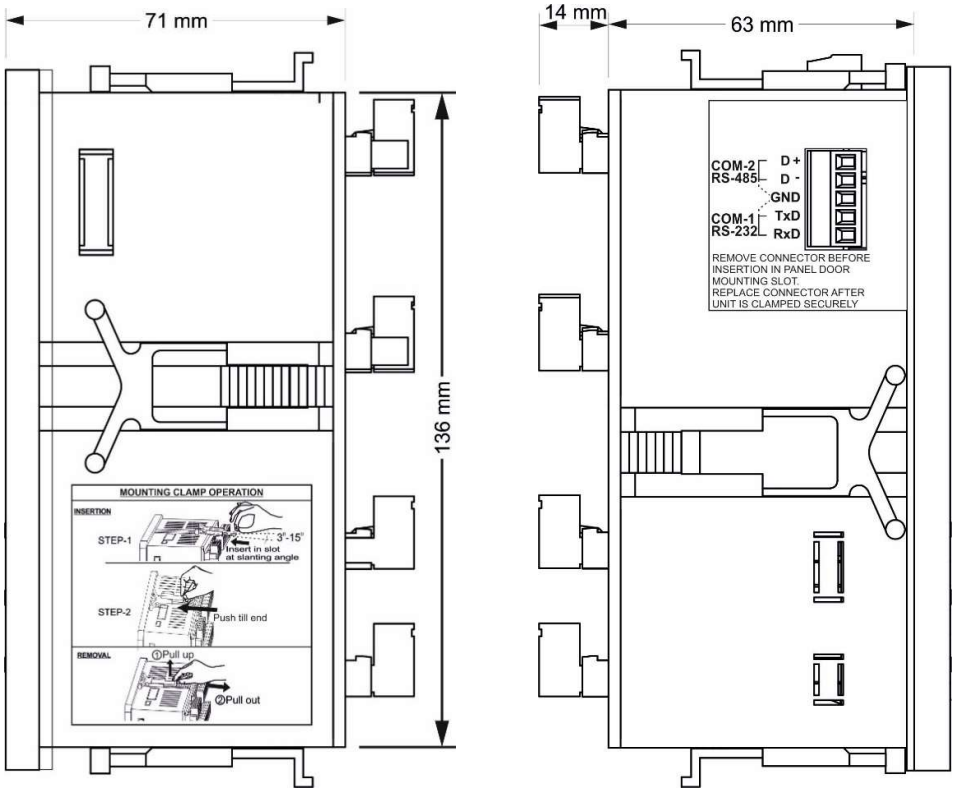
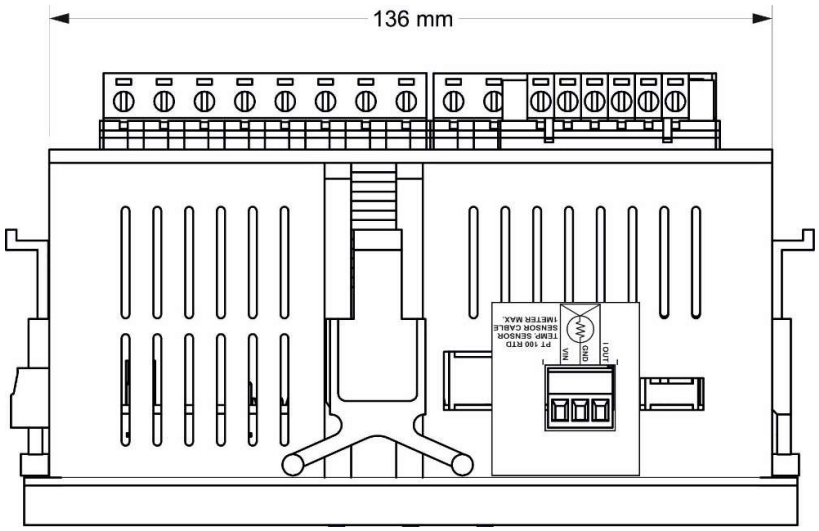
MECHANICALS:

Side Views:



Top View:



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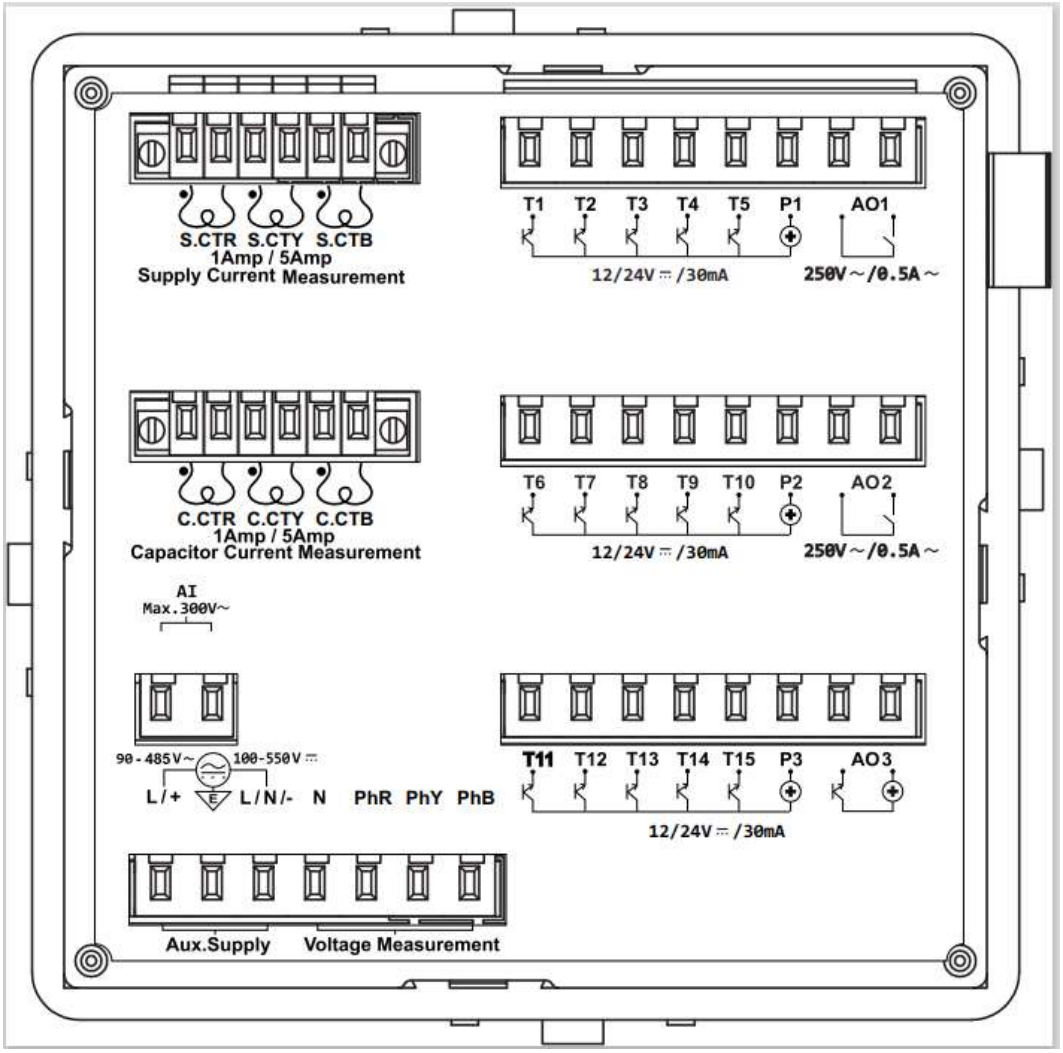
MECHANICALS:

Back View:



BR 5600 T power factor controller for LV High-Speed Capacitor switching

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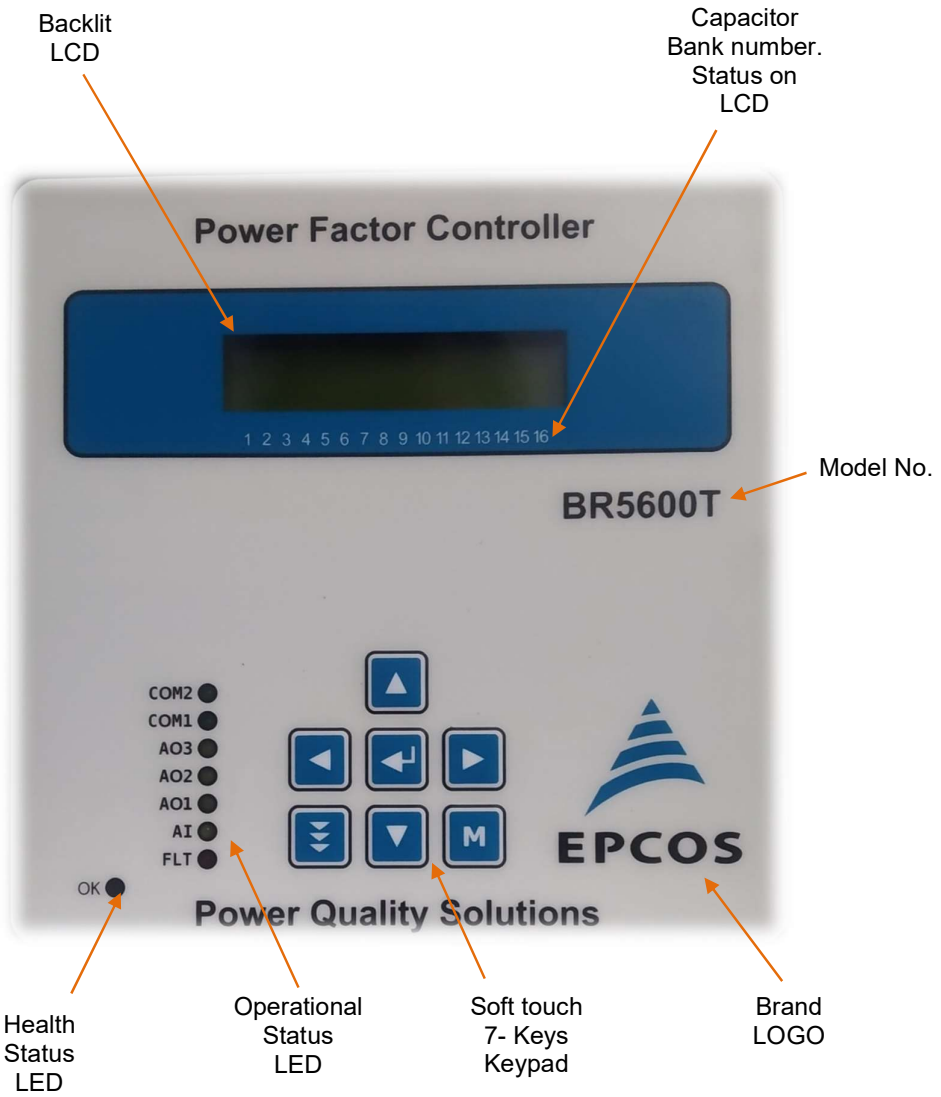
OPERATIONAL PARTS

Front View (Photo):



OPERATIONAL PARTS:

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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Back View – Terminals positioning (Photo):

Supply CT Current fb

Capacitor CT Current fb

Auxiliary Input

1st SET 5-Capacitor Control Transistors + 1 Aux. Output Relay

2nd SET 5-Capacitor Control Transistors + 1 Aux. Output Relay

3rd SET 5-Capacitor Control Transistors + 1 Aux. Output Transistor. (can be used as 16th step of capacitor.)

Auxiliary Supply

Supply (PT) Voltage fb

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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OPERATIONAL PARTS:

Auxiliary Control Terminals View (Photo):

Right Side View

Serial Communication Terminal Block

COM-1: RS-232

COM-2: RS-485

Top Side View

External Temperature Sensor RTD input.

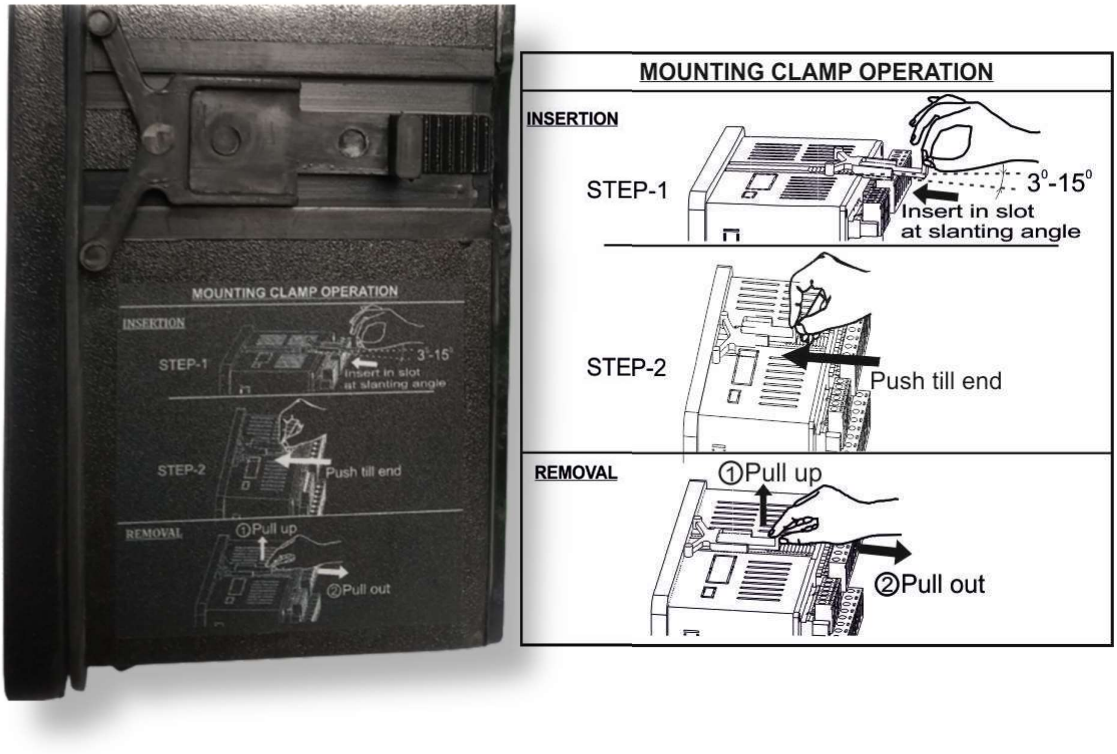
PT – 100 (3 wire)

BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

OPERATIONAL PARTS:

Panel door mounting clamps:



<u>Ensure instructions while mounting the unit on PF correction panel door:</u>

- ✓ Remove the Right-hand side plugs terminal (communication) and Upper side plug terminal (External Temperature sensor PT-100).
- ✓ Remove the 4 clamps as per instruction here above.
- ✓ Insert BR5600T unit from front of panel door. Insert and secure the mounting clamps as per instructions here above.
- ✓ Put back both the plug terminals.

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OPERATIONAL PARTS:

Keyboard

Seven (7) Keys

Soft touch with operational feel

Navigation Keys

- **UP Key**
- **DOWN Key**
- **LEFT Key**
- **RIGHT Key**

Control Keys

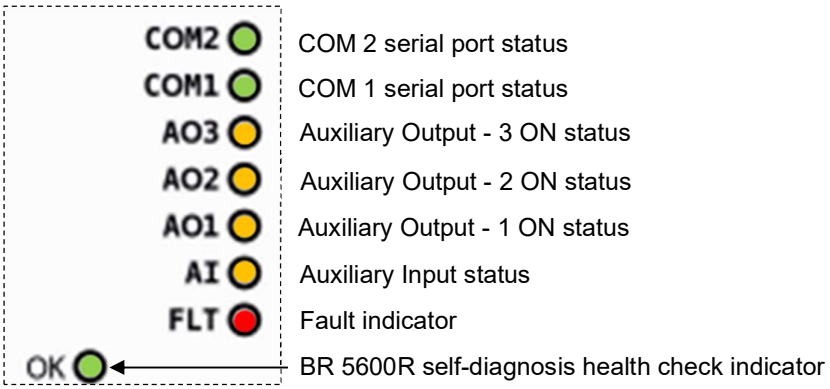
- **ENT Key**
- **MODE Key**
- **SAVE Key**

BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

OPERATIONAL PARTS:

LED indication on front



LED Function	INFORMATION	OFF	ON	BLINK SLOW	BLINK FAST
COM 2	RS-485 Comm	No comm	Comm on	--NA--	--NA--
COM 1	RS-232-GPRS RS-232 PC-Ap	No comm No comm	Establish Comm on	Trying --NA--	Data on --NA--
AO3	Aux Output 3	OFF	ON	--NA--	--NA--
AO2	Aux Output 2	OFF	ON	--NA--	--NA--
AO1	Aux Output 1	OFF	ON	--NA--	--NA--
AI	Aux Input	Dig “0”	Dig “1”	AC meas.	--NA--
FLT	Fault	No fault	Cap.FLT	Fault/s	--NA--
OK	Unit Health	Abnormal	Abnormal	All ok	Abnormal

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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INITIAL CHECKS

Checks before Powering up new BR5600T unit:

1. Inspect BR5600T unit for any physical damage and for tamper-proof seals in torn state. In case of any of these issues, the unit should not be used and should be replaced with the good one.

2. Check BR5600T unit is securely mounted on RTPFC system panel door with all the 4 clamps. As per earlier given instructions.

3. Ensure the Wiring to BR5600T is as per the required scheme. The 1.5mm^2 Cu gauge and 1.1kV insulation wires for all Voltage / relay terminals are used. The 2.5mm^2 Cu gauge and 1.1kV insulation wires for all Current (CTs) terminals are used.

4. Check that Supply current CTs and Capacitor current CTs are kept in shorting condition. (CT Shorting external to BR5600T unit)

5. Ensure that right type of lugs (Pin type) is properly crimped to wires for connection to BR5600T. Tightening of the screws of the terminals with Maximum 1.5Nm torque.

6. Check that Supply Current CT terminals and Capacitor Current CT socket terminals are secured by terminal side screws with its plug terminals parts.

7. Ensure the right capacity Resistor is used across the control command of the “Thyristor Switched Capacitors”. This is specifically needed for the TSC modules that requires the Push-Pull type of control command.

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Operations manual

DISPLAY – LCD VIEWING

Default Display Screen:

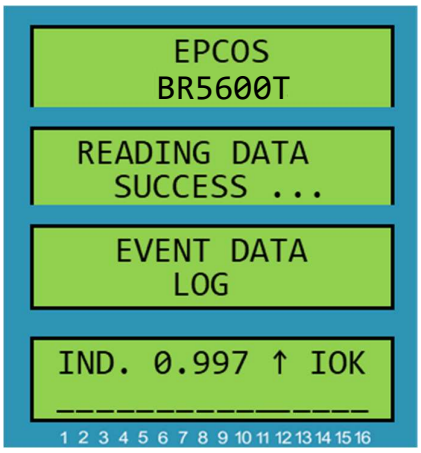
On powering up the BR5600T unit

Power ON Screens observed: …….

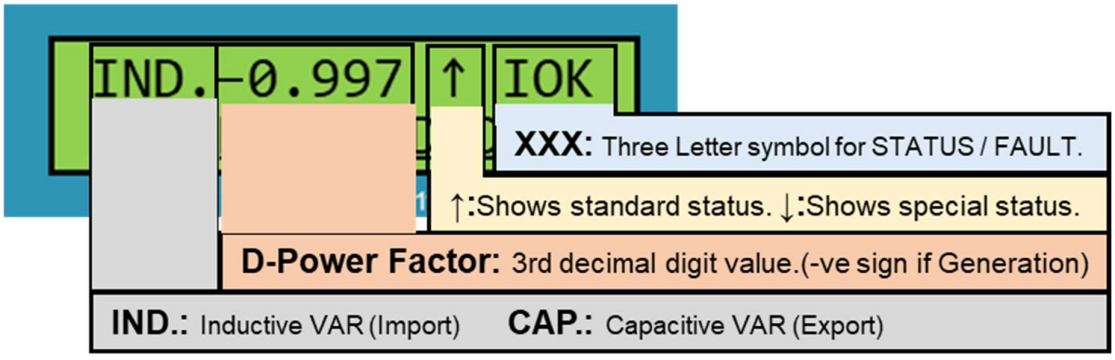
5

Seconds

Default Display: ……..



Display top Line:



Note:

STATUS / FAULT : Please refer the listing for details in later part herein.

Power Factor : Number represents D-PF (Not overall Power Factor)

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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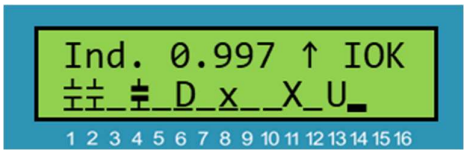
DISPLAY – LCD VIEWING:

Default Display Screen (Continued):

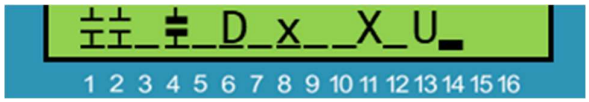


↑ or ↓ symbol:

↑ Standard: Grid operation

↓ Non-standard: Generator op or Test Capacitors.

Display bottom Line:



Symbols and their meaning:

- Blank: Step No. not in use.
- Step No. is in use. Its OFF.
- Step No. is in use. Its ON.
- Step No. is in use. Its Discharging.
- Step No. used as FIXED. Its OFF
- Step No. used as FIXED. Its ON
- Step No. is detected faulty.
- Step No. is masked by user.
- Step No. Utilization limit reached. Masked

Bottom Line Display Inferences:

- Steps Unused: 3 Nos. (5,15,16)
- Steps OFF: 7 Nos. (3,7,9,10,12)
- Steps ON: 2 Nos. (1,2)
- Steps Discharging: 1 No. (6)
- Steps Fixed & OFF: 1 No. (14)
- Steps Fixed & ON: 1 No. (4)
- Steps declared faulty: 1 No. (8)
- Steps masked by user: 1 No. (11)
- Steps masked due to utilization limit: 1 No (13)

Note:

At Power up, all the capacitor status are in “Discharge” – **D** state. In case user wishes to bypass this waiting time, can do so by pressing < (Left) key.

DISPLAY – LCD VIEWING:

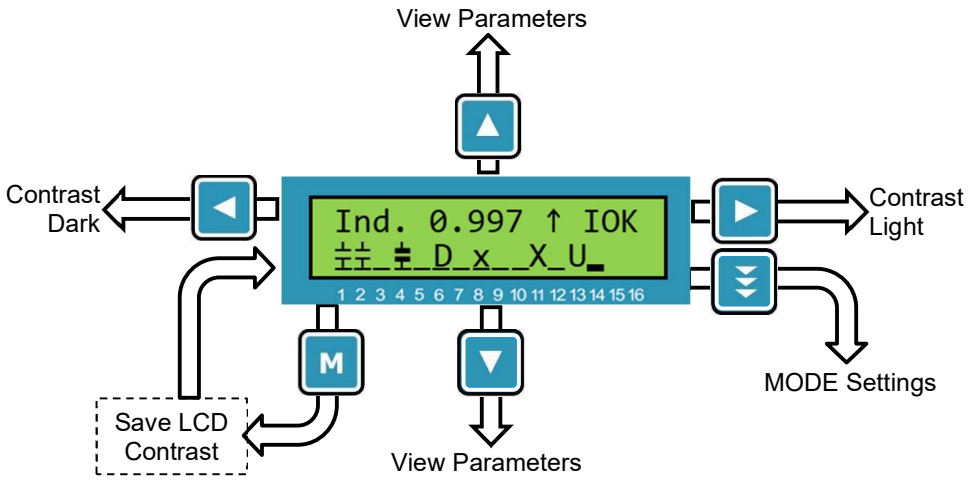
LCD Display & Keyboard functionality

LCD Contrast (Viewing Angle) adjustment:

Contrast on LCD can be adjusted as per the Viewing Angle position.

The adjustment is possible on “Default display” by ◄ - **LEFT** key or ► - **RIGHT** key. Multiple strokes of the ◄ key increases the darkness. Similarly, multiple strokes of the ► key reduces the darkness, making display lighter. After the adjustment, pressing of ◙ - **SAVE** key ensures saving the contrast adjustment.

LCD Contrast & Viewing Electrical Parameters:



The diagram view of “Default Screen” with various keyboard functionalities is self-explanatory.

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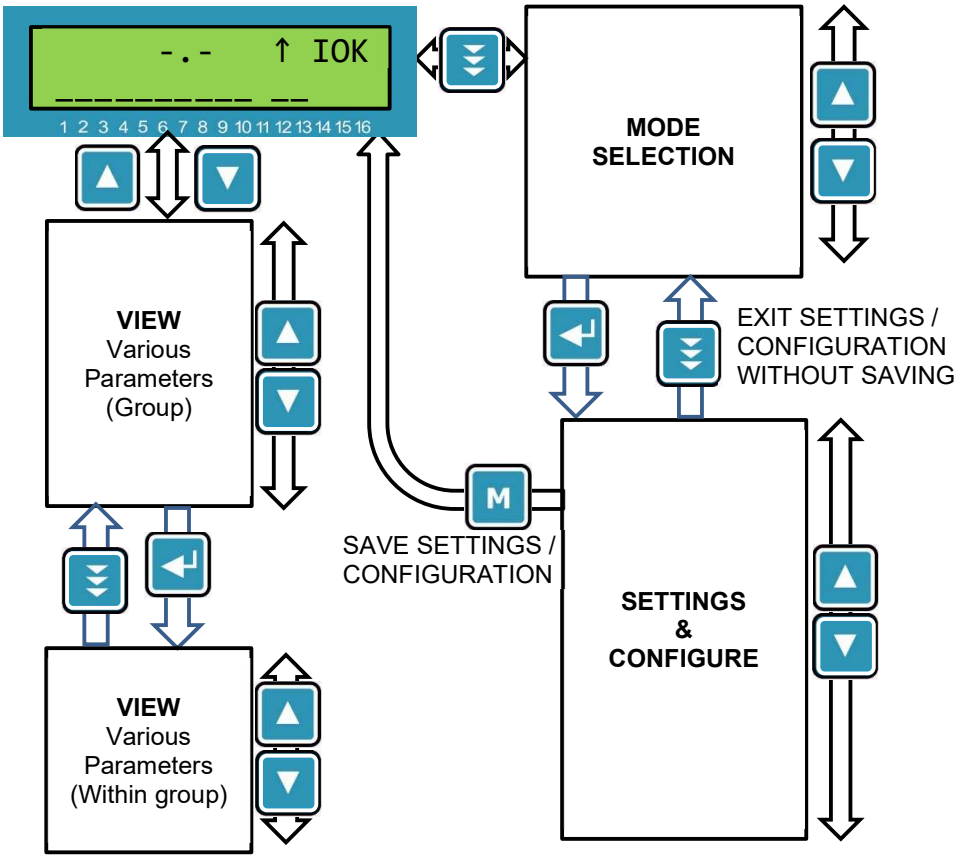
DISPLAY – LCD VIEWING:

LCD VIEWING / SETTING STRUCTURE - Flow chart view:



As can be seen from the diagram above, there are two primary Display functions achieved:

1. Display of the measurement parameters.
2. Configuration (settings) of the BR5600T unit as per Application & User requirements.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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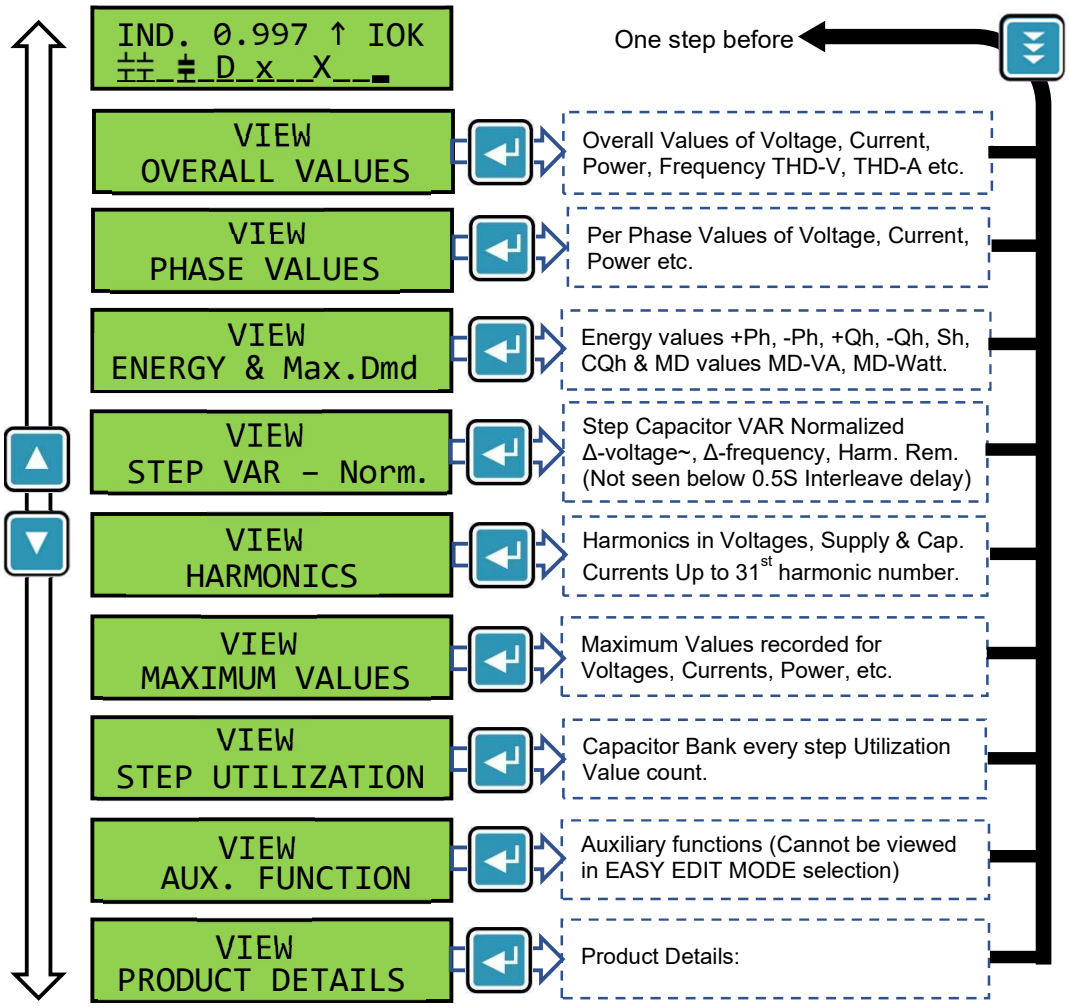
DISPLAY – LCD VIEWING:

Viewing Measured Parameters

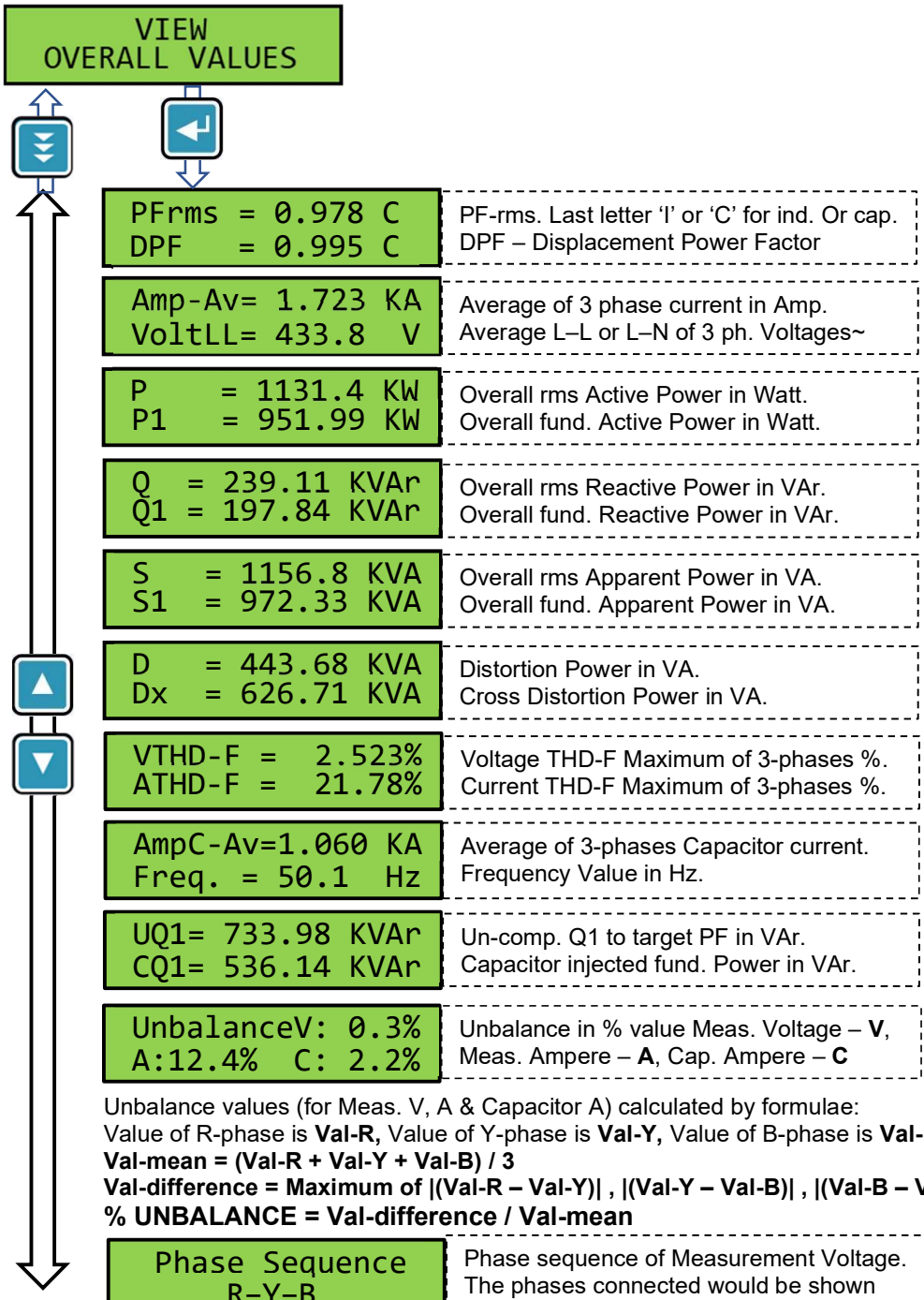
Main Groups for observing the measured values:



On pressing Enter Key, the group values can be observed.

DISPLAY – LCD VIEWING:

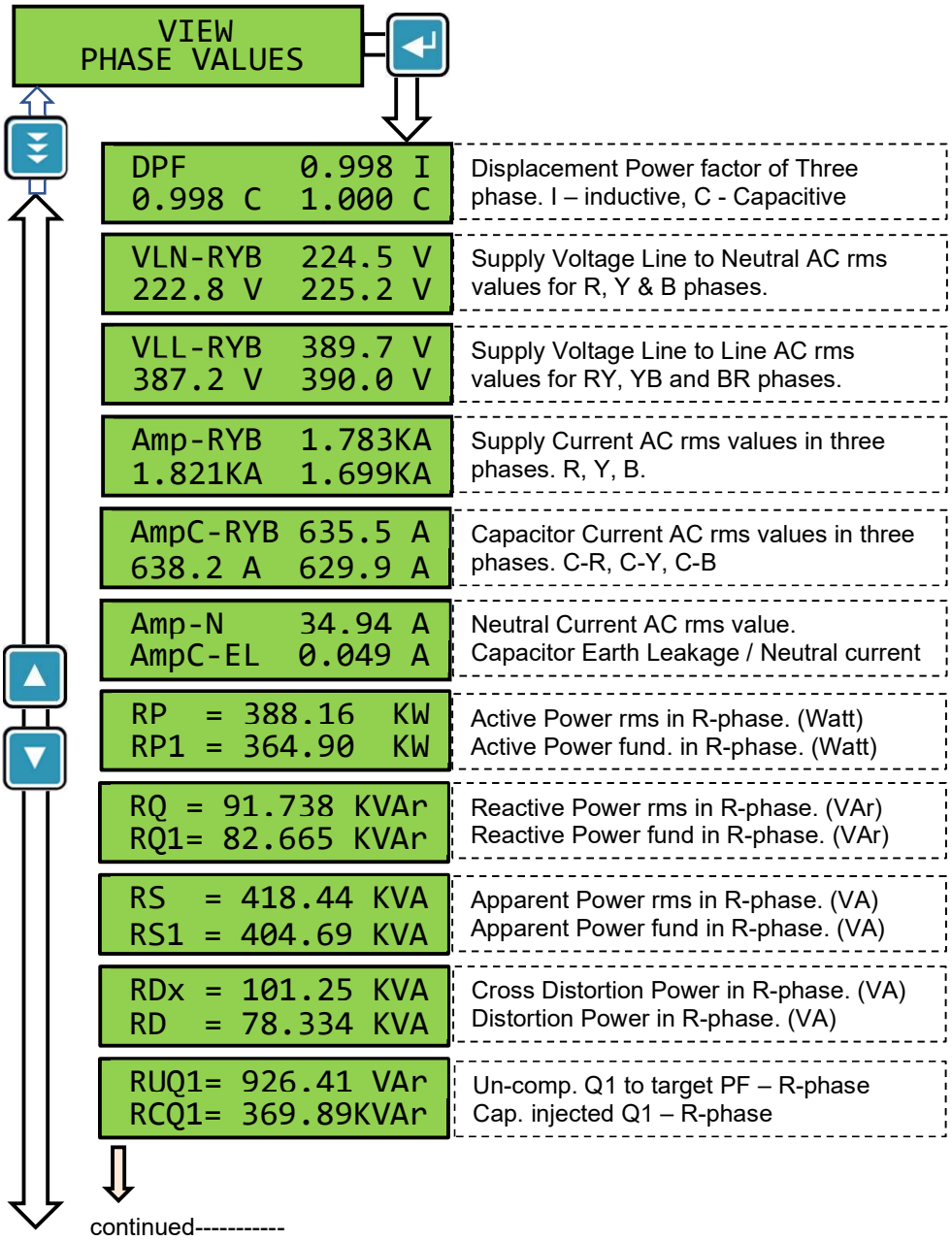
Viewing Overall Values



Unbalance values (for Meas. V, A & Capacitor A) calculated by formulae:
Value of R-phase is **Val-R,** Value of Y-phase is **Val-Y,** Value of B-phase is **Val-B**
Val-mean = (Val-R + Val-Y + Val-B) / 3
Val-difference = Maximum of |(Val-R – Val-Y)| , |(Val-Y – Val-B)| , |(Val-B – Val-R)|
% UNBALANCE = Val-difference / Val-mean

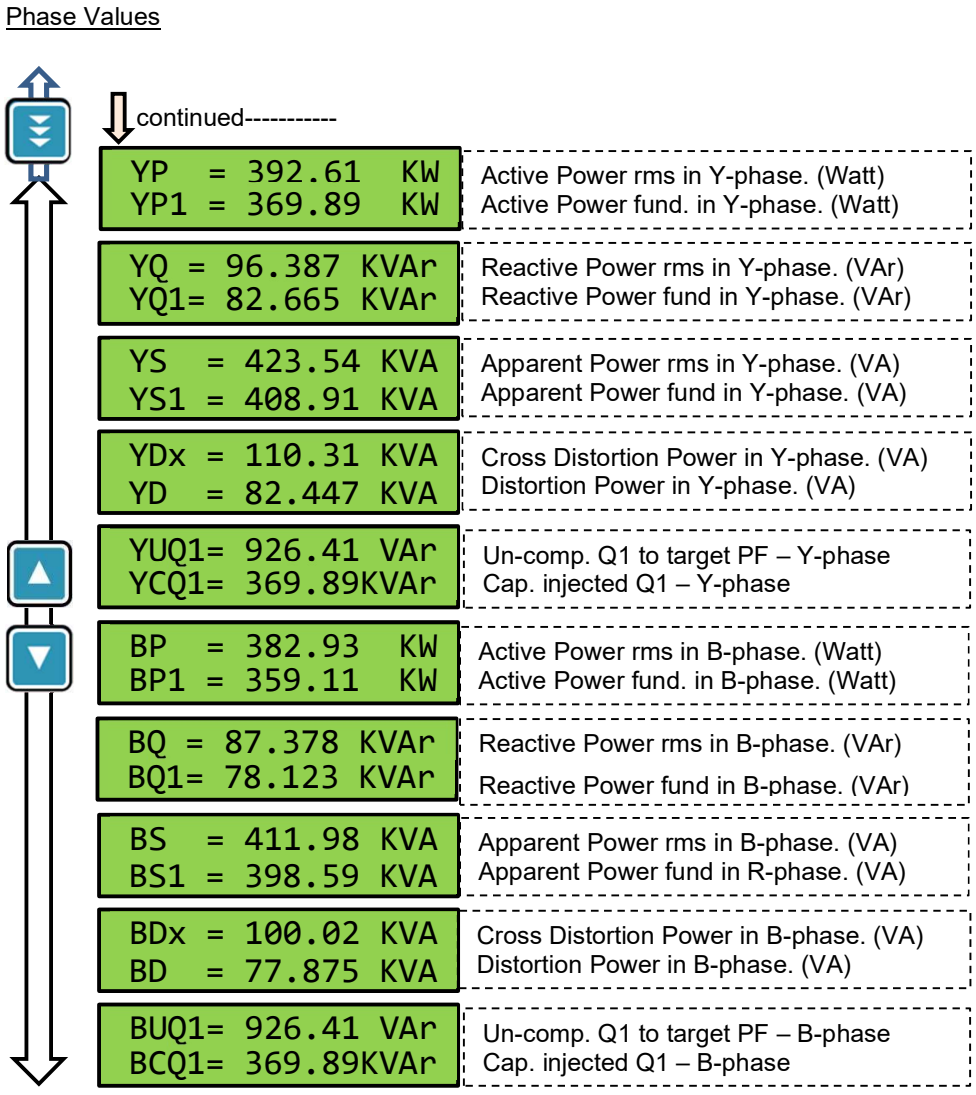
DISPLAY – LCD VIEWING:

Viewing Phase Values



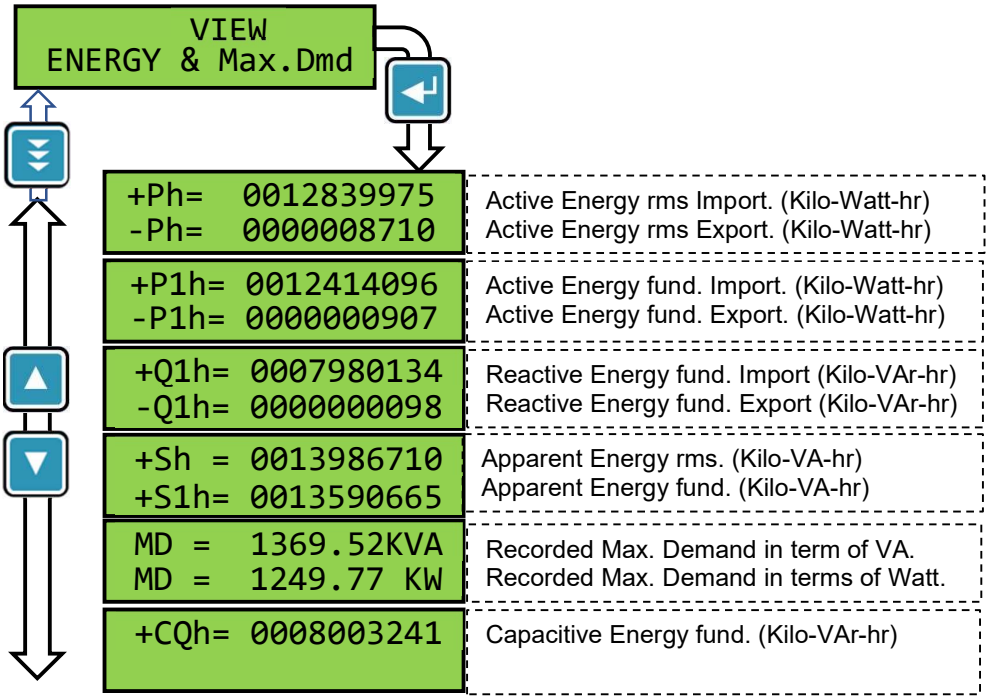
DISPLAY – LCD VIEWING:

Viewing Phase Values ---- continued:

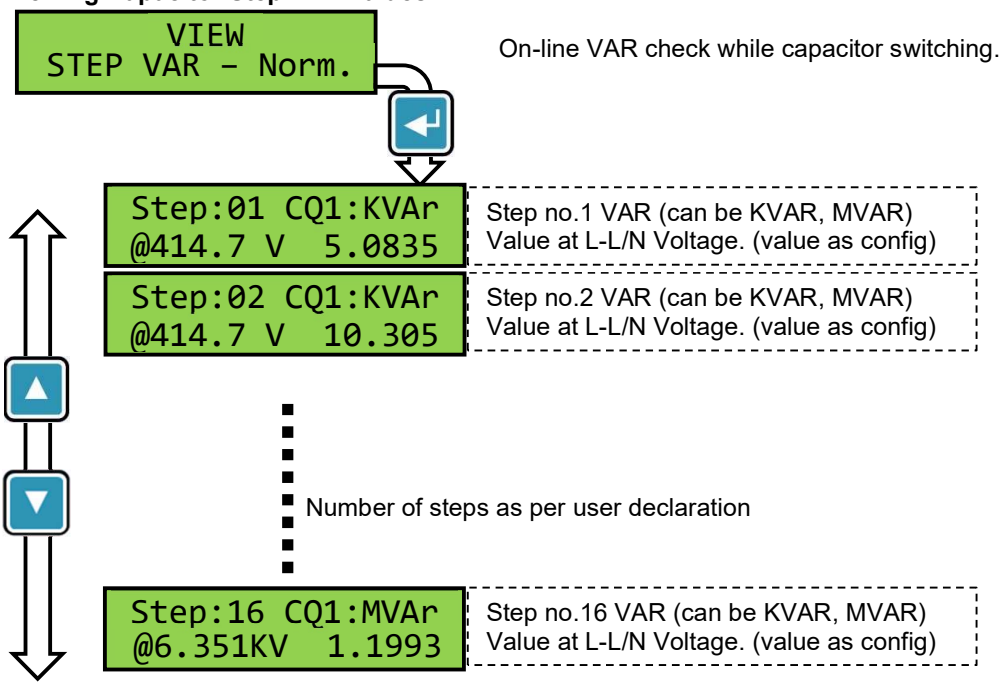


DISPLAY – LCD VIEWING:

Viewing Energy and Maximum Demand

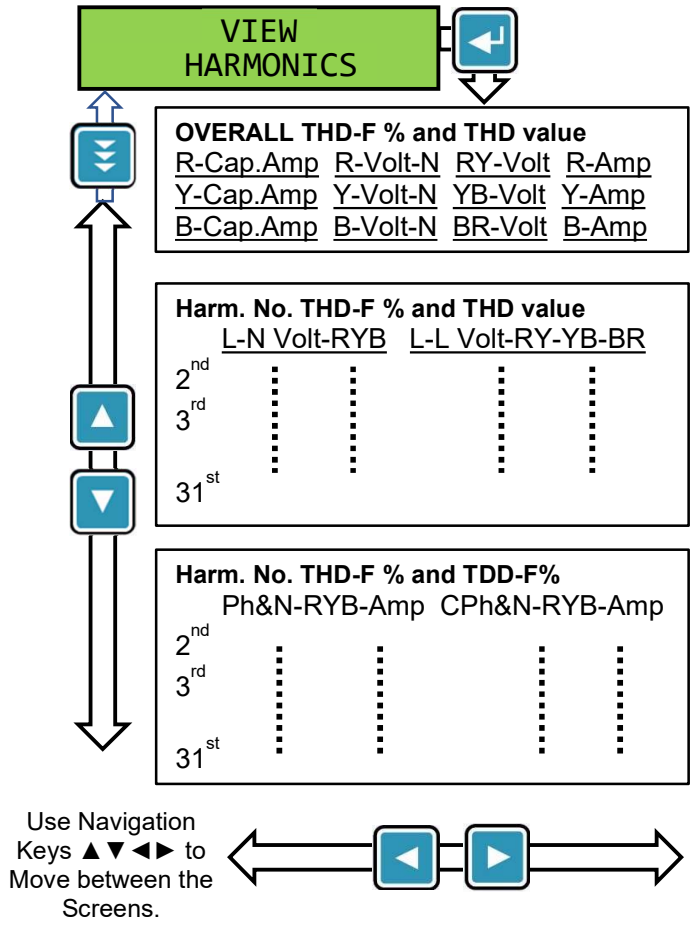


Viewing Capacitor Step VAR values



DISPLAY – LCD VIEWING:

Viewing Harmonics

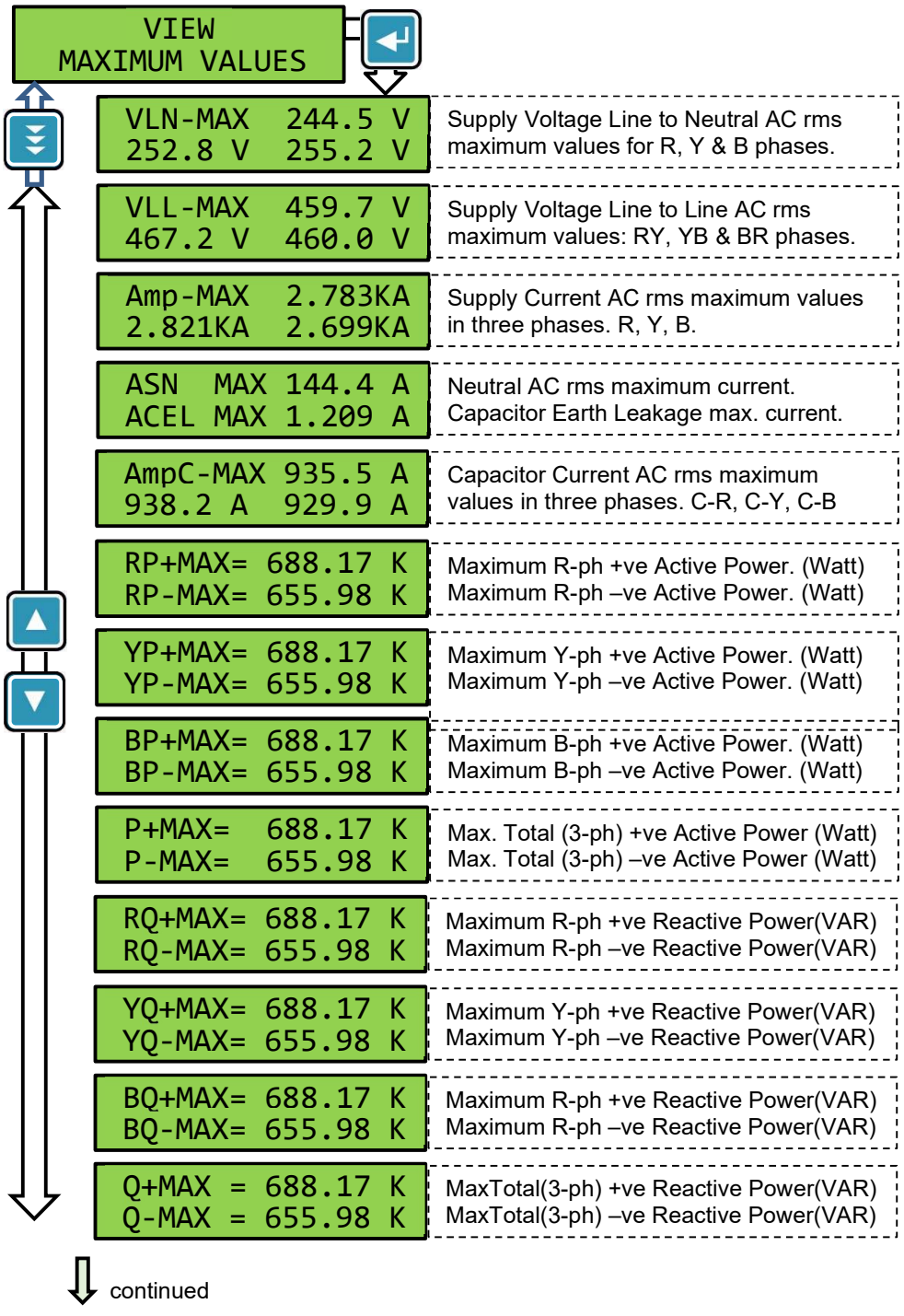


Note that Harmonics for Voltage are displayed as **THD-F%** and **THD-F Value.**

Harmonics for Supply current and Capacitor current are displayed as **THD-F% and TDD-F%.**

DISPLAY – LCD VIEWING:

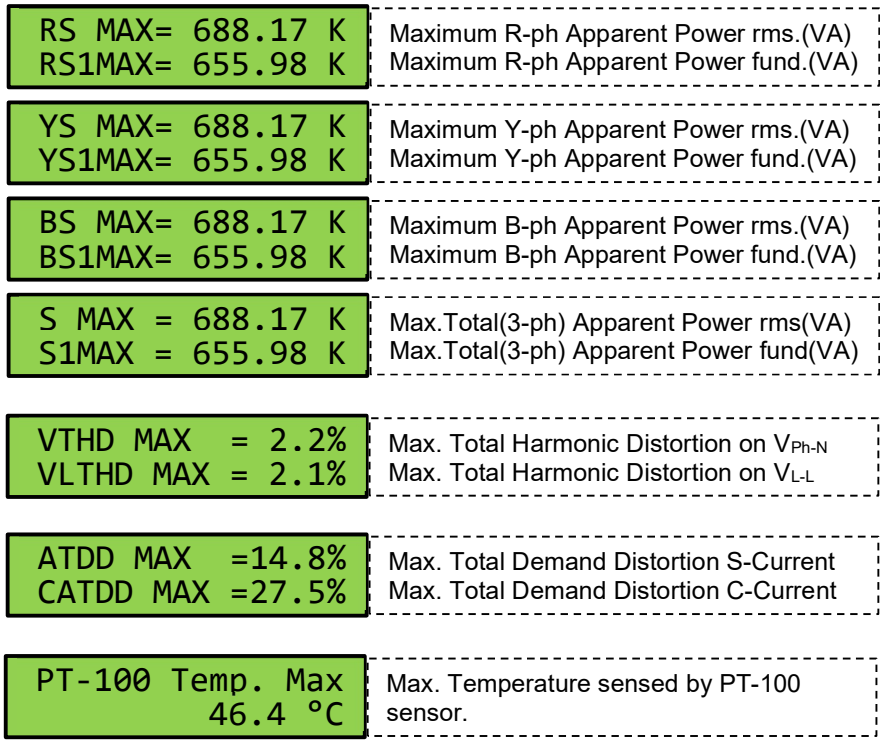
Viewing Maximum Logged Values:



continued

DISPLAY – LCD VIEWING:

continued ⇩



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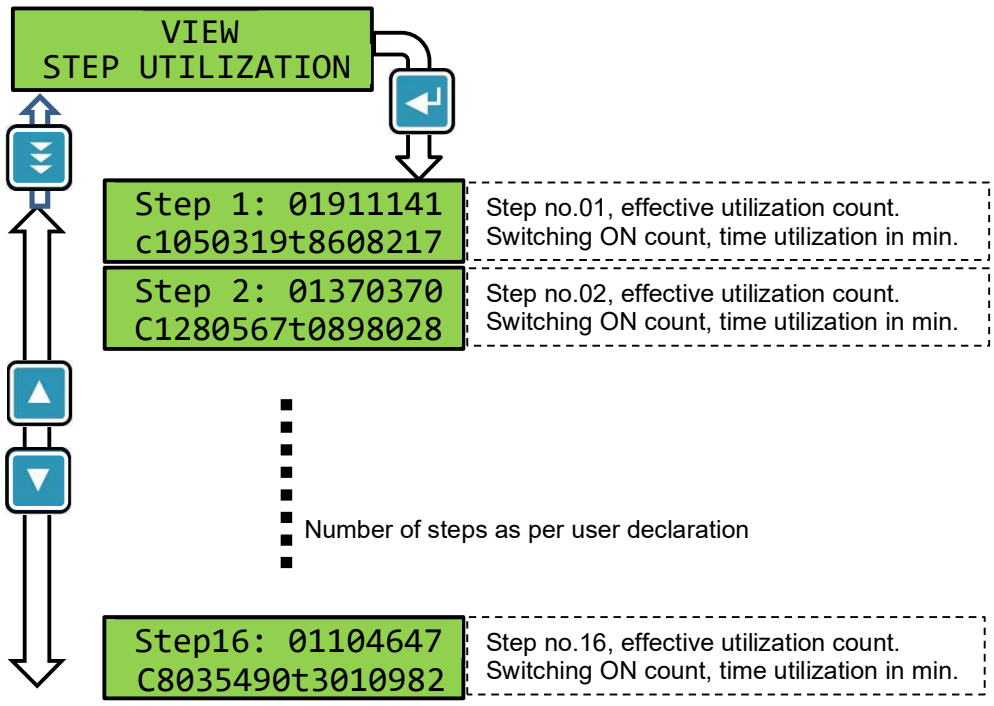
DISPLAY – LCD VIEWING:

Viewing Capacitor Steps Utilization:



COUNTS = (switching ON counts / **C**) + (ON time in minutes / **T**)

For Example:

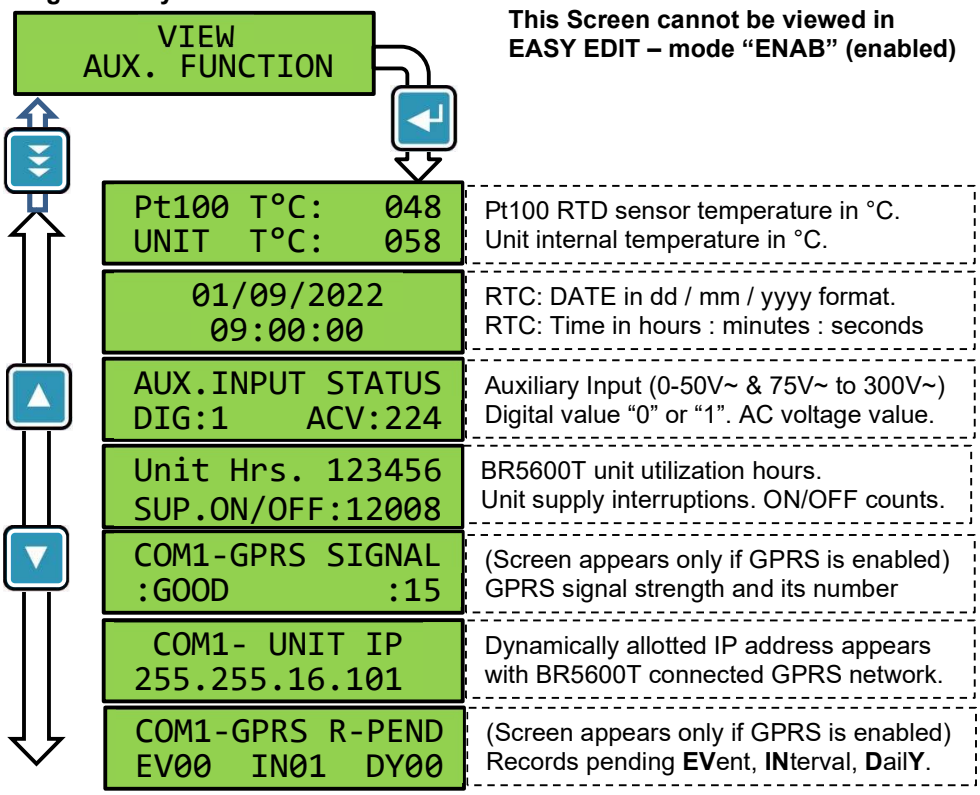
c8035490 – switching ON count.
&
t3010982 time utilization in min.

If Value of C = 10 and Value of T = 10 (Setting adjusted in EXPERT EDIT – CAP CONTROL)

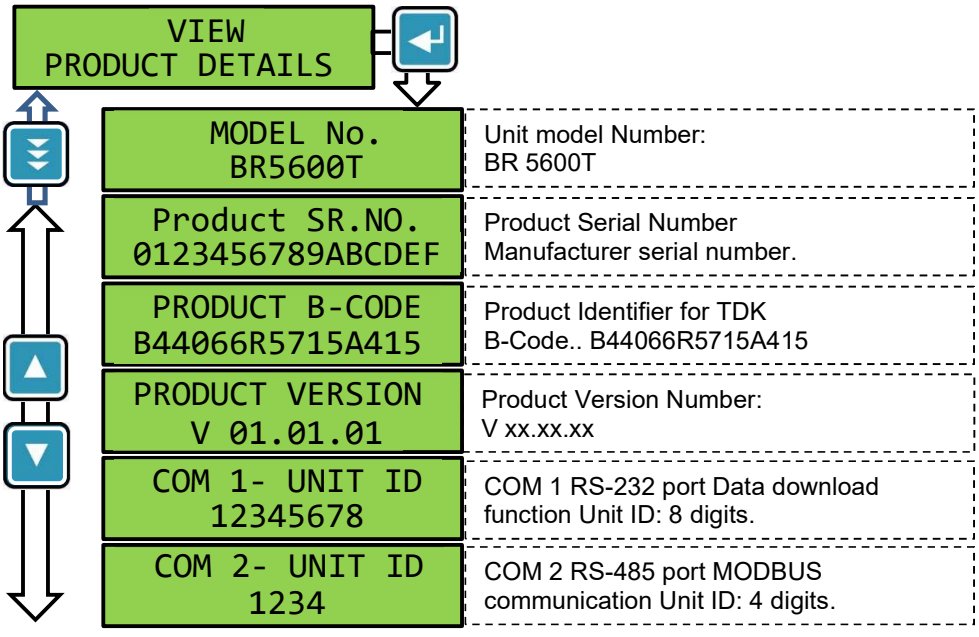
COUNT = (8035490 / 10) + (3010982 / 10) = **1104647**

DISPLAY – LCD VIEWING:

Viewing Auxiliary Functions



Viewing Product Details



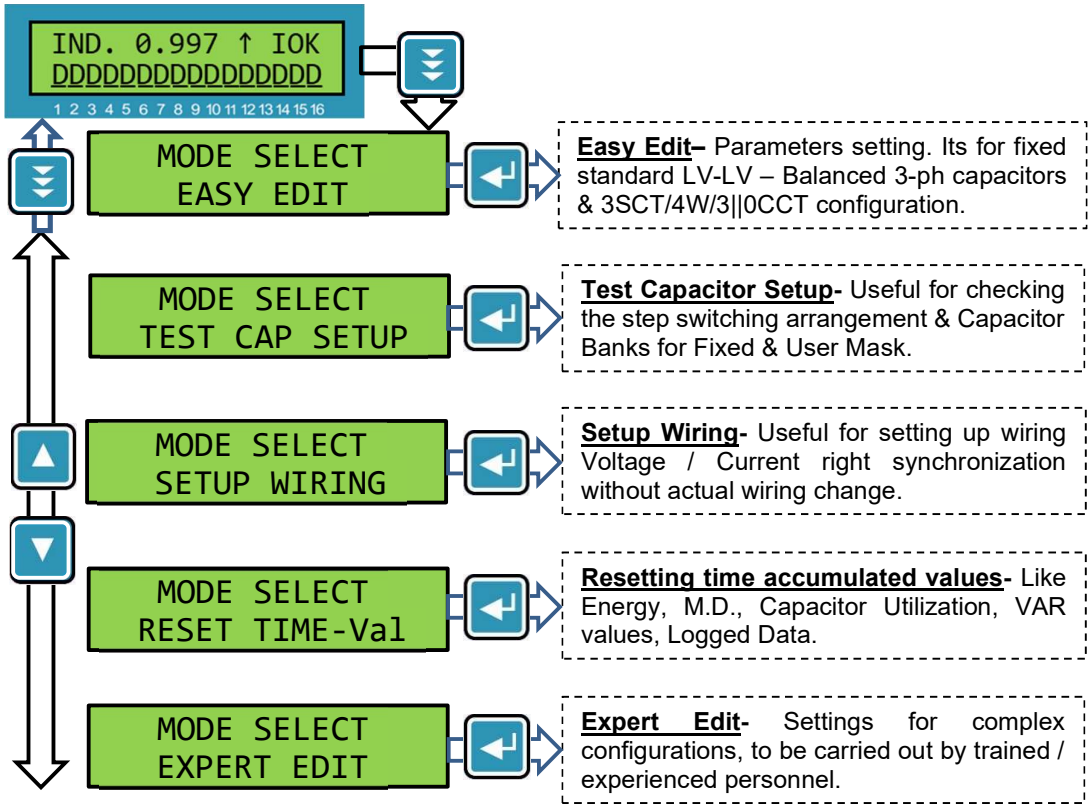
BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

CONFIGURATION / SETTINGS

Mode Configuration Group

All the MODE SELECT group are for setting up various configurations.



* **Expert Edit Screen would not appear when Easy Setup Enabled**

There are various settings and configurations available in BR5600T. This makes the unit versatile for most varieties of applications. It's worth noting that the settings carried out for a specified application would be totally different than the other application type. Some settings mandate some other functions & related settings screens to be disabled.

While carrying out the EXPERT EDIT settings, one can observe that some of the screens shown in further part of the topic of "Settings for BR5600T configuration" may not be seen due to some other area settings. Users are advised to take note of this.

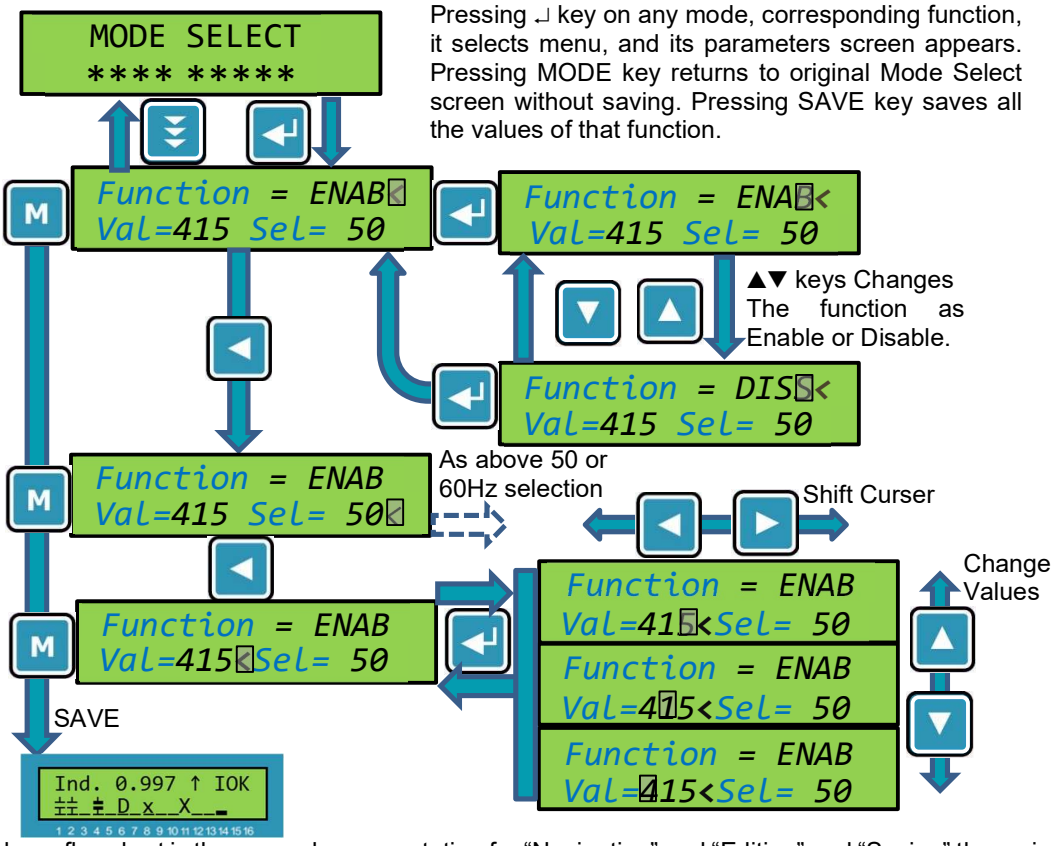
The details of various functions and their interlocks with regards to other functions are given as a part of Operations Manual.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

CONFIGURATION / SETTINGS:

PARAMETER EDITING FLOWCHART



The above flowchart is the general representation for “Navigating” and “Editing” and “Saving” the various user defined Settings / Configurations.
Note Various actions defined in the flow diagram.
Pressing the ENTER Key on the MODE SELECT screen puts the unit into “User Setting”.

- ✓ The **<** symbol would appear next to the Editable Parameter. **<** symbol shows the variable to be selected for EDITING.
- ✓ The **<** symbol can be moved around the same screen for different variable selection. This can be done by using the LEFT ARROW Key.
- ✓ Once the **<** symbol is seen next to the variable that is to be EDITED, the ENTER key can be used for EDITING the variable. The variable digit would be seen with a blinking curser.
- ✓ The variable digit to be edited can be selected by LEFT or RIGHT ARROW Keys.
- ✓ The digit value can be increased or decreased respectively by UP or DOWN ARROW Keys.
- ✓ Note that some digits of the variable may not be increased or decreased due Limit value is reached. In such case change the other digit of the variable to bring the value within limit.
- ✓ On completing the editing of a variable, the ENTER Key pressing would save the value temporarily.
- ✓ Various screens can be selected by UP or DOWN ARROW Keys.
- ✓ On completing the Editing of all the settings and configurations, the SAVE Key should be pressed to permanently save the EDITED variable values. For discarding all the edited settings, the MODE Key should be pressed.
- ✓ No Activity for 5-minutes on MODE SETTINGS will bring unit without saving to default screen.

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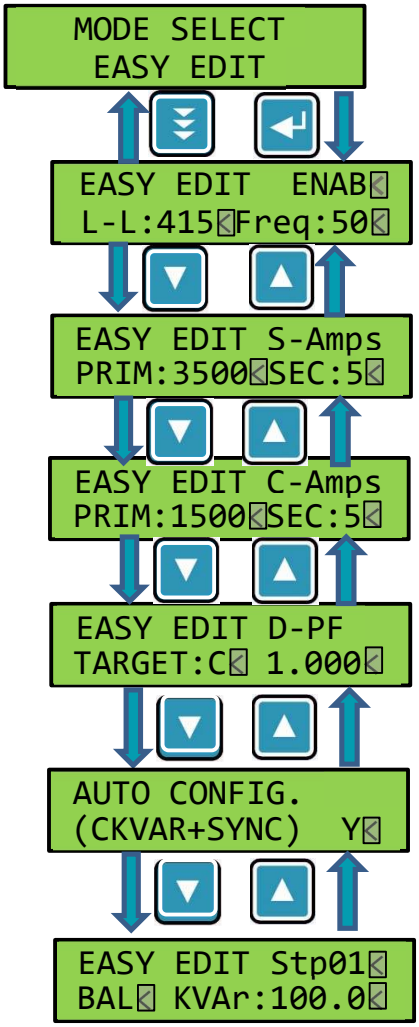
Operations manual

CONFIGURATION / SETTINGS:
MODE SELECT : EASY EDIT



M — Pressing SAVE Key Saves the EASY EDIT settings.

"DISS" indicates **EASY EDIT is Disabled**.
"ENAB" indicates **EASY EDIT is Enabled**.
With "ENAB", Line to Line Voltage and Supply Frequency selection variables can be edited.
Supply frequency selection is 50Hz or 60Hz.

Adjustment of Supply-CT:
Supply measurement Current feedback CT.
Primary (PRIM) current Ampere value
Secondary (SEC) current Amp value (1 or 5)

Adjustment of Capacitor-CT current feedback.
Primary (PRIM) current Ampere value
Secondary (SEC) current Amp value: X or 1 or 5
X: No feedback, 1: 1Amp.at rated, 5: 5Amp at rated.

Target Power Factor Setting:
Displacement Power factor setting value to be adjusted up to third digit after decimal.
I – Inductive OR C – Capacitive can be set.

AUTO CONFIGURATION: If "Y", performs Automatic Cap. Bank KVAR value detection for **16** steps (includes AO3 as 16th step) + Automatic synchronization of Voltage & Current feedback wiring. (slow load change)
AUTO CONFIG. Process can be aborted by ↵ Key.
AUTO CONFIG if "N", need to do setting on next screen.

Cap. Steps settings: (to be used if Auto Config unused)
Selection of Step number
Value of KVAR (at rated supply voltage & freq.)
Bank to be disabled or enabled (NOT / BAL)

AUTO COFIGURATION feature (once enabled) can detect the capacitor bank step KVAR (Reactive Power) value automatically and detects the Voltage & Current feedback wiring. If found wrong, corrects it automatically. This feature prevents the hassles of calculation and is convenient.
This feature, though in presence of highly fluctuating load, may fail to detect the right KVAR value and may not auto correct the wiring sequence. Therefore, in presence of high fluctuating load conditions, user is advised to manually enter the capacitor bank step KVAR value. Due to RTPFC system applicability with fluctuating load, manual calculations of step KVAR becomes necessary. Normally, User is required to deploy Manual Wiring setup: "**MODE SELECT: SETUP WIRING: MANUAL SYNC**".

The details of capacitor Bank step KVAR value calculation can be referred from **Annexure-A**.

Some other parameters that are kept fixed in EASY EDIT menu (not available for user) are:

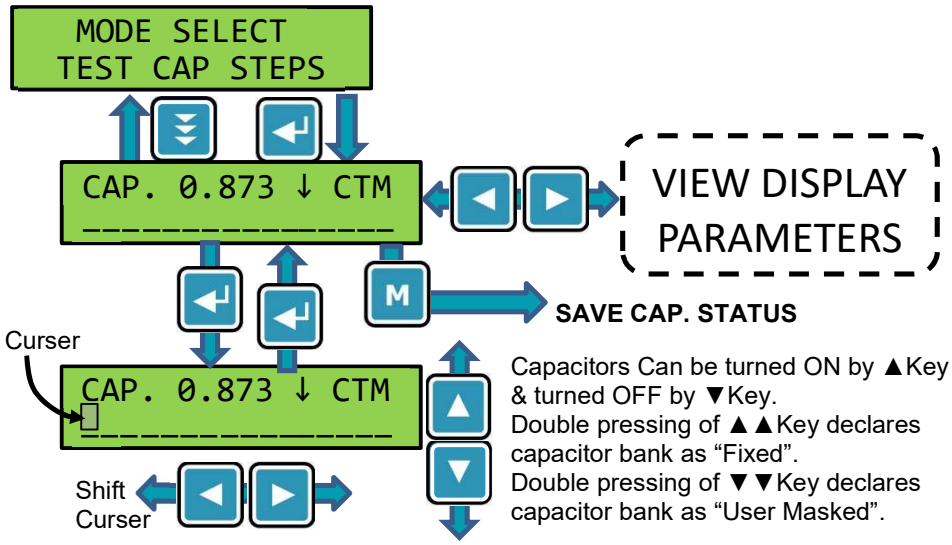
- Correction Time: 25 Nos. Supply Cycles
- Discharge Time: 250 Nos. Supply Cycles
- Interleaving Time: 0.5 Seconds.

CONFIGURATION / SETTINGS:

MODE SELECT : TESTING of CAPACITOR STEPS

For testing the Capacitor Steps Manually, this option is used. This permit turning ON and turning OFF the capacitor steps by complete user control.

Flow chart for Testing the capacitor steps is as follows.



The functionalities achieved by TEST CAP STEPS is.

- ✓ Checking the control wiring in APFC system for turn ON & OFF the capacitor duty contactors (or equivalent electro-mechanical devices).
- ✓ Checking the individual Capacitor banks by turning them ON & OFF. Capacitor health can be monitored by checking the current through them.
- ✓ Checking if the supply system parameters are correctly controlled – Reactive Power -Q.
- ✓ Masking or Un-Masking the capacitor steps manually. Un-Masking the capacitor steps that are Masked due to “Capacitor health monitoring feature”.
- ✓ Declaring the capacitor as “FIXED”. By this feature, some banks can be kept permanently ON during regular Automatic PF correction operation. This is to be done only if User desires the Fixed capacitive compensation.
- ✓ During manual ON / OFF capacitor steps, the effect of capacitors can be seen on regular LCD display parameter view.

Added Note: The arrow down symbol “↓” on LCD display is for indicating steps testing. The symbol is additionally used for indicating Digital Input status as 0 (zero) = ↑ and 1 (one) = ↓. The digital Input functionality if enabled, the arrow symbol is prioritized for its functionality and testing mode would not be controlling the arrow display on LCD. Users are advised to take note.

CONFIGURATION / SETTINGS:

MODE SELECT : SETUP WIRING

The wiring setup is to ensure the right Voltage Phases & right Current feedback sequence is connected to BR5600T from Supply system. Ensuring the Current feedback CTs (Current Transformers) are with right polarity and synchronized with the right Voltage phases.

In case the wiring sequence is wrongly connected, using the “SETUP WIRING” can correct supply Voltage & Current synchronization without physically changing the wires.

There are two methods used for setting up wiring without physically change of wiring.

1. **Manual Synchronization (By trained personnel with 100% success rate)**

2. **Automatic Synchronization (Recommended only for Steady load conditions)**

Manual Synchronization allows user to switch ON / OFF the capacitors and check the right values of fundamental Power (Active & Reactive) by selecting the right Voltage / Current combination and the Current CT polarity.

The general guidelines are explained here after the flowchart.

For Manual Wiring Setup, a good understanding of the 4 – Quadrant Power and Power Factor Correction is necessary. With this, the 100% success rate for synchronization can be achieved in Manual Synchronization.

Automatic Synchronization carries out the supply Voltage & Current feedback synchronization automatically. For automatically carrying out the job, it needs to turn ON and turn OFF the capacitor banks. Therefore, it is necessary to complete the User settings by either EASY EDIT or EXPERT EDIT.

Note: Automatic Synchronization option is available to the user if balanced 3-phase capacitor banks are available. This also means that Automatic Synchronization would not be available if capacitor banks declared by user are either “Individual Single-Phase Banks” or “Banks are not connected”.

Disclaimer:
Applicability with RTPFC highly fluctuating loading conditions, Automatic wiring Setup may fail to detect the right wiring sequence. In such case it will force user to carry out the Manual Wiring Setup. The success chances for Automatic wiring setup are lower with

- Load fluctuations are high and abrupt.
- RTPFC reactive power injection capacity is far lower than the supply system loading.

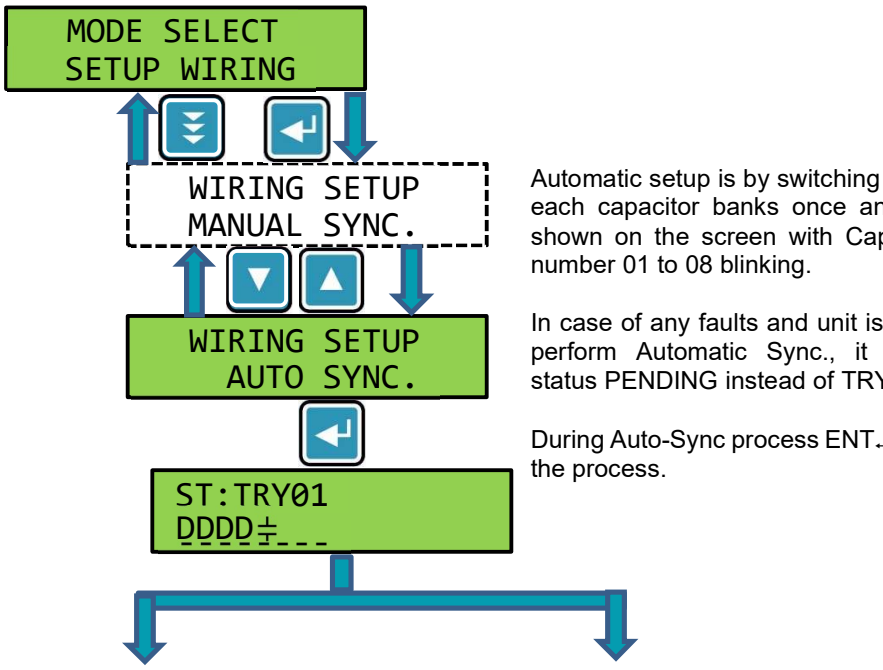
This feature therefore should be used as a convenience feature. User should understand that there is a possibility of failure and in such case Manual Wiring setup or the Physical Wiring change would be mandatory.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

CONFIGURATION / SETTINGS:

Automatic Wiring Setup – Flow diagram:



Automatic setup is by switching ON-OFF of each capacitor banks once and status is shown on the screen with Capacitor step number 01 to 08 blinking.

In case of any faults and unit is not able to perform Automatic Sync., it shows the status PENDING instead of TRY01.

During Auto-Sync process ENT↵ key aborts the process.

For 3 Seconds and then continues normal operation in Default screen (with newly selected wiring positions)

For 3 Seconds and then forces user to enter the Manual Setup.

Note that once the Wiring Setup is a Success, the unit BR5600T would remember the success sequence throughout its life. Auxiliary Supply Powering down would not disturb this memorized sequence.

In case of any physical changes in the wiring, the Automatic Wiring Setup can be run. In case user wishes to abort the Automatic Wiring process, can do so by pressing the ENTER ↵ Key.

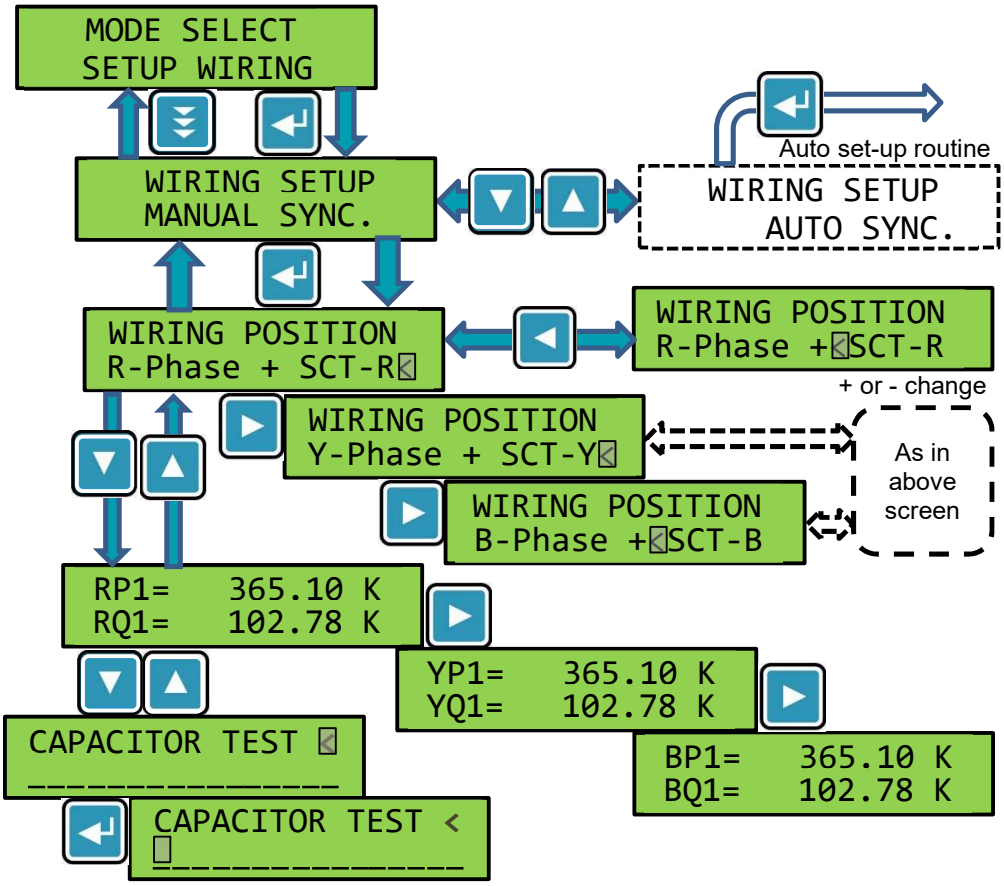
There is an option in EXPERT EDIT to automatically get into the “Automatic Wiring Setup” at BR5600T Powering Up. If such an option is selected, the unit would perform the Automatic Wiring Setup at every Power Up of Auxiliary supply. Number of tries for Automatic Wiring can be user defined.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

CONFIGURATION / SETTINGS:

Manual Wiring Setup – Flow diagram:



As per the previous page keyboard / display navigation structure, user can shift between the:

1. Current feedback Phase positioning and polarity declaration screens
2. Fundamental Power P1 & Q1 (Active & Reactive) screens (per Phase screens)
3. Capacitor ON/OFF control screen.

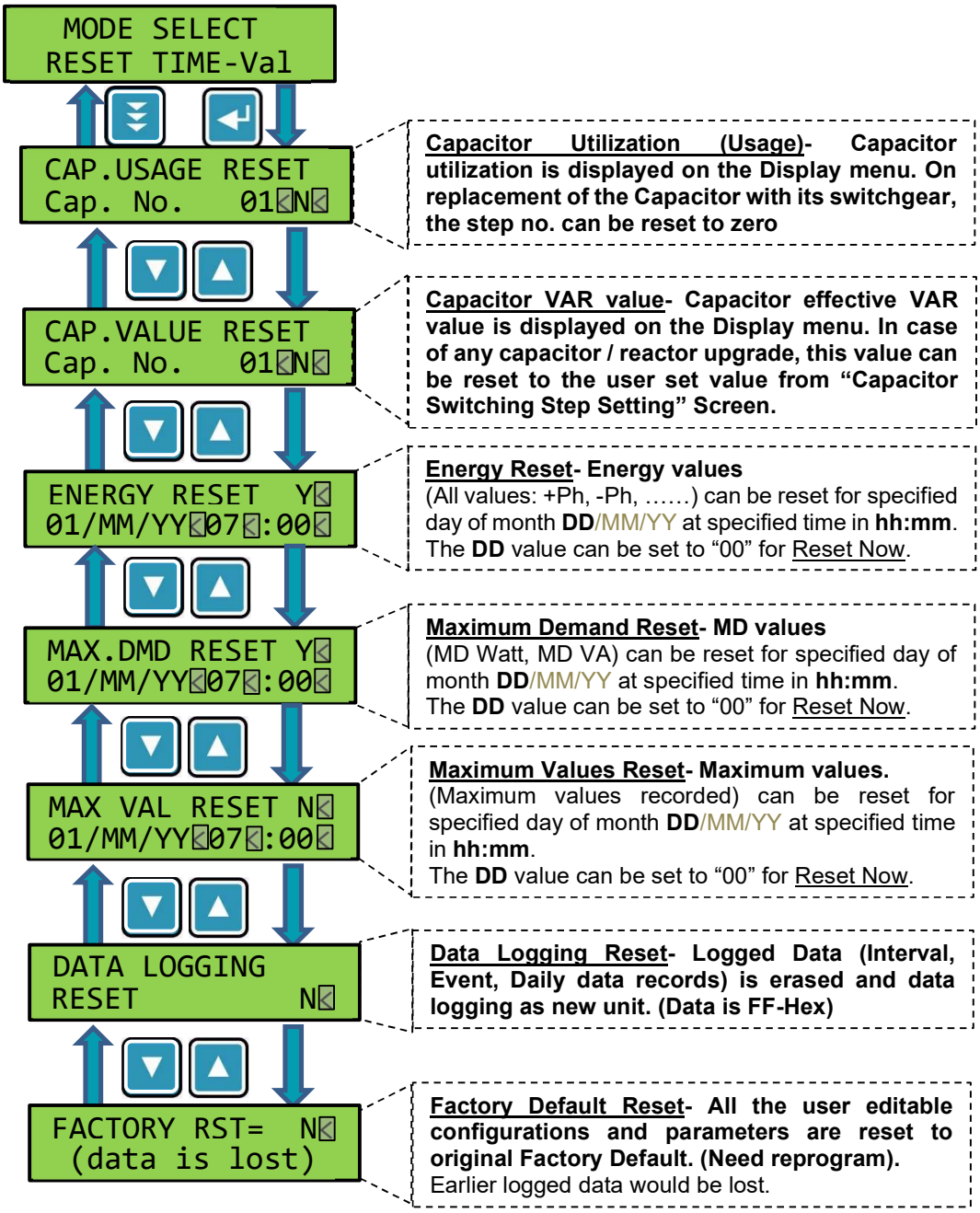
In manual wiring, one can try declaring various combinations of CT phase positioning and CT polarity. With right combination, the Power of R, Y, B phases would remain unaltered for P1 – Active Power and would change Q1 – Reactive Power as per the value of capacitor added / removed.

The right combination should be checked for all the three phases.

CONFIGURATION / SETTINGS:

MODE SELECT : RESET TIME & VALUES

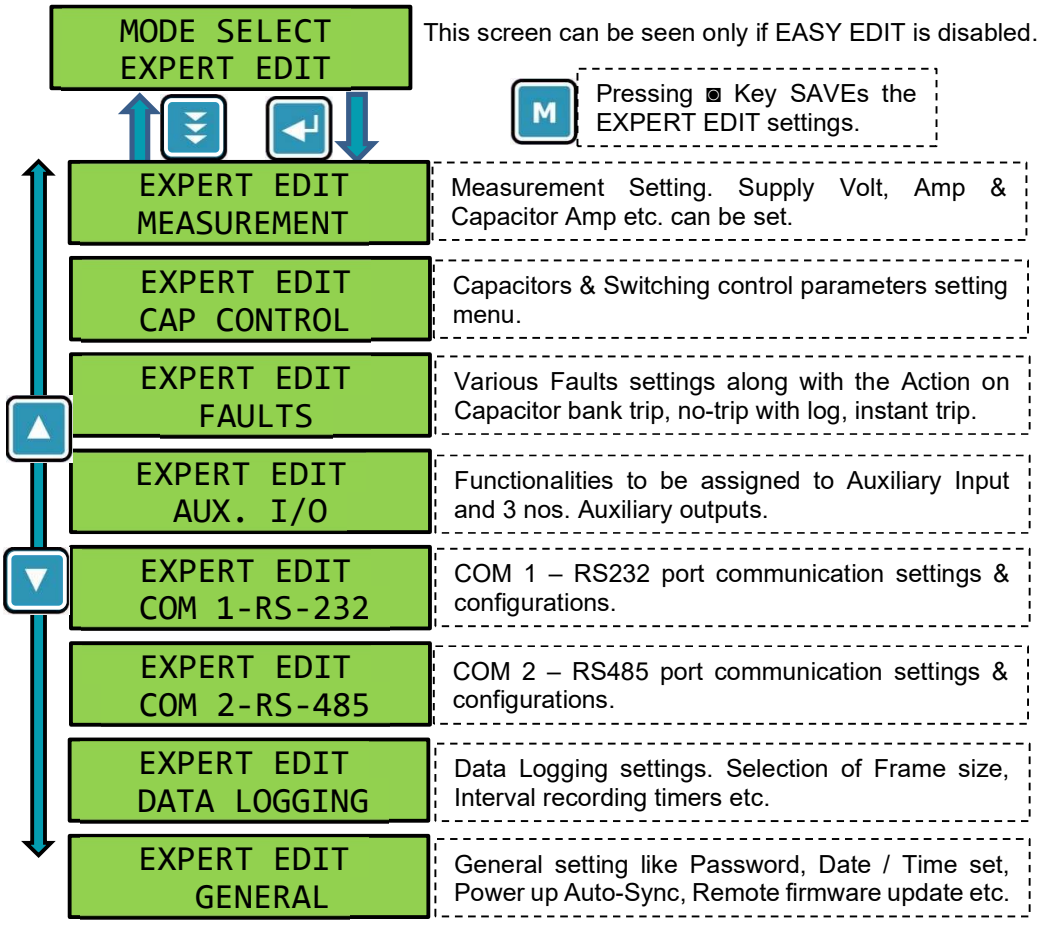
There are various settings with regards to time and values that need to be reset by the User. Such operations are performed in this section.



CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT

Expert Edit is used for Configuring and carrying out various settings. It has multiple Sub-Headings. These are shown hereunder:



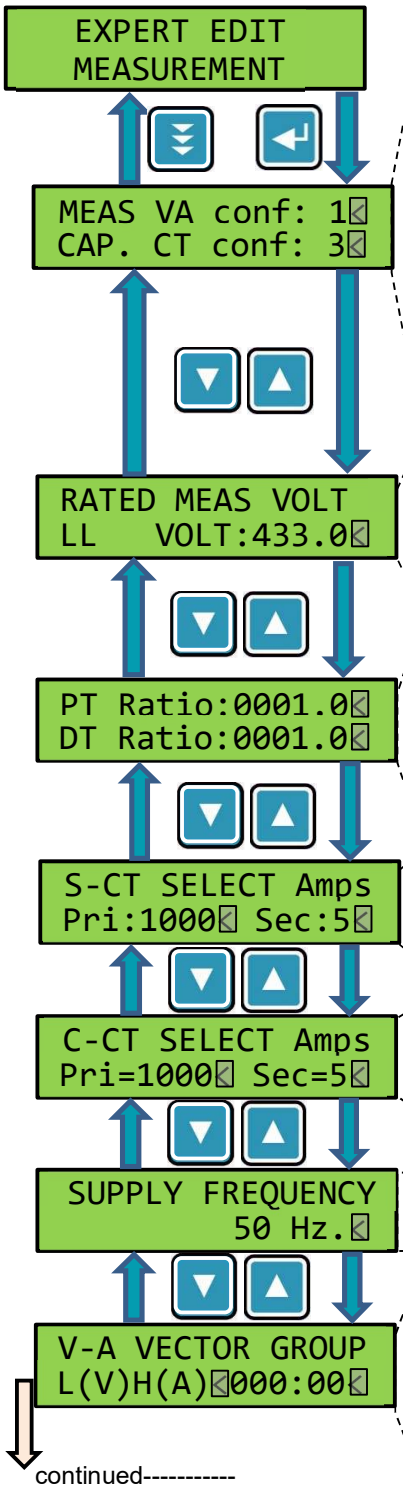
Expert Edit:

- The “EXPERT EDIT” Mode is enabled only if the “EASY EDIT” is kept Disabled (DISS).
- The Expert Edit menu is used for getting access to the Specialized and Refined functionality settings of BR5600T.
- The trained person is expected to carry out these settings.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

CONFIGURATION / SETTINGS:
MODE SELECT : EXPERT EDIT : MEASUREMENT



Measurement on supply Voltage / Current configuration:
There are different configurations.
Viz. **1** – Voltage 3-ph / 3 or 4 wires. Current 3 CT
2 – Voltage 3-ph / 3 wires. Current 2 CT
3 – Voltage 2-ph / 2 wires (L–L) Current 1 CT
4 – Voltage 1-ph / 2 wires (L–N) Current 1 CT
(Refer the diagrams in initial part of this Operations Manual.)
Capacitor current CT feedback configuration: There are 4 different configurations for Capacitor current feedback.
Viz. **0** – No capacitor current feedback connected.
1 – One number capacitor current feedback CT.
2 – Two number capacitor current feedback CTs.
3 – Three number capacitor current feedback CTs.

Rated Measurement Voltage-
Value in Volt~ at measurement terminals. This has range of 50V~ Line-Neutral (LN) and up to 500V~ Line-Line (LL). Previous screen Measurement VA configuration 1, 2, 3 shows LL & 4 shows LN

Voltage feedback PT- Value adjustable other than 1.0. With Higher rated voltages than 500V~, separate step-down voltage PT is used. The PT HV to LV ratio is to be set.
Distribution Transformer ratio- With Voltage measurement is on HV side and switched capacitor banks on LV side. As shown in diagram in earlier part: Application Scheme No.3. The Distribution transformer HV to LV ratio = DT ratio is set.

Supply Current CT/s (S-CT) ratio setting-
Primary Current = **Pri:0001** to **9999** – Amp. range
Secondary Current = **Sec: 1** or **5** – Amp. Select

Capacitor Current CT/s ratio setting-
Primary Current =Pri – Amp. range 1-9999.
Secondary Current =Sec – Select Amp 1 / 5

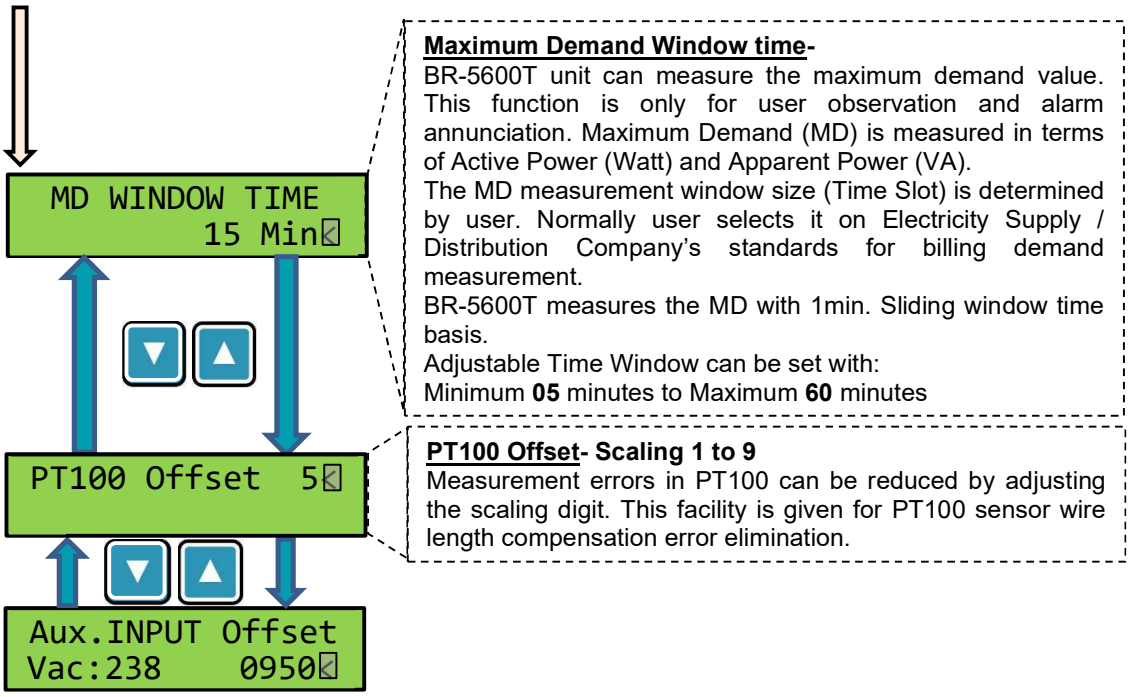
AC measurement supply rated frequency
Adjusted as **50** Hz. or **60** Hz.

Volt-Amp Vector Group Settings
Refer **Annexure-B** for detailed explanation: VA Vector Group.
For measurement positions of PT (Volt) and CT (Current):
Low Voltage (Volt) & High Voltage (Current): **L(V)H(A)**
High Voltage (Volt) & Low Voltage (Current): **H(V)L(A)**
For Voltage-Current Vector positioning (Degrees):
000°:**00**, 030°:**01**, 060°:**02**, ... 300°:**10**, 330°:**11**

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : MEASUREMENT

continued----------



Maximum Demand Window time-
BR-5600T unit can measure the maximum demand value. This function is only for user observation and alarm annunciation. Maximum Demand (MD) is measured in terms of Active Power (Watt) and Apparent Power (VA).
The MD measurement window size (Time Slot) is determined by user. Normally user selects it on Electricity Supply / Distribution Company's standards for billing demand measurement.
BR-5600T measures the MD with 1min. Sliding window time basis.
Adjustable Time Window can be set with:
Minimum **05** minutes to Maximum **60** minutes

PT100 Offset- Scaling 1 to 9
Measurement errors in PT100 can be reduced by adjusting the scaling digit. This facility is given for PT100 sensor wire length compensation error elimination.

The last Screen in measurement section is for calibration of Auxiliary Input AC voltage measurement. The Calibration settings are to be carried out by user if and only if the Auxiliary input functionality as **CONT-V**. Otherwise, there is no need to carry out any calibration process, and screen would not be available for user to edit.

A new BR5600T Auxiliary input is factory calibrated for perfect sinusoidal AC voltage input. The Operating conditions at site of commissioning may be different. The voltage may differ from perfect sinusoidal waveshape. Calibration is needed only under such conditions. For a given site, it is normally carried out just once. (At the time of commissioning)

Procedure for Calibration:

Instrument needed: AC voltage measurement meter (RMS value). Range 0 to 300Vac. Accuracy 1%.

- Apply AC voltage that is going to be used Auxiliary Input channel.
- Check the AC voltage with a measurement meter.
- Check the AC voltage displayed on the BR5600T screen.
- Adjust the Offset count suitably so as to match the BR5600T screen displayed reading equal to the meter displayed value.
- Once the readings on BR5600T and the meter are matched, ensure SAVE Key is pressed.
- Now the unit is calibrated as per site conditions.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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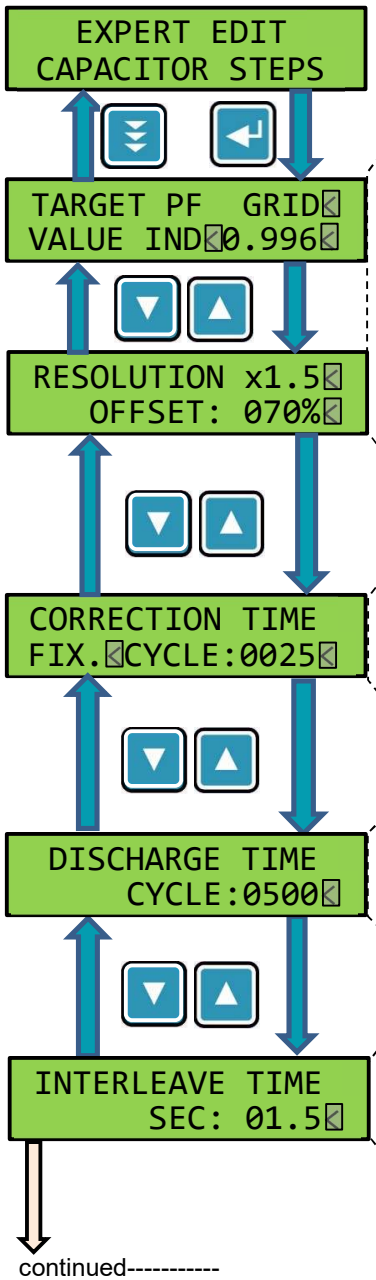
CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : CAP CONTROL



Details on Power Factor settings + Resolution + Offset is explained in **Annexure-C**.

TARGET D-PF: The desired Power Factor is set on this screen. It is normally set for **GRID** (EB supply) & can be set for **GENR** (Generator) for Aux.Input functionality is selected for GRID / GENERATOR. The target value can be **IND** (inductive) or **CAP** (capacitive). The Target Value can be set up to 3 digits after decimal.
RESOLUTION MULTIPLIER: The value of multiplier can be set from **1.1** to **9.9**.
OFFSET: The No action Band "Offset" can be adjusted from **000%** to **100%**. Default value is 050%.

Correction Cycle Time-
BR5600T automatic correction cycle time can be Either **FIX.** or **PRO.** (Fixed or proportionate). Time is given in supply cycles. Can be adjusted from **0001** to **3600**.
Fixed: the correction time is constant.
Proportionate: Time is variable. Setting of the time = "Time required for 100% PF correction capacity".

Capacitor safe Discharge Time-
The Capacitor bank after switching off needs to be discharged before it is switched on. The discharge time is set on BR5600T as per the capacitor rating and discharge devices connected. The timing can be set for capacitor discharge from **0001** to **7200** supply cycles.

Interleaving Time Delay- Multiple Capacitors simultaneous switching by electromechanical switchgear can cause transients which are harmful to electrical loads. At the end of "Correction Time", if more than one (1) capacitor banks are never switched on simultaneously. There is "Interleaving Time" introduced between consecutive switching. Adjustment range 00.5 to 60.0 Seconds. 00.0 can be set for instant ON.

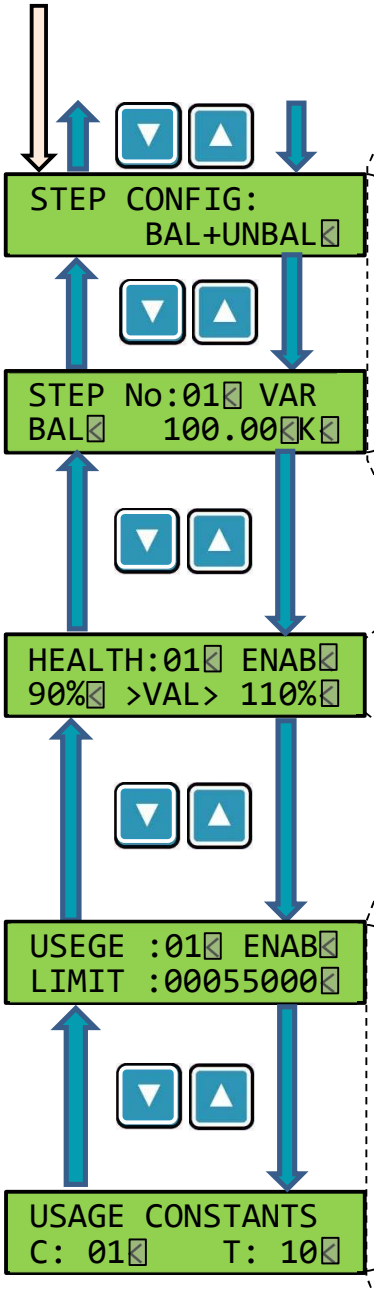
BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : CAP CONTROL

continued----------



Scheme for phase Un-balance-
BAL – Balanced 3-phase capacitors.
UNBAL – Individual phase capacitors.
BAL+UNBAL – Balanced + Individual phase cap

Capacitor Bank details-
Step No: 01 to 16 can be selected for setting its values.
Capacitor **VAR units** in **K**VAR or **M**VAR can be set.
Capacitor **Step usage**: Options available:

- **NOT : Step is not used**
- **BAL : Balanced three phases.**
- **UBR : Single phase unit phase-R.**
- **UBY : Single phase unit phase-Y.**
- **UBB : Single phase unit phase-B.**

Capacitor **K:** KVAR / **M:** MVAR value are at rated voltage of the supply bus. This may not be the rating plate value.
Note: The effect of detuned reactor that is normally used with the capacitor bank, is to be considered while entering the right step VAR value. Refer **Annexure-A** for detailed explanation.

Capacitor Health Monitoring-
For each capacitor step **health monitoring**. Step No.**01-16** to be individually selected. Set **ENAB** / **DISS** (Enable / Disable) for the health monitoring.
Tolerance above & below can be set.

Capacitor Usage Limit:
Each capacitor step is monitored for its usage. Usage is in terms of a number (Count) and number of on time in minutes, is calculated as per formula:
Usage Count =
[Switch ON count / C] + [time (Min) / T]
(This is effective empirical formula)
Standard values (without harmonic effect) with C=10 & T=10:
MPP Normal Duty: 00158000
MPP Heavy Duty: 00320000
APP: 00650000
MD (Super heavy duty): 02000000.

USAGE CONSTANTS:
In the above Usage Count formula, the Constants C and T are user set value depending upon the type of capacitors, site conditions of Voltage fluctuations, Harmonics etc.
As per the manufacturer of capacitor – these constants may change. Giving these editable constants is to keep flexibility of adjustments.
When C is set to zero, the on / off consideration is removed & when T is set to zero, the time consideration is removed.

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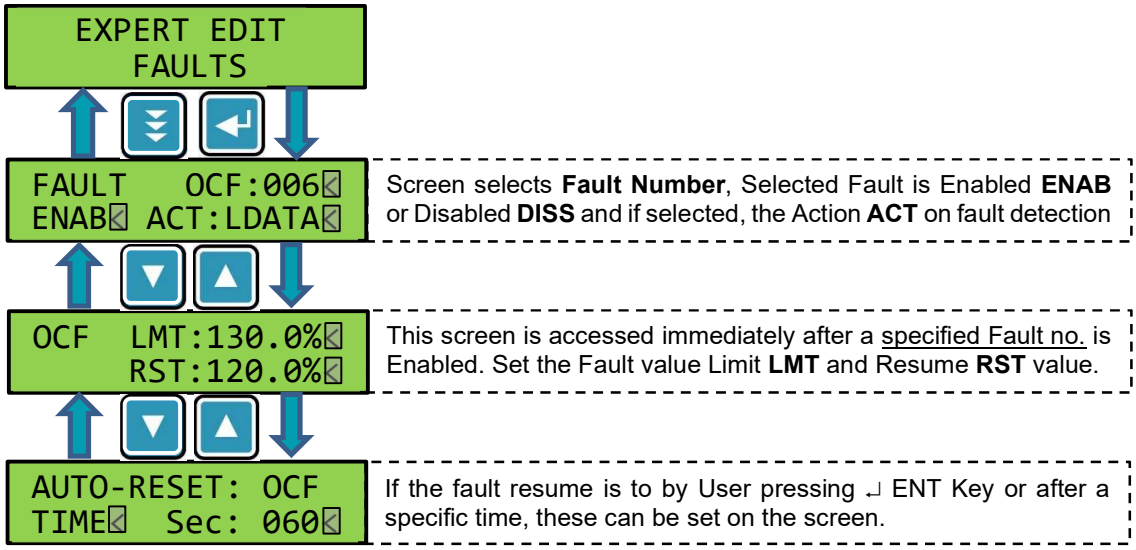
Operations manual

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : FAULTS



Faults-
There are multiple type of faults that are detected. BR5600T can detect multiple faults with 27 types have user settings. The action against the detected faults can be of different nature. The detailed Faults listing is in the next pages of this document.

Based on the Fault Number, the abbreviation showing 3 characters would appear.
E.g., **OCF** : Over Current Fault
UVF : Under Voltage Fault

Fault can be enabled **ENAB** or disabled **DISS**.

The action against the fault occurrence can be set as
ACT: **LDATA** : Indicative with Data log.
NTRIP : Normal trip of capacitor banks.
INS-X : Instant trip of Capacitor banks.

Trip limit for the selected fault appears on this next screen.
Limit Value: **LMT** can be set as per the requirement &
Resume Value (Reset of Fault): **RST** is set.
This is to avoid fault hunting by introduction of hysteresis between LMT & RST.

Some faults can be “auto-reset” by timer or by pressing the ↵ key on front keyboard.
Timer-Reset / **Human-Reset** can be set to decide reset action. For timer, the time in Seconds **Sec**: is to be adjusted & set.
The Last screen above can be set for: **LIMT** – Limit set auto-reset.
ENTR – By pressing ENT ↵ Key by user.
TIME – Automatically after the time elapse.

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : FAULTS Listing

Fault Number	Fault Code	Faults Description	Faults Covered
001	**UVF**	Under Voltage fault observed in any one or more of the phase Voltages measured	UVR
			UVY
			UVB
			UVF
002	**OVF**	Over Voltage fault observed in any one or more of the phase Voltages measured.	OVR
			OVY
			OVB
			OVF
003	**ZVF**	Zero Voltage detected in any one or more phases of measurement voltage	ZVR
			ZVY
			ZVB
			ZVF
004	**SUF**	Under Frequency on supply.	SUF
005	**SOF**	Over Frequency on supply.	SOF
006	**OCF**	Measurement Over Current detection in any one or more of the three phases.	OCR
			OCY
			OCB
			OCF
007	**OCN**	Neutral Over Current detection	OCN
008	**ZCF**	Zero current detected in any one or more of three phases.	ZCR
			ZCY
			ZCB
			ZCF
009	**COF**	Capacitor Over Current in any one or more of three phases.	COR
			COY
			COB
			COF
010	**CEL**	Capacitor Earth Leakage for 3wire Capacitors OR Capacitor Neutral Current for 4wire Capacitors current Exceeding the limit	CEL
011	**CUF**	Capacitor Under Current detection in any one or more phases.	CUR
			CUY
			CUB
			CUF

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : FAULTS Listing
Continued …….

Fault Number	Fault Code	Faults Description	Faults Covered
012	**VHF**	Line to Neutral Voltage Over harmonics detection in any one or more phases.	VHR
			VHY
			VHB
			VHF
013	**CHF**	Supply Current Over harmonics detection in any one or more phases.	CHR
			CHY
			CHB
			CHF
014	**ChF**	Capacitor Current Over harmonics detection in any one or more phases.	ChR
			ChY
			ChB
			ChF
015	**ULF**	Under Load in terms of Active Power (P) detected in any one or more phases.	ULR
			ULY
			ULB
			ULF
016	**EOT**	External Over Temperature detection by PT100 sensor connected.	EOT
017	**MOT**	MCU (Microcontroller) Temperature detection exceeding the limit.	MOT
018	**OBF**	Out of bank fault detected in any one or more of the phases or for balanced Capacitors	OBR
			OBY
			OBB
			OBF
019	**PFL**	Excessive Leading Power Factor seen with Balanced & Phase Capacitor banks in OFF condition - Any one or more phases.	PFR
			PFY
			PFB
			PFL
020	**MDW**	Maximum Demand i.t.o. Watt exceeding	MDW
021	**MDV**	Maximum Demand i.t.o. VA exceeding	MDV

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : FAULTS Listing
Continued …….

Fault Number	Fault Code	Faults Description	Faults Covered
022	**AVL**	Auxiliary Input AC Voltage is Lower than the set limit.	AVL
023	**AVH**	Auxiliary Input AC Voltage is Higher than the set limit.	AVH
024	**UBV**	Unbalance in Voltages of Phase to Neutral exceeding the set limit	UBV
025	**UBA**	Unbalance in Supply current is exceeding the set limit	UBA
026	**UBC**	Unbalance in Capacitor banks current is exceeding the set limit	UBC
027	**VhF**	Line to Line Voltage Over harmonics detection in any one or more phases.	VhR
			VhY
			VhB
			VhF

For User convenience, the number of Fault settings for three phases have been put together. This is done to reduce & limit the number of fault settings to 27.

All the individual faults in data logging are logged as overall faults as well as individual phase faults.

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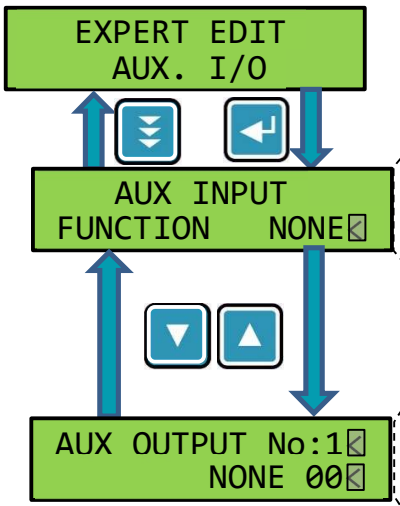
CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : AUX. I/O



Auxiliary Input- BR5600T has one Aux. input channel. It is used with AC Sinusoidal Voltage ranging from 0V~ to 300V~. It can be assigned with one function. This function user can select from list available. Total six (6) different functions list is available.
Details of all these functions is in subsequent part of this document.

Auxiliary Output- BR5600T has three Aux. output channels. Two (AO1 & AO2) are potential free Relay – Normally Open (NO) contacts. Third one is transistor output (AO3). Various functionalities that are available can be assigned to each of the Aux. Output channel.

Details of all these functions is in subsequent part of this document.

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : AUX. I/O Continued ……..

Auxiliary Input:	**For Aux. I/P.**		
Sr. No.	**Function**	**Function Details**	**Additional Remarks**
0	**NONE**	Auxiliary Input is Disabled.	No influence on PF controller actions
1	**CONT-V**	Measures input AC Voltage (within 68V~ to 290V~) and passes to the Fault / Event setting function.	Extremely useful function for monitoring of the control AC supply healthiness. This is given to Auxiliary control functions and input to SMPS. With selection of this function, Fault / Event setting have options of AVL & AVH to be enabled or disabled (along with action and resume limits settings)
2	**EN/DS**	0V~ to 10V~ : Enables PF correction action. 68V~ to 290V~: Disables PF correction action.	In disabled PF correction action, all the Steps are kept off.
3	**EB/GEN**	0V~ to 10V~ : Normal Electricity Supply. 68V~ to 290V~: Generator Supply	Generator ON info is given via Supply Changeover switch. This function selection gives additional Screens options in Target PF settings menu for Generator PF setting.
4	**HOLD**	0V~ to 10V~ : No Action. 68V~ to 290V~: Capacitors on Hold - As it is position.	The correction time is extended infinitely till the Digital 1 is observed on this port. (Correction Measurement is stopped) (Normal display measurement is on). Feature is useful for specific critical time when supply system glitches due to capacitor switching are to be avoided.
5	**32S-MI**	0V~ to 10V~ : Self PF Comp. 68V~ to 290V~: - On hold.	Master receives Hold position command from other unit in Follower operation.
6	**32S-FI**	0V~ to 10V~ : Disable cap. control 68V~ to 290V~: PF control enable	Follower receives command for Enabling the normal capacitor control operation.

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : AUX. I/O Continued ……..

Auxiliary Output:		**For O/P1, O/P2, O/P3**	
Sr. No.	**Function**	**Function Details**	**Additional Remarks**
0	**NONE**	No function is assigned to Aux. o/p.	--
1	**FAN**	Fan ON/OFF for temp. control	User set limit for external over-temperature.
2	**ALARMI**	Annunciation indicative faults	Faults that are logged by unit are informed by output
3	**ALARMT**	Cap. trip fault Annunciation	Faults that trip all Caps. by unit are informed by output
4	**ALARMC**	One or more capacitor health issue	Any Capacitor bank if detected faulty by unit.
5	**ASYCFL**	Alarm for Auto-Sync failure	Automatic synchronization failure annunciation.
6	**Cap-EL**	Capacitor shows Earth leakage / Neutral current	Selected only for Cap. Configuration = 3.
7	**OT-MCU**	MCU of unit exceeds limit set	Unit internal temperature exceeding alarm
8	**RTC-AL**	Annunciation for Clock Time failure	Real time clock is detected with likely wrong time.
9	**P-Data**	GPRS Comm. data pending.	GPRS network data to be sent is pending.
10	**GPRSNW**	GPRS comm. error possibility	GPRS modem (on RS-232) has detected poor network.
11	**OK-ON**	Unit working without any fault	Healthy function indicator.
12	**K-16**	Additional Cap. Bank switch	Only applicable for AO3. (Not in AO1 & AO2)
Addition	**32S-FO**	O/P1 as follower when in operation	These functions are applicable for O/P1 only. These are automatically assigned with Aux. I/P point 5,6 functions.
	32S-MO	O/P1 as master when in operation	

The last function assigned to **AO1** is automatically selected when Auxiliary Input function of **32S-MI** or **32S-FI** is selected.
In this case **AO1** can only be assigned as **32S-FO** or **32S-MO** functionality.

Specifically, if Auxiliary Input is: **32S-MI** then Auxiliary Output (AO1) is assigned **32S-MO** functionality.
If Auxiliary Input is: **32S-FI** then Auxiliary Output (AO1) is assigned **32S-FO** functionality.

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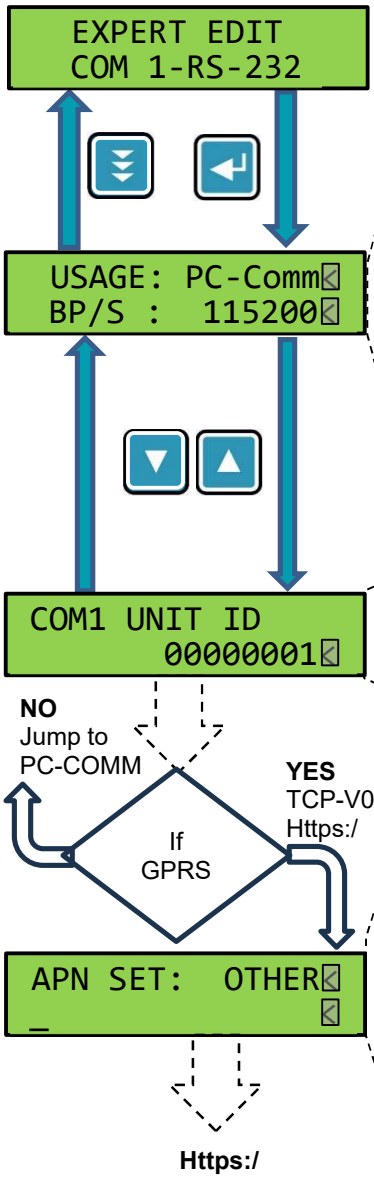
CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : COM 1-RS-232



<u>COM 1 post usage</u>- COM 1 (RS-232) serial communication port used for either the PC-App RS-232 communication or for AT+ communication with GPRS modem confirming.
<u>3GPP TS 51.010-1 Rev.</u>

- 0: DISABLE (COM 1 port is disabled)
- 1: PC-Comm (PC-App communication)
- 3: Https:/ (GPRS – https:// …..)

<u>Baud rate of COM 1</u>-

- 004800 BPS (4.8 kBPS)
- 009600 BPS (9.6 kBPS)
- 019200 BPS (19.2 kBPS)
- 038400 BPS (38.4 kBPS)
- 057600 BPS (57.6 kBPS)
- 115200 BPS (115.2 kBPS)

<u>Unit ID</u>- COM 1: 8-decimal digits long.

GPRS connected server uses this ID to identify the location of connected specific Automatic PF Correction system.

An **Access Point Name** (APN) is a gateway between GPRS, 2G, 3G, 4G modem network. A modem making a data connection must be configured with an APN to present to the carrier network.
Screen applicable only for **https:/** option.
<u>APN SELECTION</u>- GPRS Service provider APN or select Another APN if not in list.
The GPRS: 2G/4G modem connected on COM 1 should operate with good connectivity service provider SIM, for ensuring reliable GPRS communication.
With **OTHER:** User needs to write the APN on bottom line of LCD. (Maximum 15nos. characters)
Already programmed APNs for INDIA are:
BSNL : internet **VI** : m2misafe **Jio** : jionet
Airtel : airtelgprs.com

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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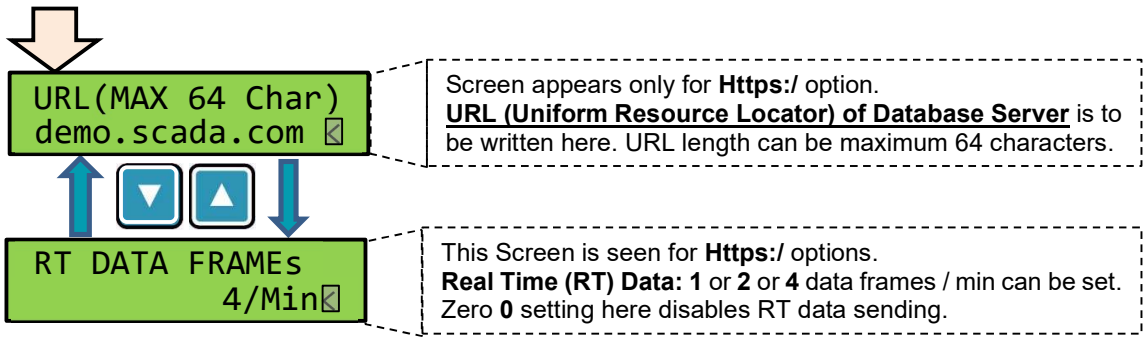
CONFIGURATION / SETTINGS:

Https:/

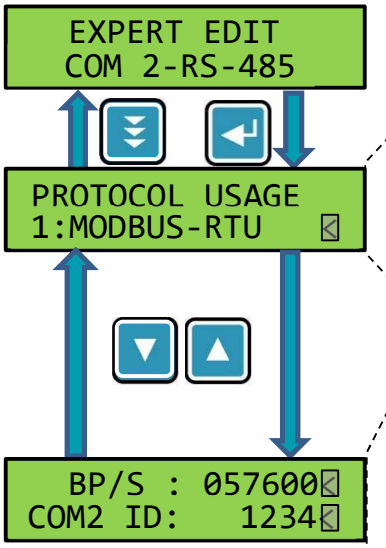


Https:/ communication with GPRS modem connection is the recommended option. The data is transmitted on “Secure” channel. There is a lot of versatility with which the data is transmitted. Data logging has User selectable options for optimal use of the memory.
Details are as per ***Communication & Data log-PFC on https Rev1.pdf*** document file.

The Communication document files can be availed from TDK India offices on request.

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : COM 2-RS-485



COM 2- Usage is RS-485 serial communication port.
Communication Options

- **0: DISABLE** – COM 2 is not used
- **1: MODBUS-RTU** – Works with Protocol Modbus-RTU
- **2: MODBUS-ASC** – Works with Protocol Modbus-ASCII
- **3: PC-Comm** – Communication with PC-App software
  PC-App software is "PF-Explorer V2.1".

Baud Rate in kBPS-

- **004800 BPS (4.8 kBPS)**
- **009600 BPS (9.6 kBPS)**
- **019200 BPS (19.2 kBPS)**
- **038400 BPS (38.4 kBPS)**
- **057600 BPS (57.6 kBPS)**

Its important to set the correct baud rate as per requirement.
COM2 ID for MODBUS- Unit ID is 4 decimal digits. It is slave RTU (Remote terminal Unit) identifier for MODBUS communication.

MODBUS – Address for Read & Write are as given in **Annexure-D**.

"**PFC DATAVIEW V1.0**" software is a Windows* OS based PC software. This software communicates with BR5600T on RS-232 and / or RS-485 communication ports. It is useful for Logged data download and viewing in MS-Excel* format. The details of the PC-App communication are detailed in "PF Explorer V2.1" software Operations Manual.
The software can be availed from TDK India offices on request.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : DATA LOGGING

Various types of Data are stored in BR5600T non-volatile memory (E^2PROM):
Data Logging in BR5600T is linked through modes of communication.

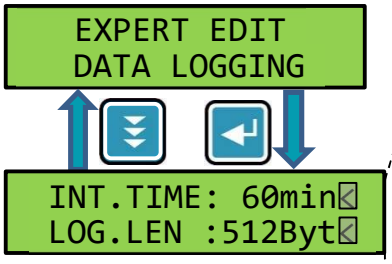
User accessible data:

- User Parameter setting Data. (Parameter setting Data is used for configuring the unit to suit the site operations)
- Faults & Events Data log. (For tracing the Faults / Events history)
- Time interval Data log. (Regular information update at fixed time interval)
- Daily Data log for time storage type of parameters – like Energy, Max. Demand, Capacitor health (VAR values) etc.

Data Logging for BR5600T internal requirement:
Data used for unit operations. Not accessible to user.
(Mandatory part of communication).

- Product Manufacturing information, serial number, model etc.
- Calibration data used for accurate measurement.
- Critical data update while unit power is switched off : Early Warning Power Fail (EWPF)

Settings in BR5600T:



DATA LOGGING- Storage of DATA.
Stored 3 types of Data-

- Fault / Event Log
- Daily Log (Every 24hrs. at day change)
- Interval Log (User set time slot)

a) 005 minutes
b) 010 minutes
c) 015 minutes
d) 030 minutes
e) 060 minutes
f) 120 minutes

Logging Record Length-
Data length can be selected by user depending upon the "Parameters to be Logged" and the "time period" requirement for exhausting the memory capacity.
64, **128**, **256** & **512** Bytes of Data length can be set.

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : DATA LOGGING
Continued …….

DATA Logs with any mode of communication. Data Logging Parameters Listing Excel document is available from TDK office.

The following Table is useful to know the "Time Period" for which the data can be stored.
For **https:/**, **PC-App** communication selection, the logged data in following time frame can be acquired from internal memory of BR5600T.

	User Set Parameters	Event / Fault data	Daily log data
Data Log Nos.	4	256	124

For User set Interval time:

Sr. No.	INTERVAL Time Slot:	Time slot units	INTERVAL (Any one type can be selected)			
			64-Bytes	128-Bytes	256-Bytes	512-Bytes
A.	Time slot 5-min	Number of Hours	533	267	133	67
		Number of Days	22	11	6	3
B.	Time slot 10-min	Number of Hours	1067	533	267	133
		Number of Days	44	22	11	6
C.	Time slot 15-min	Number of Hours	1600	800	400	200
		Number of Days	67	33	17	8
D.	Time slot 30-min	Number of Hours	3200	1600	800	400
		Number of Days	133	67	33	17
E.	Time slot 60-min	Number of Hours	6400	3200	1600	800
		Number of Days	267	133	67	33
F.	Time slot 120-min	Number of Hours	12800	6400	3200	1600
		Number of Days	533	267	133	67

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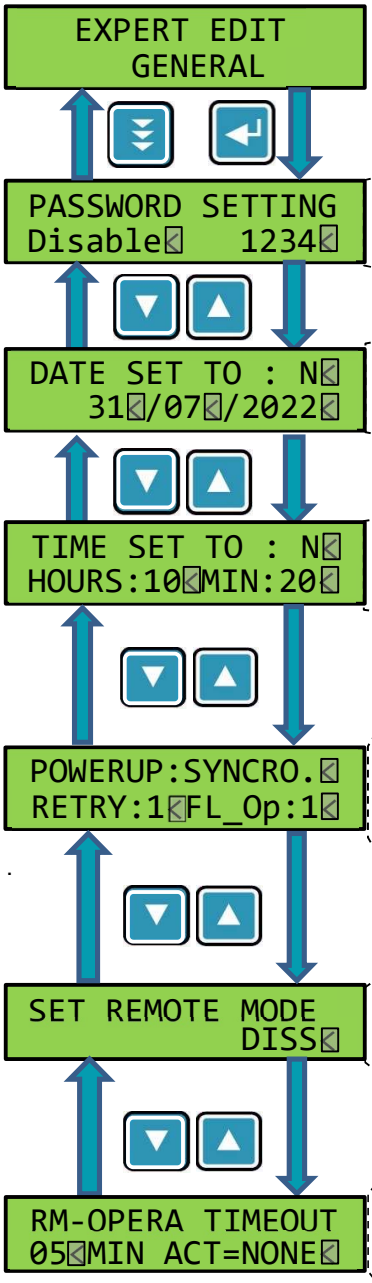
Operations manual

CONFIGURATION / SETTINGS:

MODE SELECT : EXPERT EDIT : GENERAL



Password- The four-digit number password can be set for getting into Expert Edit. This is to prevent un-authorized change of settings. It can be Enable or Disable.

Date Setting- Date on BR5600T needs to be set while first time power up or if unit is kept in Power-Off condition for more than 30 days. Setting Y & dd mm yyyy + save is needed.

Time Setting- Time needs to be set while first time power up or if unit is kept in Power-Off condition for more than 30 days. Setting Y & HH (Hour) MM (Minutes) + save is needed.

Power-Up working Default-

- **AUTO:** Normal auto PF correction. (Default option)
- **MANUAL:** User set control on cap-steps.
- **SYNCRO.:** Auto-Synchronization of Grid

No. of Retries **RETRY** & Failure Options **FL_Op**
1 to **9** Retries and Failure options **1** or **2** or **3** can be selected.
Failure option 1: Continue PF correction with last settings.
Failure option 2: Go to Manual Synchronize option.
Failure option 3: Hold without PF correction. ↵ Key to abort.

Remote Mode with MODBUS – COM 2:
DISS: Disable Remote mode (Normal working of BR5600T)
REM1: Remote Operation Type 1.
Presently one type of Remote option is with this unit version.
Brief working details on this is here-under.

Remote Mode Operation Timeout: If REM1 is set. This screen is visible. It gives timeout error when Remote communication is idle for the specified time. The time is in minutes & adjustable from 01 to 60 minutes.
Action after Timeout:
NONE: Keeps operating in Remote.
AUTO: Exits Remote mode to Normal working.

Remote Operation Type 1 (REM1) : The supply measurement parameters like Voltage, Current, Power (P1 & Q1) are written through MOD-Bus communication from Remote Master MOD-Bus Server. The Capacitor switching action is carried out by BR5600T in REM1 by using the measurement values from Remote master.

STATUS & ERROR MESSAGES

Non-Volatile Memory Reading / Writing operation Status AND Error / Information messages

E^2PROM (Non-Volatile Memory) Reading Operational messages:

Reading Data Success....	Any data read from non-volatile memory is successfully read for further usage. Normally data read is against the communication request on Com 1 or Com2 ports, or system requirements.
Reading Data Fail... ERC	**ERC: Calibration data read Error.** It is system error. The unit would be displaying System Fault and the measurement data is likely to be inaccurate. Unit would normally correct this Error with next power up. For repeated errors seen, unit should be sent to Authorized service center.
Reading Data Fail... ERP	**ERP: User Setting Parameter read error.** It is Unit level Fatal Error. The unit would be displaying **…Fatal Error…** The unit to be sent to Authorized service center.
Reading Data Fail... ERE	**ERE: Early Warning Power Fail recovery Data read error** Aux. supply Power up, unit recovers critical retention data like Energy, Max-Values etc. When reading this data fails, unit continues normal operation with some data lost.
Reading Data Fail... ERL	**ERL: Logged Data read error.** The logged data read shows errors. The event with such ERL is logged and normal operation resumes. On occurrence, specific data record can be lost while communicating.
Reading Data Fail... ERU	**ERU: Unit information Data read error.** The unit information data read can have errors. This error cannot be seen under normal user operations. This error can be seen only when the factory setting of unit information.

STATUS & ERROR MESSAGES:

Non-Volatile Memory Reading / Writing operation Status AND Error / Information messages

E^2PROM (Non-Volatile Memory) Writing Operational messages:

Data Save Success...	Any data saved to memory is successfully written for further usage. Data written is against the specific action like Data log request Event, Interval, Daily, Editable Parameters etc. Data log requests generated.
Data Save Fail... EWC	**EWC: <u>Calibration data</u> write Error.** This error can be seen only when the unit is written with calibration data in factory. As Calibration write records are not written in normal operation, such message would not be seen.
Data Save Fail... EWP	**EWP: <u>User Setting Parameter</u> writing error.** It is Unit level Fatal Error. The unit after multiple unsuccessful tries, does not recover. The unit is to be sent to service center for rectification.
Data Save Fail... EWE	**EWE: <u>Early Warning Power Fail</u> recovery Data write error.** Aux. supply Power up, unit recovers critical retention data. If this data recovery fails, unit continues with some data lost.
Data Save Fail... EWL	**EWL: <u>Logged Data</u> write error.** Specific logged data record in E^2PROM memory would be skipped. Other working be normal.
Data Save Fail... EWU	**EWU: <u>Unit information Data</u> write error.** The unit information data writing can have errors. This error cannot be seen under normal user operations. This error can be seen only when the factory setting of unit information.

STATUS & ERROR MESSAGES:

Non-Volatile Memory Reading / Writing operation Status AND Error / Information messages

Other Messages (That can appear momentarily):

Incorrect Password	This message appears when incorrect password is entered while getting into “Expert Edit” Menu.
Interval Data LOG	Data acquired for every interval is logged in the Non-volatile memory.
Event Data LOG	Data acquired for Event detected (including fault) is logged in the Non-volatile memory.
Daily Data LOG	Data acquired for 24Hrs Daily log (at change of date detection) is logged in the Non-volatile memory.
WIRING SETUP ***SUCCESS***	Auto Synchronization (within “Wiring Setup” or “Power up Sync”) has successfully passed and unit is ready for regular operation.
WIRING SETUP :::FAIL:::	Auto Synchronization (within “Wiring Setup” or “Power up Sync”) has failed and unit would take further actions as per settings.
WIRING SETUP NOT Possible	Auto Synchronization if initiated (within “Wiring Setup” or “Power up Sync”) during configurations that do not support this function.
WIRING SETUP ABORT	During progress of Auto Synchronization, if user aborts the process by ↵ key pressing, message is momentarily displayed.
BANK SETUP ***SUCCESS***	In “Easy Edit” => “Auto Configuration”, displays this message when Capacitor Banks VAR values are successfully acquired.
BANK SETUP :::FAIL:::	In “Easy Edit” => “Auto Configuration”, displays this message when Capacitor Banks VAR values can-not be acquired.
BANK SETUP NOT Possible	In “Easy Edit” => “Auto Configuration”, displays this message when other settings do not permit the auto-config process.
BANK SETUP ABORT	In “Easy Edit” => “Auto Configuration”, displays this message when user action of aborting the process by pressing ↵ key.
Log Data Erasing InProcess 82.3%	In MODE SELECT => RESET TIME-VAL => DATA LOGGING if selected “Y” for RESET, this screen appears. ↵ to abort process

Note that all the Message Convey screens would appear on the front LCD display screen for a short time span. These are information messages about some specific action carried out by the unit.

STATUS & ERROR MESSAGES:

Displayed Messages on Default Screen:

Sr. No.	Event / Fault	Events and Faults Description	LCD display	Location in Error Word	Type
1	**IOK**	I am OK. No Event / Fault	**IOK**	EW8-15	Status
2	**UVR**	Measurement Under Voltage. R-phase	**UVF**	EW1-1	S-Fault
3	**UVY**	Measurement Under Voltage. Y-phase	**UVF**	EW1-3	S-Fault
4	**UVB**	Measurement Under Voltage. B-phase	**UVF**	EW1-5	S-Fault
5	**OVR**	Measurement Over Voltage. R-phase	**OVF**	EW1-0	S-Fault
6	**OVY**	Measurement Over Voltage. Y-phase	**OVF**	EW1-2	S-Fault
7	**OVB**	Measurement Over Voltage. B-phase	**OVF**	EW1-4	S-Fault
8	**ZVR**	Measurement Zero Voltage. R-phase	**ZVF**	EW6-0	S-Fault
9	**ZVY**	Measurement Zero Voltage. Y-phase	**ZVF**	EW6-1	S-Fault
10	**ZVB**	Measurement Zero Voltage. B-phase	**ZVF**	EW6-2	S-Fault
11	**SUF**	Measurement Under Frequency	**SUF**	EW2-3	S-Fault
12	**SOF**	Measurement Over Frequency	**SOF**	EW2-2	S-Fault
13	**OCR**	Measurement Over Current. R-Phase	**OCF**	EW1-6	S-Fault
14	**OCY**	Measurement Over Current. Y-Phase	**OCF**	EW1-8	S-Fault
15	**OCB**	Measurement Over Current. B-Phase	**OCF**	EW1-10	S-Fault
16	**OCN**	Measurement Over Current. Neutral	**OCN**	EW2-10	S-Fault
17	**ZCR**	Measurement Zero Current. R-Phase	**ZCF**	EW6-3	S-Fault
18	**ZCY**	Measurement Zero Current. Y-Phase	**ZCF**	EW6-4	S-Fault
19	**ZCB**	Measurement Zero Current. B-Phase	**ZCF**	EW6-5	S-Fault
20	**COR**	Capacitor Over Current. R-Phase	**COF**	EW1-12	C-Fault
21	**COY**	Capacitor Over Current. Y-Phase	**COF**	EW1-14	C-Fault
22	**COB**	Capacitor Over Current. B-Phase	**COF**	EW2-0	C-Fault
23	**CEL**	Capacitor Earth Leakage fault	**CEL**	EW3-7	C-Fault
24	**CUR**	Capacitor Under Current. R-Phase	**CUF**	EW1-13	C-Fault
25	**CUY**	Capacitor Under Current. Y-Phase	**CUF**	EW1-15	C-Fault
26	**CUB**	Capacitor Under Current. B-Phase	**CUF**	EW2-1	C-Fault
27	**VHR**	Measurement Voltage over Harmonics.R-phase	**VHF**	EW6-6	S-Fault
28	**VHY**	Measurement Voltage over Harmonics.Y-phase	**VHF**	EW6-7	S-Fault
29	**VHB**	Measurement Voltage over Harmonics.B-phase	**VHF**	EW6-8	S-Fault
30	**CHR**	Measurement Current over Harmonics. R-phase	**CHF**	EW6-9	S-Fault
31	**CHY**	Measurement Current over Harmonics. Y-phase	**CHF**	EW6-10	S-Fault
32	**CHB**	Measurement Current over Harmonics. B-phase	**CHF**	EW6-11	S-Fault
33	**ChR**	Cap. Current over Harmonics. R-phase	**ChF**	EW2-5	C-Fault

STATUS & ERROR MESSAGES:

Displayed Messages on Default Screen: Continued……..

Sr. No.	Event / Fault	Events and Faults Description	LCD display	Location in Error Word	Type
34	ChY	Cap. Current over Harmonics. Y-phase	ChF	EW2-6	C-Fault
35	ChB	Cap. Current over Harmonics. B-phase	ChF	EW2-7	C-Fault
36	ULR	Measurement Under Load. R-phase. (i.t.o. Watt)	ULF	EW1-7	S-Fault
37	ULY	Measurement Under Load. Y-phase. (i.t.o. Watt)	ULF	EW1-9	S-Fault
38	ULB	Measurement Under Load. B-phase. (i.t.o. Watt)	ULF	EW1-11	S-Fault
39	EOT	External Over Temperature (Thro' Pt-100)	EOT	EW2-11	Aux-Fault
40	MOT	MCU Over Temperature	MOT	EW2-4	Aux-Fault
41	OBR	Out of Banks - VAR shortage - R-phase	OBF	EW6-12	C-Fault
42	OBY	Out of Banks - VAR shortage - Y-phase	OBF	EW6-13	C-Fault
43	OBB	Out of Banks - VAR shortage - B-phase	OBF	EW6-14	C-Fault
44	PFR	Leading Displacement Power Factor in R-phase	PFL	EW3-10	Status
45	PFY	Leading Displacement Power Factor in Y-phase	PFL	EW3-11	Status
46	PFB	Leading Displacement Power Factor in B-phase	PFL	EW3-12	Status
47	MDW	Maximum Demand (Kilo-Watt) Exceed	MDW	EW3-2	S-Fault
48	MDV	Maximum Demand (KVA) Exceed	MDV	EW3-3	S-Fault
49	AVL	Aux. Input Control ac voltage low	AVL	EW3-13	Aux-Fault
50	AVH	Aux. Input Control ac voltage high	AVH	EW3-14	Aux-Fault
51	UBV	Unbalance in 3 phase voltage	UBV	EW3-4	S-Fault
52	UBA	Unbalance in 3 phase meas. Current	UBA	EW2-9	S-Fault
53	UBC	Unbalance in 3 phase cap. Current	UBC	EW3-5	C-Fault
54	VRH	Measurement Voltage over Harmonics. R-Y phases L-L voltage	VhF	EW6-15	S-Fault
55	VYH	Measurement Voltage over Harmonics. Y-B phases L-L voltage	VhF	EW7-0	S-Fault
56	VBH	Measurement Voltage over Harmonics. B-R phases L-L voltage	VhF	EW7-1	S-Fault
57	UVF	Under voltage in any one or three phases - L-L or L-N value.	UVF	EW7-2	S-Fault
58	OVF	Over voltage in any one or three phases - L-L or L-N value.	OVF	EW7-3	S-Fault
59	PFL	Overall D-PF is leading	PFL	EW7-4	Status
60	OBF	Out of banks for any one of the phases	OBF	EW2-8	C-Fault
61	ZVF	Zero Voltage detected in all three phases	ZVF	EW3-1	S-Fault
62	OCF	Over current in any 1 of 3 S-CT	OCF	EW7-5	S-Fault
63	ZCF	Zero Current detected in all three S-CT	ZCF	EW3-0	S-Fault
64	COF	Over current in any 1 of 3 C-CT	COF	EW7-6	C-Fault
65	CUF	Under current in any 1 of 3 C-CT	CUF	EW7-7	C-Fault
66	VHF	Over Voltage harmonics in any one of three phase with L-N sensing.	VHF	EW3-8	S-Fault

STATUS & ERROR MESSAGES:

Displayed Messages on Default Screen: Continued……..

Sr. No.	Status / Errors	Status & System Errors Description	Display	Location in Error Word	Type
67	**VhF**	Over Voltage harmonics in any one of three phases with L-L sensing.	**VhF**	EW7-8	S-Fault
68	**CHF**	Over Current harmonics in any one of three S-CTs.	**CHF**	EW3-9	S-Fault
69	**ChF**	Over Current harmonics in any one of three C-CTs.	**ChF**	EW7-9	C-Fault
70	**ULF**	Active Power under load detected in any one of the three phases.	**ULF**	EW7-10	S-Fault
71	**ERC**	EEPROM Read error 1 - calibration data (System Error fault)	**ERC**	EW5-0	Sys-Fault
72	**ERP**	EEPROM Read error 2 - parameter data (System Error fault)	**ERP**	EW5-1	Sys-Fault
73	**ERE**	EEPROM Read error 3 - EWPF data (System Error fault)	**ERE**	EW5-2	Sys-Fault
74	**ERL**	EEPROM Read error 4 - logged data (System Error fault)	**ERL**	EW5-3	Sys-Fault
75	**ERU**	EEPROM Read error 5 - Unit info data (System Error fault)	**ERU**	EW4-2	Sys-Fault
76	**EWC**	EEPROM Write error 1 - calibration data (System Error fault)	**EWC**	EW5-4	Sys-Fault
77	**EWP**	EEPROM Write error 2 - parameter data (System Error fault)	**EWP**	EW5-5	Sys-Fault
78	**EWE**	EEPROM Write error 3 - EWPF data (System Error fault)	**EWE**	EW5-6	Sys-Fault
79	**EWL**	EEPROM Write error 4 - logged data (System Error fault)	**EWL**	EW5-7	Sys-Fault
80	**EWU**	EEPROM Write error 5 - Unit info data (System Error fault)	**EWU**	EW4-3	Sys-Fault
81	**RTC**	RTC needs resetting (Real Time clock) (Unit Power down 30+days)	**RTC**	EW2-14	Status
82	**WDR**	Watch Dog timer Reset (System Error fault)	**WDR**	EW4-9	Sys-Fault
83	**SyF**	Automatic Synchronization Failure	**SyF**	EW4-0	Aux-Fault
84	**SyA**	Automatic Synchronization Aborted by user	**SyA**	EW4-10	Status
85	**SyP**	Automatic Synchronization Pass	**SyP**	EW4-11	Status
86	**CTM**	Capacitor Testing (Manual) Mode	**CTM**	EW4-1	Status
87	**ASM**	Automatic Synchronization Mode(user)	**ASM**	EW4-12	Status
88	**PEM**	Parameter Editing & Configuration Mode (not on LCD only log)	**PEM**	EW4-13	Status
89	**RM1**	Operation in Remote 1 mode by COM 2	**RM1**	EW4-4	Status

STATUS & ERROR MESSAGES:

Displayed Messages on Default Screen: Continued……..

Sr. No.	Status / Errors	Status & System Errors Description	Display	Location in Error Word	Type
90	**RM2**	Operation in Remote 2 mode by COM 2	**RM2**	EW4-5	Status
91	**CBF**	One or More Capacitors declared faulty. Bank VAR out of tolerance	**CBF**	EW3-15	C-Fault
92	**4GN**	GPRS modem on COM1 - Network weak	**4GN**	EW4-15	Aux-Fault
93	**PUP**	Unit Power UP event (not on LCD only log)	**PUP**	EW2-13	Status
94	**PDW**	Unit Power DOWN event (not on LCD only log)	**PDN**	EW2-12	Status
95	**HLD**	Hold status from Aux. Input command or 32S-Mi on Aux.Input function	**HLD**	EW4-7	Status
96	**DSB**	Disable status on Aux. input or as 32S-Fi on Aux. Input functionality	**DSB**	EW4-6	Status
97	**CM1**	Com1 port RS-232 communication Error	**CM1**	EW5-8	Aux-Fault
98	**CM2**	Com2 port RS-485 communication Error	**CM2**	EW5-9	Aux-Fault
99	**AMG**	Generator Mode in enable state	**AMG**	EW4-8	Status
100	**PSV**	Parameters Saved Event (not on LCD only log)	**PSV**	EW5-10	Status
101	**CRT**	Capacitor bank VAR values reset (not on LCD only log)	**CRT**	EW5-11	Status
102	**MRT**	Max. Values reset (not on LCD only log)	**MRT**	EW5-12	Status
103	**UCR**	Cap. Bank utilization counter reset (even 1) (not on LCD only log)	**UCR**	EW5-13	Status
104	**WST**	Wiring positioning saved in Manual Sync. (not on LCD only log)	**WST**	EW5-14	Status
105	**EOF**	Energy Counters Overflow event	**EOF**	EW4-14	Status
106	**NVF**	EEPROM fault (System Error fault)	**NVF**	EW2-15	Sys-Fault
107	**VOL**	Voltage control - Under voltage cap additn	**VOL**	EW8-0	Status
108	**VOH**	Voltage control - Over voltage cap remove	**VOH**	EW8-1	Status
109	**VOR**	Voltage control Over-ride - VAR operation	**VOR**	EW8-2	Status
110	**ASP**	Automatic Synchronizing pending	**ASP**	EW7-11	Status
111	**ABD**	Auto Configuration(Easy Edit) operational	**ABD**	EW7-12	Status
112	**ABP**	Auto Configuration (Easy Edit) is pending.	**ABP**	EW7-13	Status
113	**MAN**	Power up manual mode	**MAN**	EW7-14	Status
114	**BDF**	Auto Bank Detection Fail	**BDF**	EW8-3	Aux-Fault
115	**BDA**	Auto Bank Detection Abort	**BDA**	EW8-4	Status
116	**BDP**	Auto Bank Detection Pass	**BDP**	EW8-5	Status

INTERLOCKS WITH CONFIGURATION SETTINGS

Sr. No.	Interlock Applicability	Affected Function
1	MODE - EASY EDIT selection - ENAB: Enabled	Viewing - Auxiliary Function - Screen absent
		MODE SELECT - EXPERT EDIT - Screen absent
2	MODE - EASY EDIT - C-Amps SEC: X	Viewing - Overall Values - AmpC-Av = N/A A
		Viewing - Overall Values - Unbalence C: N/A %
		Viewing - Phase Values - AmpC-EL N/A A
		Viewing - Harmonics - Cap. RYB ph. Amp screens absent
		Viewing - Harmonics - Cap. RYB 2nd to 31st spectrum absent
		Viewing - Max. Values - ACEL MAX N/A A
		Viewing - Max. Values - AmpC-MAX screen absent
		Viewing - Max. Values - CATDD MAX N/A A
		MODE SELECT - SETUP WIRING - MANUAL SYNC - view P/Q/CQ. CQ absent
3	MODE - EXPERT EDIT - MEASUREMENT	MODE SELECT - SETUP WIRING - AUTO SYNC. Screen is absent
	MEASUREMENT VA CONF: 2 (2 S-CT)	MODE SELECT - EXPERT EDIT - CAP. CONTROL - STEP CONFIG: Only BAL option
		MODE SELECT - EXPERT EDIT - CAP. CONTROL - STEP No. BAL & NOT option
		MODE SELECT - EXPERT EDIT - FAULT - Some Faults cannot be enabled.
		MODE SELECT - EXPERT EDIT - GENERAL - POWERUP: SYNCRO. option absent
4	MODE - EXPERT EDIT - MEASUREMENT	Viewing - Overall Values - Unbalance for V: N/A & A: N/A is observed
	MEASUREMENT VA CONF: 3 (1 S-CT Quadrature)	Viewing - Overall Values - V-Phase Sequence Screen is absent
		Viewing - Phase Values Screen is absent.
		Viewing - Harmonics - Only R-ph S-CT and Y-B phases Voltage Harmonics seen
		Viewing - Max. Values - VLL-MAX N/A A for Line to Line voltage values not measured.
		Viewing - Max. Values - Amp-MAX N/A A for Line current values not measured.
		Viewing - Max. Values - ASN-MAX N/A A for Neutral current values not measured.
		Viewing - Max. Values - for fundamental power P1 & Q1 not seen.
		MODE SELECT - SETUP WIRING - MANUAL SYNC. - S-CT position only for R-Voltage
		MODE SELECT - EXPERT EDIT - CAP. CONTROL - STEP CONFIG: Only BAL option
		MODE SELECT - EXPERT EDIT - CAP. CONTROL - STEP No. BAL & NOT option
		MODE SELECT - EXPERT EDIT - FAULT - Some Faults cannot be enabled.
5	MODE - EXPERT EDIT - MEASUREMENT	MODE SELECT - EXPERT EDIT - MEASUREMENT - Rated Voltage is Line-Neutral
	MEASUREMENT VA CONF: 4 (1 S-CT In-phase)	Viewing - Overall Values - Unbalance for V: N/A & A: N/A is observed
		Viewing - Overall Values - V-Phase Sequence Screen is absent
		Viewing - Phase Values Screen is absent.
		Viewing - Harmonics - Only R-ph S-CT and R-N phase Voltage Harmonics seen
		Viewing - Max. Values - VLN-MAX N/A A for other Ph-N values not measured.
		Viewing - Max. Values - Amp-MAX N/A A for other current values not measured.
		Viewing - Max. Values - ASN-MAX N/A A for Neutral current values not measured.
		Viewing - Max. Values - for fundamental power P1 & Q1 not seen.
		MODE SELECT - SETUP WIRING - MANUAL SYNC. - S-CT position only for R-Voltage
		MODE SELECT - EXPERT EDIT - MEASUREMENT - RATED MEAS VOLT - LN (not LL)
		MODE SELECT - EXPERT EDIT - CAP. CONTROL - STEP CONFIG: Only BAL option
		MODE SELECT - EXPERT EDIT - CAP. CONTROL - STEP No. BAL & NOT option
		MODE SELECT - EXPERT EDIT - FAULT - Some Faults cannot be enabled.
6	MODE - EXPERT EDIT - MEASUREMENT	Viewing - Overall Values - Unbalence C: N/A %
	CAPACITOR CT CONF: 2 (2 C-CT)	Viewing - Phase Values - AmpC-EL N/A A (value not shown)
		Viewing - Max. Values - ACEL-MAX N/A A for other current values not measured.
		MODE SELECT - SETUP WIRING - MANUAL SYNC. - C-CT for B phase not shown
		MODE SELECT - EXPERT EDIT - FAULT - Some Faults cannot be enabled.
		MODE SELECT - EXPERT EDIT - Aux.I/O - AUX OUTPUT - Cap-EL 06 is not seen
7	MODE - EXPERT EDIT - MEASUREMENT	Viewing - Overall Values - Unbalence C: N/A %
	CAPACITOR CT CONF: 1 (1 C-CT)	Viewing - Phase Values - AmpC-RYB N/A A for Y and B phase capacitor current.
		Viewing - Phase Values - AmpC-EL N/A A (value not shown)
		Viewing - Max. Values - ACEL-MAX N/A A for other current values not measured.
		MODE SELECT - SETUP WIRING - MANUAL SYNC. - C-CT for Y & B phase not shown
		MODE SELECT - EXPERT EDIT - FAULT - Some Faults cannot be enabled.
		MODE SELECT - EXPERT EDIT - Aux.I/O - AUX OUTPUT - Cap-EL 06 is not seen

INTERLOCKS WITH CONFIGURATION SETTINGS

Sr. No.	Interlock Applicability	Affected Function
8	MODE - EXPERT EDIT - MEASUREMENT	Viewing - Overall Values - AmpC-Av: NA A
	CAPACITOR CT CONF: 0 (0 C-CT)	Viewing - Overall Values - CQ1: NA *VAR Line on screen is absent
		Viewing - Overall Values - Unbalence C: N/A %
		Viewing - Phase Values - AmpC-RYB N/A A for Y and B phase capacitor current.
		Viewing - Phase Values - AmpC-EL N/A A (value not shown)
		Viewing - Max. Values - ACEL-MAX N/A A for other current values not measured.
		Viewing - Max. Values - CATDD MAX N/A A
		MODE SELECT - SETUP WIRING - MANUAL SYNC. - C-CT for R, Y & B not shown
		MODE SELECT - EXPERT EDIT - FAULT - Some Faults cannot be enabled.
		MODE SELECT - EXPERT EDIT - Aux.I/O - AUX OUTPUT - Cap-EL 06 is not seen
		Viewing - STEP VAR: Values takes minimum 10Nos ON/OFF of specific bank to update
9	MODE - EXPERT EDIT - CAP CONTROL	MODE SELECT - SETUP WIRING screen is absent.
	STEP CONFIG: UNBAL setting.	MODE SELECT - EXPERT EDIT - GENERAL - POWERUP: SYNCRO. option absent
		MODE SELECT - EXPERT EDIT - CAP CONTROL - STEP No. : BAL option absent
		MODE SELECT - EXPERT EDIT - FAULT - Some Faults cannot be enabled.
		MODE SELECT - EXPERT EDIT - Aux.I/O - AUX OUTPUT - Cap-EL 06 is not seen
10	MODE - EXPERT EDIT - CAP CONTROL	MODE SELECT - SETUP WIRING screen is absent.
	STEP CONFIG: BAL+UNBAL setting.	MODE SELECT - EXPERT EDIT - GENERAL - POWERUP: SYNCRO. option absent
		MODE SELECT - EXPERT EDIT - FAULT - Some Faults cannot be enabled.
		MODE SELECT - EXPERT EDIT - Aux.I/O - AUX OUTPUT - Cap-EL 06 is not seen
11	MODE - EXPERT EDIT - COM 1-RS-232 - USAGE:	Viewing - Aux. Function - COM1-GPRS R-PEND - screen is absent
	Usage **PC-Comm** is set	MODE SELECT - EXPERT EDIT - COM 1-RS-232: APN SET screen is absent.
		MODE SELECT - EXPERT EDIT - COM 1-RS-232: RT DATA FRAMEs screen absent.
		MODE SELECT - EXPERT EDIT - COM 1-RS-232: URL (in HTTPS:/) screen is absent.
		MODE SELECT - EXPERT EDIT - COM 1-RS-232: SERVER IP V4 (in TCP-V01) absent.
		MODE SELECT - EXPERT EDIT - COM 1-RS-232: PORT (in TCP-V01) absent.
12	MODE - EXPERT EDIT - COM 1-RS-232 - USAGE:	MODE SELECT - EXPERT EDIT - COM 1-RS-232: SERVER IP V4 (in TCP-V01) absent.
	Usage **Https:/** is set	MODE SELECT - EXPERT EDIT - COM 1-RS-232: PORT (in TCP-V01) absent.
13	MODE - EXPERT EDIT - COM 2-RS-485 - USAGE:	MODE SELECT - EXPERT EDIT - GENERAL: SET REMOTE MODE screen absent
	Usage **PC-Comm** or **DISABLE** is set	MODE SELECT - EXPERT EDIT - GENERAL: RM-OPERA TIMEOUT screen absent
14	MODE - EXPERT EDIT - GENERAL -	MODE SELECT - EXPERT EDIT - GENERAL: RM-OPERA TIMEOUT screen absent
	SET REMOTE MODE: DISS	
15	MODE - EXPERT EDIT - GENERAL - ...	User cannot enter MODE SELECT - EXPERT EDIT without setting correct password
	PASSWORD SETTING: Enable	

BR 5600 T power factor controller for LV High-Speed Capacitor switching

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COMMISSIONING INSTRUCTIONS

Guidelines for Capacitor Bank configuration in PF correction system:

The accuracy of Power Factor correction system to correct the Power Factor is primarily dependent upon the Capacitor bank value (VAR) selection. The bank selection gives the RESOLUTION of the VAR adjustment.
Important Criteria for Capacitor bank selection.

- ✓ Capacitor banks should be always selected in the configuration as X1:1:2:4:8….. Or X1:1:3:6:12….. Or X1:2:4:8…. Etc. This ensures that with any combination of the capacitor banks, the difference between the two successive combinations is “1”. Any other combination like X1:3:3:4…. Will give difference between successive combinations as “2” in some cases and “1” in some cases. This means the RESOLUTION of the PF correction system in second case is “2”. In such case, the NO ACTION band is adjusted > 2, to avoid hunting of capacitor banks switching.
- ✓ The value of Capacitor Bank should be considered at supply rated voltage. (Capacitor Name plate VAR values may be different at different voltages).
- ✓ In case of usage of harmonic blocking reactors (anti-resonant detuned reactors) with capacitor banks, the effective value of capacitor – reactor series combination at rated voltage should be considered as Step reactive power.
- ✓ For PF correction systems using 3-phase balanced capacitors + individual phase capacitors for reactive power unbalance, RESOLUTION by smallest individual phase capacitors i.t.o. reactive power – VAR should be equal to or less than 1/3 value of Balance capacitor smallest bank VAR.

Selection of Power Factor Controller model and system components:

A. Unit is for switching ON / OFF the capacitor Banks by usage of Thyristor switched Capacitor – TSC, thus, BR5600R should not be used with such RTPFC systems.
B. Maximum supply AC voltage of 250V~ and maximum current loading up to 30mA dc should be available for TSC ON command from BR5600T. Usage of Resistor across the Control command is recommended for TSC modules that requires push pull command.
C. SMPS input voltage should be monitored for Under Voltage value. UV at input of SMPS supply is not a healthy scenario. BR5600T Aux. Input can be used for AC volt monitoring if not used for other functionality.
D. The measurement supply rated voltage availability at the BR5600T terminals should be within a specification given range. For higher voltage systems feedback, usage of Potential Transformers (PTs) is mandatory.
E. The measurement Current feedback should be from Class 1 accuracy (or better) measurement class CTs. The VA burden offered by BR5600T across its terminals is < 1VA. User is advised to use the right VA burden CT rating, depending upon the wire size and feedback wire length.
F. The capacitor Current feedback should be preferably from Class 0.5 accuracy (or better) measurement class CTs. The VA burden across the terminals is <1VA. User is advised to use the right VA burden CT rating, depending upon the CT usage (These CTs would be normally placed within the PF correction system).
G. The auxiliary supply to the unit should be within the specifications given range of 90V~ to 485V~. For Higher voltage systems, ensure the usage of step-down transformer for right Auxiliary Voltage values.

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COMMISSIONING INSTRUCTIONS:

Pre-Energizing instructions:

- CT secondary terminals (for measurement CTs and Capacitor current CTs) should always be kept shorted.
- Ensure that PF system is checked for all the routine tests like, wiring continuity and megger / HV insulation test.
- Ensure the right tightening of the Power Connection terminals and joints and lugs crimping.
- Keep the capacitor banks disconnected. (By either HRC fuse removal or SFU / MCCB / Circuit breaker in off condition).

Initial Energizing the Control supply:

- Switch ON the control section supply to PF correction system.
- Ensure the Power ON display on BR5600T.
- By pressing of LEFT key, the capacitor discharging can be defeated.
- Adjust the contrast of BR5600T by using LEFT or RIGHT keys and then pressing save key.
- In MODE SELECT => RESET TIME-VAL => DATA LOGGING RESET => Y and SAVE Key.
- Adjust on BR5600T, the “Rated supply voltage” and “Rated supply frequency” as per the supply system requirements.
- Adjust on BR5600T, the primary and secondary CT ratios of measurement current and capacitor current.
- Remove the shorting links of the CTs secondary circuit, so that CT secondary current flows through BR5600T terminals.
- In case of HV feedback requirements, adjust PT ratio and DT ratio.
- BR5600T display – “Overall Values” and “Phase Values” shows the right measurements. Ensure that the values seen on display match with the values seen with supply system energy meter / load manager instrument.
- Check all the Capacitor switches working by testing steps in “TEST CAPACITOR STEPS”.
- Ensure that all the capacitor VAR values are correctly entered (This can be done after energizing the unit too). Now adjust all EDIT parameters + SAVE on BR5600T as required.

Post-Energizing instructions:

- After Pre-Energizing process, turn-on the MCCB / Breakers / fuses for the capacitor banks.
- Keeping the BR5600T in “TEST CAPACITOR STEPS”, turn ON the Capacitor bank steps one by one. Check the capacitor current in all the three phases. (Can check by clamp on Ammeter or check on the display of BR5600T). Ensure the right current value depending upon the step VAR rating requirements.
- In case of EASY EDIT the Capacitor bank VAR values and correct Voltage / Current feedback synchronization be done with AUTO CONFIG (though its not recommended with highly fluctuating loading conditions – The possibility of Auto Config failure is high in this case)
- Sure way, in EASY or EXPERT EDIT, capacitor banks VAR values to be manually stored in BR5600T. Refer Annexure-A for capacitor bank VAR calculations.
- Check the Auxiliary Input function like ACV measurement value or any other assigned digital input function.
- Check the Auxiliary Outputs function assigned.

COMMISSIONING INSTRUCTIONS:

Continued …….

- Go to the MODE SELECT – SETUP WIRING function. Either use the Automatic or Manual Sync for ensuring that the supply is well synchronised. The synchronization correctness is checked by observing the right Per Phase Active & Reactive Power values and their sign +/-.
- In case BR5600T is set using EXPERT EDIT, ensure the right DATE / TIME is set on the unit.
- For communication related requirement, ensure the right Baud rate and unit ID is set on the unit. GPRS modem if connected, the right service provider and Server addresses are set.
- Put the unit in Automatic (Normal) operation and observe the automatic high speed Reactive Power compensation to the desired level. Observe the Power Factor is near the Target Power Factor setting.
- After the confirmation of Automatic operation, refinement adjustment for achieving better results through following Expert Edit parameters.
  – Correction & Discharge time.
  – No Action Band & Offset adjustments.

Observe the PF correction system for good performance for few hours.

FAULT FINDING GUIDELINES

Fault type	Probable reason	Action to take
Unit does not turn on	• Auxiliary supply is not connected. • Auxiliary supply out of range <90V~ or >485V~	• Check input supply for recovery. • Ensure the right voltage is applied to Aux. Supply
Unit does not switch on capacitors even if PF is below the Target PF limit value	• Improper Voltage & Current feedback synchronization • Any NTRIP or INS-X declared Faults are in action. • Unit Active Power w.r.t. rated Apparent Power is very low.	• Take various options for synchronization. • Clear the reasons for the fault detected. • This is OK. Just confirm that unit is within no action VAR band.
Error Messages appears and goes off	• Check the type of Error message and from operations manual the causes would be known	• Apply recommended action as for given error.
Unit Screen is totally dark or totally bright and Backlight is ON.	• Contrast for the LCD is not adjusted correctly	• Use Left & Right Arrow keys on the front of the unit with multiple presses, the issue should be resolved.
Any Communication or complex faults	• Adjustment & Configuration parameters are incorrectly done.	• Refer the details of this operations manual for corrective action.
RS-485 – MODBUS communication is not working	• Check RS-485 connection with incorrect practices. • Baud-rate is in-correct. Or communication settings incorrect • Specified values seen from communication are incorrect.	• Refer RS-485 connection with termination resistors and fan-out limits + distances. • Set the baud rate and communication settings by referring to given specs. • Refer the MODBUS Address table and data length + conversions.
While editing, some of the screens &/or parameters are not seen as given in operations manual	• Some other Parameters functionalities are preventing such value edits or prevents usage of functions.	• Check the functionality that is preventing edit operations. Decide if such functionality is out of product design scope by referring to this Operations manual.
Unit is totally in hanged state. Health indication LED slow blinking is not seen	• Hardware Error.	• Replace the unit with new one. Send faulty unit to Authorized service center.
RS-232 connected GPRS is not getting connected to network	• SIM card in Modem is not active • Network settings incorrect	• Activate SIM • Edit correct settings in Expert Edit.

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ANNEXURE-A

Capacitor Sizing at rated Voltage

In Power Factor Controllers (PFC), it's important to set the right values of Capacitor Banks (Steps) in terms of VAR (Volt-Amp-Reactive). The nameplate specified value of the capacitor may not be the value that is seen by the supply system. The reasons for such ambiguity are:

- The Rated Voltage of the Electrical supply system may not be the voltage at which the name plate VAR rating is defined.
- Capacitor Banks are connected in series with "Anti-resonant detuned Reactors". The effective VAR value of such inductor + capacitor combination gives different VAR value at supply system rated voltage. This would certainly be different than the capacitor name plate VAR rating.
- Capacitors used for Power Factor correction are of different types. Many types are self-healing type. Over a period of its usage, the value changes. This changed value of VAR would be different than the name plate rating.

The PFC efficiency to correct the electrical supply system Power Factor is depends upon how accurate the Capacitor banks VAR values are known. In case the Capacitor VAR values are incorrectly put, the following undesirable phenomena can / may be seen.

- Capacitor frequently turns ON and OFF. This is called hunting and reduces the life of the capacitors.
- Target Power Factor set on PFC may not be accurately achieved and would differ from system designed specifications.
- Capacitor Health monitoring carried out by PFC may declare the Capacitor Steps as faulty and would mask them for usage. This can hamper the Supply system Power Factor.

How to calculate the right rating of Capacitor Banks?

In case of Capacitors that are used without "Anti-Resonant Detuned Reactors", the formula is simple.

Capacitor Name Plate KVAR value = VAR1
VAR1 is defined on name plate at 3-ph L-L voltage = V_{L1}
Name plate supply frequency = fr.
Rated Voltage of supply system – 3-ph L-L voltage = V_R
Assume that Supply system frequency is same as rated frequency on the capacitor name plate.

Capacitor Step KVAR (setting on PFC) = VAR1 x $(V_R / V_{L1})^2$. (When used without series inductors.)

The formula becomes bit complex when Capacitor are used with "Anti-Resonant Detuned Reactors". It's important to know the value (Henry) of the reactor. The value is dependent upon:

1. Supply rated frequency – 50Hz or 60Hz and nominal supply voltage.
2. Value of Capacitor VAR at specified Voltage. (Note if specified voltage is L-L or L-N.)
3. If Detuning frequency is for 5th harmonics upward spectrum and moderately high harmonics thus using @ 7% drop reactors OR for 3rd harmonics upward spectrum and / or extra high harmonics thus using @ 14% drop reactors.
    a. For **50Hz**, detuning frequency for **7%** drop reactors usage is **189Hz**.
    b. For **50Hz**, detuning frequency for **14%** drop reactors usage is **134Hz**.
    c. For **60Hz**, detuning frequency for **7%** drop reactors usage is **227Hz**.
    d. For **60Hz**, detuning frequency for **14%** drop reactors usage is **161Hz**.

Once the information from the above 3 points is available, the inductor value and the overall Capacitor-Inductor combined VAR value at Nominal Supply Voltage can be calculated by standard formulae.

ANNEXURE – A

Capacitor Sizing at rated Voltage continued ……..

For calculations, the following data is to be checked and kept handy:

Rated Frequency of Supply	= f_R	
Nominal supply voltage Line-Line value	= V_{N-LL}	
Nominal supply voltage Line-Neutral	= V_{N-LN}	= (V_{N-LL} / √3)
Capacitor Nameplate KVAR value	= $CKVAR_{NP}$	
Capacitor Nameplate KVAR Voltage LL	= V_{CR-LL}	
Capacitor Nameplate KVAR Voltage LN	= V_{CR-LN}	= (V_{CR-LL} / √3)
Detuned Resonance Frequency	= f_{RES}	

Use the following formulae to calculate various needed parameters:

For 3-phase Balanced Capacitors:

Per Phase capacitor value (L-N) = (1000 x **$CKVAR_{NP}$) / (2** x π x **f_R** x **V_{CR-LL}^2)** Farad (unit)

Per Phase reactor value = f_R x **V_{CR-LL}^2 / (2** x π x **f_{RES}^2** x **$CKVAR_{NP}$** x **1000)** Henry (unit)

Capacitor KVAR 3-phase = (V_{N-LL} / V_{CR-LL})^2 x **$CKVAR_{NP}$ / [1 – (f_R / f_{RES})^2]** KVAR (unit)

For 1-phase Capacitors (Used for unbalanced Compensation):

Note: **$CKVAR_{NP}$** is the Single-phase capacitor Name Plate KVAR value.

Per Phase capacitor value (L-N) = (1000 x **$CKVAR_{NP}$) / (2** x π x **f_R** x **V_{CR-LN}^2)** Farad (unit)

Per Phase reactor value = f_R x **V_{CR-LN}^2 / (2** x π x **f_{RES}^2** x **$CKVAR_{NP}$** x **1000)** Henry (unit)

Capacitor KVAR 1-phase = (V_{N-LN} / V_{CR-LN})^2 x **$CKVAR_{NP}$ / [1 – (f_R / f_{RES})^2]** KVAR (unit)

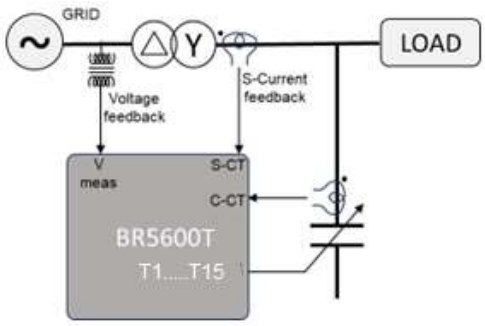
It is advisable to use the above specified formulae and find out the exact capacitor step VAR at Nominal Supply Voltage. The right value of Capacitors can ensure the efficient functioning of the Auto Power Factor Correction system.

ANNEXURE-B

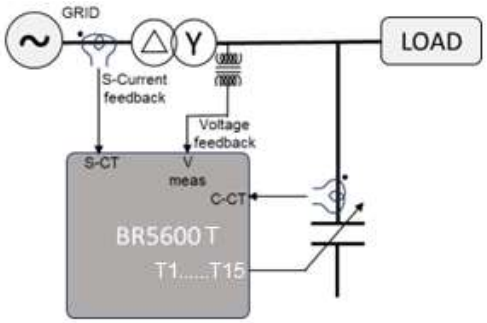
Voltage & Current Feedback Vector Group Selection

Consider the scheme where the supply measurement of Voltage and Current are on two different sides of the transformer. In such a scheme, the Capacitors are switched ON / OFF on the Lower Voltage (LV) side of the transformer.

As shown in the earlier part of the manual, the schemes can be:



H(V)L(A)
High Voltage fb-Low Voltage Ampere



L(V)H(A)
High Voltage Ampere-Low Voltage fb.

In the L(V)H(A) scheme, the voltage feedback can be direct (without PT) if the voltage range is within BR5600T voltage measurement range.

The Distribution transformer can be of various types and can have input voltage to output voltage phase angle relationship.
Based upon this phase relationship, transformers are declared as
DY-01 – 01 O'clock Phasor position - 030°
DY-05 – 05 O'clock Phasor position - 150°
DY-11 – 11 O'clock Phasor position - 330°
DY-07 – 07 O'clock Phasor position - 210°
DD-00 – 12 O'clock Phasor position - 000°
DD-06 – 06 O'clock Phasor position - 180°
YY-00 – 12 O'clock Phasor position - 000°
YY-06 – 06 O'clock Phasor position - 180°
And many more combinations with Z-winding & Scott-connected transformers with alternate set of phase angle relationships.

Thus, BR5600T can be configured for 000°, 030°, 060°……...300°, 330° phase angle relationships if the Voltage sensing and Current sensing is carried out on two different sides of the transformer. This would ensure the right power calculations and ensure desirable Power Factor correction. Users are advised to configure the correct phasor positioning angle.

When such feedback configurations are not used, the phase angle settings should be kept at 0°. i.e., sensing the Voltage and Current from the same supply bus (either HV bus OR LV bus). Anu other setting would cause the BR5600T to malfunction. Users are advised to take note of such settings.

ANNEXURE-C

Power Factor Settings + Offset + No Action VAR band

There are multiple settings provided in BR5600T.

- ✓ Target Power Factor (D-PF) Value.
- ✓ Target Power Factor selection for “Inductive” or “Capacitive”
- ✓ Smallest capacitor bank reactive power multiplying factor.
- ✓ Offset value to No action band around Target Power Factor.

The target PF settings are applicable to “Per Phase VAR control” (BR5600T) and “Overall VAR control”. The settings are applied to all the three phases in Per Phase VAR control.
Applications for Grid supply and Generator supply needs dual Target Power Factor settings. In such cases the settings for:

- ✓ Target Power Factor (D-PF) Value.
- ✓ Target Power Factor selection for “Inductive” or “Capacitive”

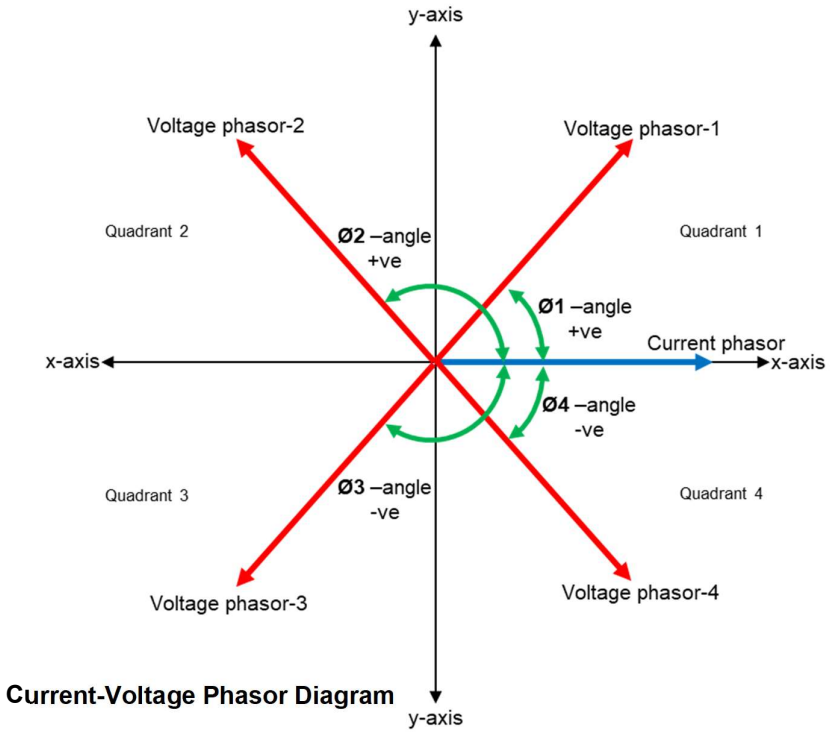
Are set with different values for Grid supply operation and Generator supply operation. Grid supply operation and Generator supply operation dual PF functionality is Enabled / Disabled through Auxiliary input settings.

The other two settings:

- ✓ Smallest capacitor bank reactive power multiplying factor.
- ✓ Offset value to No action band around Target Power Factor.

Is the same for Grid or Generator supply operations.

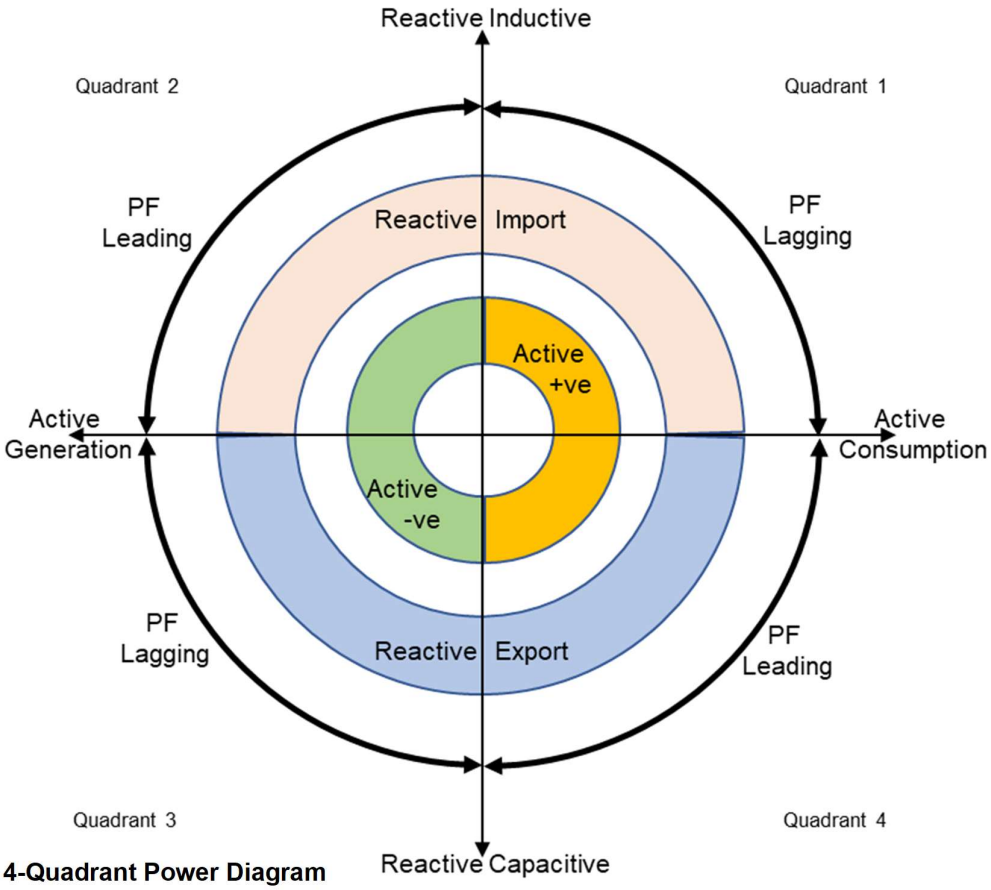
The Target Power Factor settings can best be explained by depicting it on the 4-Quadrant Voltage-Current and the Power Diagram.



Current-Voltage Phasor Diagram

ANNEXURE-C

Power Factor Settings + Offset + No Action VAR band Continued …….



4-Quadrant Power Diagram

Active Power "P" = V x I x cos(ø) is +ve in Quadrant 1 & Quadrant 4 / -ve in Quadrant 2 & Quadrant 3.
Reactive Power "Q" = V x I x sin(ø) is +ve in Quadrant 1 & Quadrant 2 / -ve in Quadrant 3 & Quadrant 4.
V-voltage value, I-current value, ø phase angle.

The Target PF settings for:

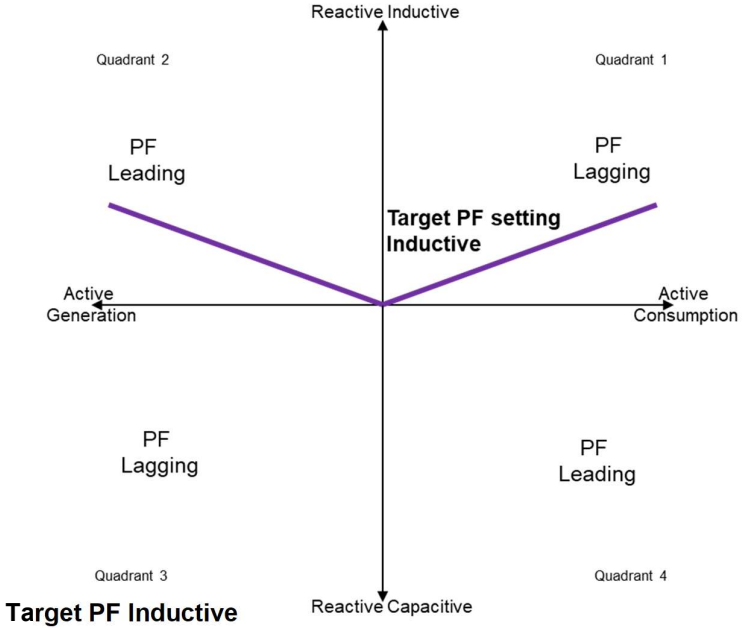
- Target Power Factor selection for "Inductive" or "Capacitive".

Thus, when the setting is Inductive, the Power Factor Controller (PFC) would be operating for maintaining Power Factor in Quadrant 1 and Quadrant 2.
When the setting is Capacitive, the PFC would be operating for maintaining Power Factor in Quadrant 4 and Quadrant 3.

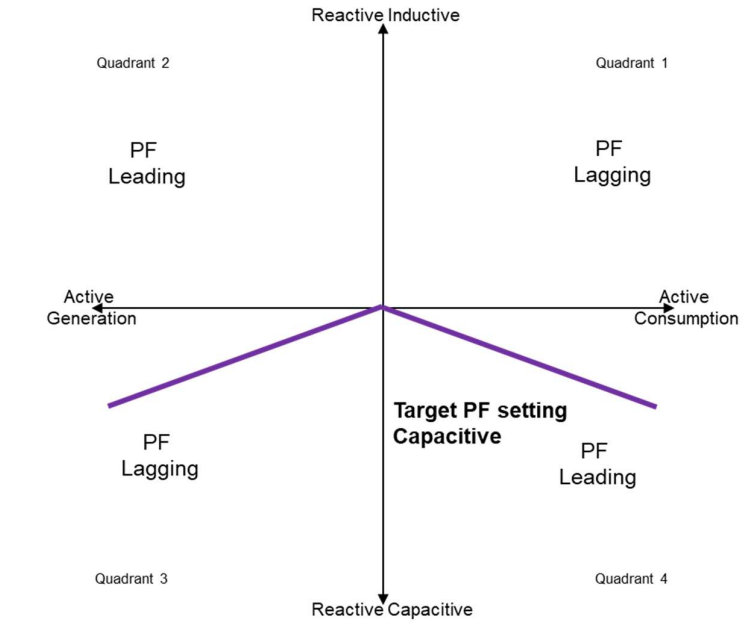
ANNEXURE-C

Power Factor Settings + Offset + No Action VAR band Continued …….

Following are the Various positions of Target PF settings for Inductive, Capacitive and Unity settings.



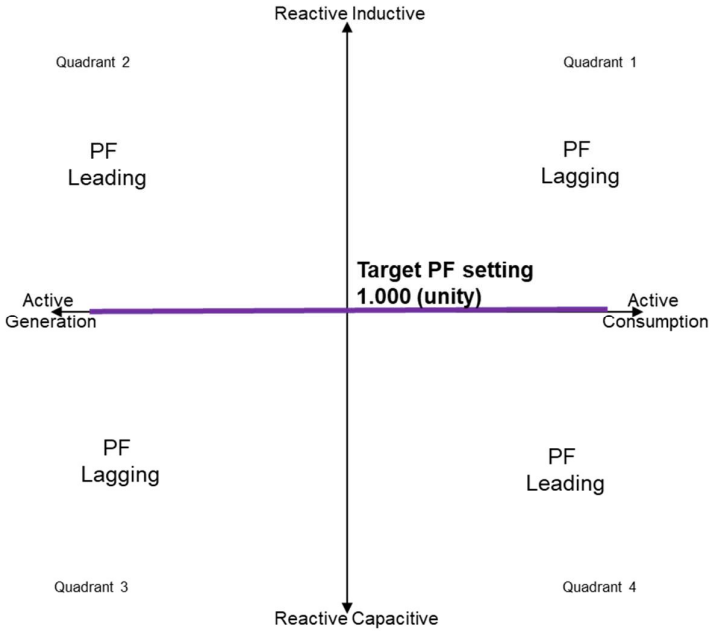
Target PF Inductive



Target PF Capacitive

ANNEXURE-C

Power Factor Settings + Offset + No Action VAR band Continued …….



Target PF 1.000 (unity)

The Value of Target PF - cos(ø) is adjustable from 1.000 to 0.000 on PFC. Based upon the cos(ø) value, the angle ø between the Target PF line and x-axis (P) would be seen on the Power diagram.

No Action Band around Target PF:

The primary objective of PFC units is to bring the Power Factor to the exact point on Target PF line. This is to be accomplished by adjusting the Reactive Power (Q) on the supply system. The Active Power (P) is due to connected load and PFC unit/s have no control on it.

The Reactive Power (Q) is adjusted by Switching-In and Switching-Out the Reactive components (like Capacitors, in some cases the Inductors). Most of the electrical loads depict inductive loading, therefore the Capacitors are used as Reactive components.

Capacitors of various ratings (VAR) are switched-in and switched-out by PFC. The action by PFC to control switching-in/out of capacitors is to bring the supply system Power Factor to exact value of Target Power Factor line. But this cannot be precisely carried out due to the minimum Capacitor VAR step size. Either Power Factor can be adjusted on inductive side of Target PF line or on capacitive side.
For an example:
If the smallest adjustable capacitor bank is 5 KVAR, and requirement to Target PF line is just 3 KVAR, then the best value that PFC can adjust is either switching-in 5 KVAR bank to get 2KVAR capacitive Q value or keeping 5 KVAR off to get 3KVAR inductive Q.

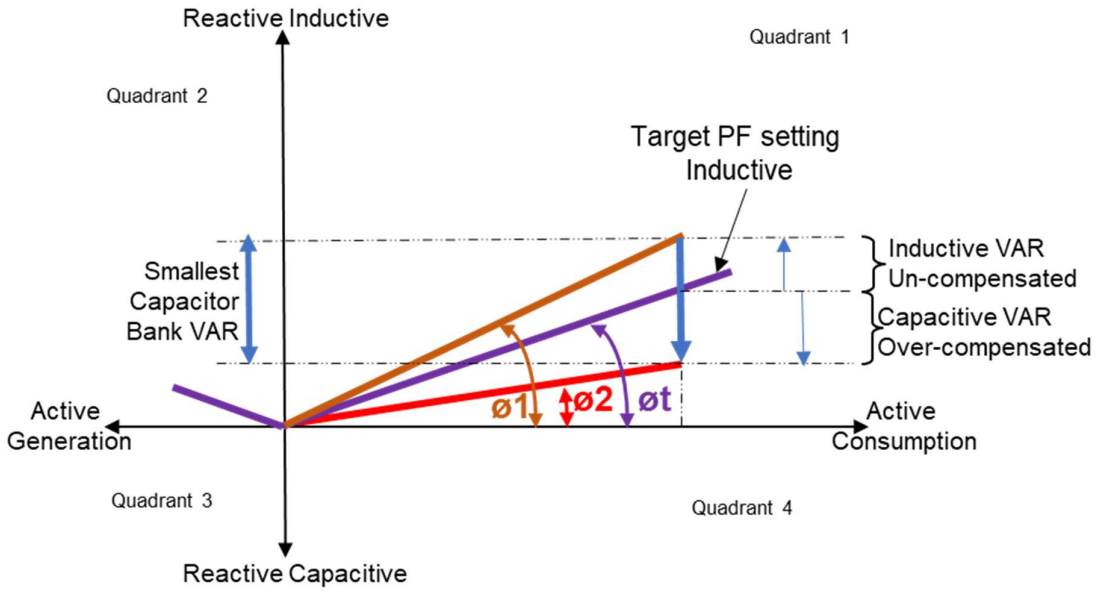
BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

ANNEXURE-C

Power Factor Settings + Offset + No Action VAR band Continued …….

This can be explained by the following diagram.



The supply Grid $PF_1 = \cos(ø1)$ when Capacitor Bank is disconnected
The supply Grid $PF_2 = \cos(ø2)$ when Capacitor Bank is connected
The user desired $PF_t = \cos(øt)$ that is "Target Power Factor"

One can see that when the Smallest Capacitor bank is inserted into Grid supply, the Power Factor is over-compensated. i.e., on the capacitive side of Target PF.
And when the Smallest Capacitor bank is disconnected from Grid supply, the Power Factor is under-compensated. i.e. on the inductive side of Target PF.

From the above explanation and example, its obvious that desired Target Power Factor can be either Over-compensated or Under-compensated. The amount of Over or Under Compensation depends upon the Smallest Capacitor bank Reactive Power VAR value.

Due to this phenomenon, the smallest capacitor would be switched On and switched Off on regular basis. (Depending upon the correction time cycle). Such continuous ON or OFF is "Undesirable Phenomenon". The reasons are:

- Reduction of Capacitor Life.
- Reduction of the Switching Contactor Life.
- Regular switching transients on the supply system.
- Regular maintenance of the PF correction system.

To prevent such undesirable phenomena, PFC creates a "NO Action VAR area" around the Target PF. Referred as **No Action Band**.

ANNEXURE-C

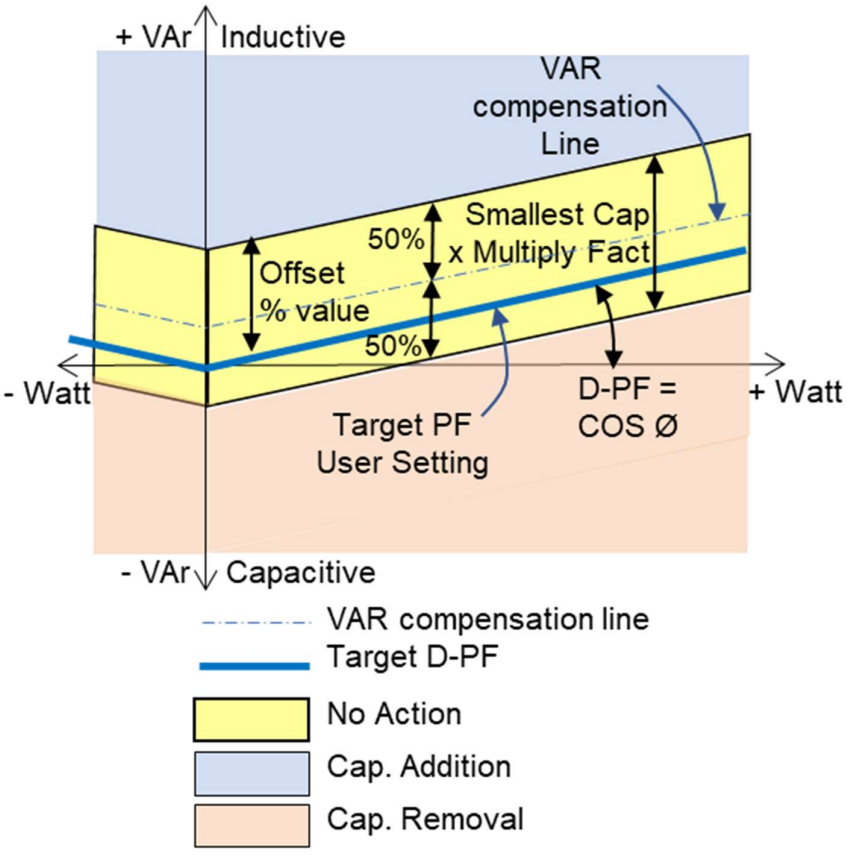
Power Factor Settings + Offset + No Action VAR band Continued …….

The requirements of such No Action Band are:

- ✓ Should be broader than or equal to the smallest capacitor bank VAR value.
- ✓ Should have the position flexibility to adjust its position around Target PF so that desired Power Factor is achieved as per supply Grid site condition.
- ✓ Users should have flexibility to adjust the No Action Band width and its position around the Target PF.

Adjustments of No Action Band:

Refer the diagram hereunder.



The settings on PFC to adjust the “No Action Band” are:

- ✓ Smallest capacitor bank reactive power multiplying factor.
- ✓ Offset value to No action band around Target Power Factor.

Smallest Capacitor Bank VAR X Multiplying Factor = No Action Band VAR value

ANNEXURE-C

Power Factor Settings + Offset + No Action VAR band Continued …….

Normally the "No Action Band VAR value" must be higher than the smallest capacitor bank to take care of VAR of smallest bank rising due to:

- ✓ Over-Voltage
- ✓ Over-Frequency
- ✓ Harmonics in capacitor

Therefore, multiplying factor adjustment range is ≥ 1.1

The Offset value default is 50%. This would be having the "No Action Band" to be equal on both the sides of the Target PF. (Inductive & Capacitive).
Increasing the value would shift the band on Inductive side and decreasing would shift the band on Capacitive side.
The Band shift is as per the site situation and electrical billing requirements.

Additionally note the "VAR compensation Line". This line depicts the line which is targeted by BR5600T for achieving the desired PF. With an offset value other than 50%, this value would be different than user defined Target Power Factor. Users are advised to set Target Power Factor accordingly to achieve the desired Target PF.

Influence of "No Action Band" on Supply Grid parameters:

- Power Factor on supply system may differ from Target Power Factor. The difference is due to "Smallest Capacitor Bank VAR value", "Multiplying Factor" and "Offset".
- At lower supply Grid loading condition, the value of Power Factor observed may differ substantially from the Target Power Factor.

Does this mean that "No Action Band" feature causes Poor Power Factor and increase the electricity Bills?
The answer is generally **NO**.

Performance ability is dependent upon the following factors.

- ✓ Smallest bank used in PF correction system and VAR adjustment "resolution".
- ✓ With unbalanced loading condition, ability to perform individual phases compensation.
- ✓ Under fluctuating load conditions, ability to perform fast switching operations.
- ✓ Harmonics on the supply system and PF correction system ability to block harmonics enhancement due to capacitors.

This means that the PFC feature of No Action Band is mandatory. But the efficient designing of the PF correction system is the key factor for Power Factor maintenance and reduced Electricity billing.

The Electricity bills are calculated on monthly Energy consumption. The values of Active, Reactive and Apparent Energy/s are used for calculation of Power Factor and KVAH units.

Therefore, during low loading conditions, the Power Factor may be low. But VAR on supply system too is low (Even though the PF is poor). This is because VAR value is still within the "No Action Band". Therefore, Reactive Energy KVARH during lower loading conditions rise is meniscal. Therefore, the impact on billing is negligible.

ANNEXURE-D

MODBUS Address Table

Read Addresses:

M: Meas. Config. C: Cap. Config.

Display Parameters													
3XXXX			Read From Registers										
All Registers: Floating type					1=Valid Value, 0=Invalid Value,-- =irrelevant								
Address		**SYM**	**Description**	R / W	M 1	M 2	M 3	M 4	C 3	C 2	C 1	C 0	
Dec	**Hex**				S-Measurement Configuration				C-Measurement Configuration				
30000	7530	FREQ	Supply Frequency	R	1	1	1	1	--	--	--	--	
30002	7532	1V	Phase 1 to Neutral RMS Voltage	R	1	0	0	0	--	--	--	--	
30004	7534	2V	Phase 2 to Neutral RMS Voltage	R	1	0	0	0	--	--	--	--	
30006	7536	3V	Phase 3 to Neutral RMS Voltage	R	1	0	0	0	--	--	--	--	
30008	7538	V	Avg Phase to Neutral RMS Voltage	R	1	0	0	1	--	--	--	--	
30010	753A	1V1	Phase 1 to N Fundamental Voltage	R	1	0	0	0	--	--	--	--	
30012	753C	2V1	Phase 2 to N Fundamental Voltage	R	1	0	0	0	--	--	--	--	
30014	753E	3V1	Phase 3 to N Fundamental Voltage	R	1	0	0	0	--	--	--	--	
30016	7540	V1	Avg Phase to N Fundamental Voltage	R	1	0	0	1	--	--	--	--	
30018	7542	12V	Phase 1 to Phase 2 RMS Voltage	R	1	1	0	0	--	--	--	--	
30020	7544	23V	Phase 2 to Phase 3 RMS Voltage	R	1	1	0	0	--	--	--	--	
30022	7546	31V	Phase 3 to Phase 1 RMS Voltage	R	1	1	0	0	--	--	--	--	
30024	7548	VL	Avg Phase to Phase RMS Voltage	R	1	1	1	0	--	--	--	--	
30026	754A	12V1	Phase 1 to Phase 2 Fund. Voltage	R	1	1	0	0	--	--	--	--	
30028	754C	23V1	Phase 2 to Phase 3 Fund. Voltage	R	1	1	0	0	--	--	--	--	
30030	754E	31V1	Phase 3 to Phase 1 Fund. Voltage	R	1	1	0	0	--	--	--	--	
30032	7550	VL1	Avg Phase to Phase Fund. Voltage	R	1	1	1	0	--	--	--	--	
30034	7552	1A	Phase 1 RMS Current	R	1	1	0	0	--	--	--	--	
30036	7554	2A	Phase 2 RMS Current	R	1	1	0	0	--	--	--	--	
30038	7556	3A	Phase 3 RMS Current	R	1	1	0	0	--	--	--	--	
30040	7558	A	Avg. Phase RMS Current	R	1	1	1	1	--	--	--	--	
30042	755A	NA	Neutral RMS Current	R	1	0	0	0	--	--	--	--	
30044	755C	1A1	Phase 1 Fundamental Current	R	1	1	0	0	--	--	--	--	
30046	755E	2A1	Phase 2 Fundamental Current	R	1	1	0	0	--	--	--	--	
30048	7560	3A1	Phase 3 Fundamental Current	R	1	1	0	0	--	--	--	--	
30050	7562	A1	Avg. Phase Fundamental Current	R	1	1	1	1	--	--	--	--	
30052	7564	NA1	Neutral Fundamental Current	R	1	0	0	0	--	--	--	--	
30054	7566	1CA	Phase 1 RMS Capacitor Current	R	--	--	--	--	1	1	1	1	
30056	7568	2CA	Phase 2 RMS Capacitor Current	R	--	--	--	--	1	1	0	0	
30058	756A	3CA	Phase 3 RMS Capacitor Current	R	--	--	--	--	1	1	0	0	
30060	756C	CA	Avg. Phase RMS Capacitor Current	R	--	--	--	--	1	1	0	0	
30062	756E	NCA	Capacitor Neutral / Earth Leakage Current	R	--	--	--	--	1	0	0	0	
30064	7570	1CA1	Phase 1 Fundamental Capacitor Current	R	--	--	--	--	1	1	1	1	
30066	7572	2CA1	Phase 2 Fundamental Capacitor Current	R	--	--	--	--	1	1	0	0	
30068	7574	3CA1	Phase 3 Fundamental Capacitor Current	R	--	--	--	--	1	1	0	0	
30070	7576	CA1	Avg. Phase Fund. Capacitor Current	R	--	--	--	--	1	1	0	0	
30072	7578	1P	Phase 1 RMS Active Power	R	1	1	0	0	--	--	--	--	
30074	757A	2P	Phase 2 RMS Active Power	R	1	1	0	0	--	--	--	--	
30076	757C	3P	Phase 3 RMS Active Power	R	1	1	0	0	--	--	--	--	
30078	757E	P	Total RMS Active Power	R	1	1	1	1	--	--	--	--	
30080	7580	1P1	Phase 1 Fundamental Active Power	R	1	1	0	0	--	--	--	--	
30082	7582	2P1	Phase 2 Fundamental Active Power	R	1	1	0	0	--	--	--	--	
30084	7584	3P1	Phase 3 Fundamental Active Power	R	1	1	0	0	--	--	--	--	
30086	7586	P1	Total fundamental Active Power	R	1	1	1	1	--	--	--	--	

ANNEXURE-D

MODBUS Address Table Continued …….

Read Addresses: (Continued)

M: Meas. Config. C: Cap. Config.

Display Parameters													
3XXXX		Read From Registers											
All Registers: Floating type					1=Valid Value, 0=Invalid Value,-- =irrelevant								
Address		**SYM**	**Description**	R / W	M 1	M 2	M 3	M 4	C 3	C 2	C 1	C 0	
Dec	**Hex**				S-Measurement Configuration				C-Measurement Configuration				
30088	7588	1Q	Phase 1 RMS Reactive Power	R	1	1	0	0	--	--	--	--	
30090	758A	2Q	Phase 2 RMS Reactive Power	R	1	1	0	0	--	--	--	--	
30092	758C	3Q	Phase 3 RMS Reactive Power	R	1	1	0	0	--	--	--	--	
30094	758E	Q	Total RMS Reactive Power	R	1	1	1	1	--	--	--	--	
30096	7590	1Q1	Phase 1 Fundamental Reactive Power	R	1	1	0	0	--	--	--	--	
30098	7592	2Q1	Phase 2 Fundamental Reactive Power	R	1	1	0	0	--	--	--	--	
30100	7594	3Q1	Phase 3 Fundamental Reactive Power	R	1	1	0	0	--	--	--	--	
30102	7596	Q1	Total Fundamental Reactive Power	R	1	1	1	1	--	--	--	--	
30104	7598	1S	Phase 1 RMS Apparent Power	R	1	1	0	0	--	--	--	--	
30106	759A	2S	Phase 2 RMS Apparent Power	R	1	1	0	0	--	--	--	--	
30108	759C	3S	Phase 3 RMS Apparent Power	R	1	1	0	0	--	--	--	--	
30110	759E	S	Total RMS Apparent Power	R	1	1	1	1	--	--	--	--	
30112	75A0	1S1	Phase 1 Fundamental Apparent Power	R	1	1	0	0	--	--	--	--	
30114	75A2	2S1	Phase 2 Fundamental Apparent Power	R	1	1	0	0	--	--	--	--	
30116	75A4	3S1	Phase 3 Fundamental Apparent Power	R	1	1	0	0	--	--	--	--	
30118	75A6	S1	Total Fundamental Apparent Power	R	1	1	1	1	--	--	--	--	
30136	75B8	1CQ	Phase 1 to Neutral RMS Reactive Power	R	--	--	--	--	1	1	0	0	
30138	75BA	2CQ	Phase 2 to Neutral RMS Reactive Power	R	--	--	--	--	1	1	0	0	
30140	75BC	3CQ	Phase 3 to Neutral RMS Reactive Power	R	--	--	--	--	1	1	0	0	
30142	75BE	CQ	Total Phase to N RMS Reactive Power	R	--	--	--	--	1	1	1	1	
30144	75C0	1CQ1	Phase 1 to N Fundamental Reactive Power	R	--	--	--	--	1	1	0	0	
30146	75C2	2CQ1	Phase 2 to N Fundamental Reactive Power	R	--	--	--	--	1	1	0	0	
30148	75C4	3CQ1	Phase 3 to N Fundamental Reactive Power	R	--	--	--	--	1	1	0	0	
30150	75C6	CQ1	Avg. Phase to N Fund. Reactive Power	R	--	--	--	--	1	1	1	1	
30152	75C8	1PF	Phase 1 Power Factor	R	1	1	0	0	--	--	--	--	
30154	75CA	2PF	Phase 2 Power Factor	R	1	1	0	0	--	--	--	--	
30156	75CC	3PF	Phase 3 Power Factor	R	1	1	0	0	--	--	--	--	
30158	75CE	PF	Overall, Power Factor	R	1	1	1	1	--	--	--	--	
30160	75D0	1DPF	Phase 1 Fundamental Power Factor	R	1	1	0	0	--	--	--	--	
30162	75D2	2DPF	Phase 2 Fundamental Power Factor	R	1	1	0	0	--	--	--	--	
30164	75D4	3DPF	Phase 3 Fundamental Power Factor	R	1	1	0	0	--	--	--	--	
30166	75D6	DPF	Overall Fundamental Power Factor	R	1	1	1	1	--	--	--	--	
30168	75D8	HR	RTCC Hours in 24 Hours Format	R	1	1	1	1	1	1	1	1	
30170	75DA	MIN	RTCC Minutes	R	1	1	1	1	1	1	1	1	
30172	75DC	SEC	RTCC Seconds	R	1	1	1	1	1	1	1	1	
30174	75DE	DAY	RTCC Weekday (not in present version)	R	1	1	1	1	1	1	1	1	
30176	75E0	DD	RTCC Calendar Date	R	1	1	1	1	1	1	1	1	
30178	75E2	MM	RTCC Calendar Month	R	1	1	1	1	1	1	1	1	
30180	75E4	YYYY	RTCC Calendar Year	R	1	1	1	1	1	1	1	1	
30186	75EA	1V_Max	Phase 1 to N RMS Voltage-Max. Recorded	R	1	0	0	1	--	--	--	--	
30188	75EC	2V_Max	Phase 2 to N RMS Voltage-Max. Recorded	R	1	0	0	0	--	--	--	--	
30190	75EE	3V_Max	Phase 3 to N RMS Voltage-Max. Recorded	R	1	0	0	0	--	--	--	--	
30202	75FA	12V_Max	Phase 12 L - L - rms Voltage max. value	R	1	1	0	0	--	--	--	--	
30204	75FC	23V_Max	Phase 23 L - L - rms Voltage max. value	R	1	1	1	0	--	--	--	--	
30206	75FE	31V_Max	Phase 31 L - L - rms Voltage max. value	R	1	1	0	0	--	--	--	--	

ANNEXURE-D

MODBUS Address Table Continued …….

Read Addresses: (Continued)

M: Meas. Config. C: Cap. Config.

Display Parameters													
3XXXX		Read From Registers											
All Registers: Floating type					1=Valid Value, 0=Invalid Value,-- =irrelevant								
Address		**SYM**	**Description**	R / W	M 1	M 2	M 3	M 4	C 3	C 2	C 1	C 0	
Dec	**Hex**				S-Measurement Configuration				C-Measurement Configuration				
30218	760A	1A_Max	Phase 1 current rms maximum value	R	1	1	1	1	--	--	--	--	
30220	760C	2A_Max	Phase 2 current rms maximum value	R	1	1	0	0	--	--	--	--	
30222	760E	3A_Max	Phase 3 current rms maximum value	R	1	1	0	0	--	--	--	--	
30226	7612	NA_Max	Neutral current rms maximum value	R	1	0	0	0	--	--	--	--	
30238	761E	1CA_Max	Cap. Phase 1 current rms max. value	R	--	--	--	--	1	1	1	1	
30240	7620	2CA_Max	Cap. Phase 2 current rms max. value	R	--	--	--	--	1	1	0	0	
30242	7622	3CA_Max	Cap. Phase 3 current rms max. value	R	--	--	--	--	1	1	0	0	
30256	7630	1P_Max	Phase 1 active power rms max. value	R	1	1	0	0	--	--	--	--	
30258	7632	2P_Max	Phase 2 active power rms max. value	R	1	1	0	0	--	--	--	--	
30260	7634	3P_Max	Phase 3 active power rms max. value	R	1	1	0	0	--	--	--	--	
30262	7636	P_Max	Total active power rms max. value	R	1	1	1	1	--	--	--	--	
30264	7638	1P1_Max	Phase 1 active power fund. Max. value	R	1	1	0	0	--	--	--	--	
30266	763A	2P1_Max	Phase 2 active power fund. Max. value	R	1	1	0	0	--	--	--	--	
30268	763C	3P1_Max	Phase 3 active power fund. Max. value	R	1	1	0	0	--	--	--	--	
30270	763E	P1_Max	Total 1 active power fund. Max. value	R	1	1	1	1	--	--	--	--	
30272	7640	1Q_Max	Phase 1 reactive power rms max. value	R	1	1	0	0	--	--	--	--	
30274	7642	2Q_Max	Phase 2 reactive power rms max. value	R	1	1	0	0	--	--	--	--	
30276	7644	3Q_Max	Phase 3 reactive power rms max. value	R	1	1	0	0	--	--	--	--	
30278	7646	Q_Max	Total reactive power rms max. value	R	1	1	1	1	--	--	--	--	
30280	7648	1Q1_Max	Phase 1 reactive power fund. Max. value	R	1	1	0	0	--	--	--	--	
30282	764A	2Q1_Max	Phase 2 reactive power fund. Max. value	R	1	1	0	0	--	--	--	--	
30284	764C	3Q1_Max	Phase 3 reactive power fund. Max. value	R	1	1	0	0	--	--	--	--	
30286	764E	Q1_Max	Total reactive power fund. Max. value	R	1	1	1	1	--	--	--	--	
30288	7650	1S_Max	Phase 1 apparent power rms max. value	R	1	1	0	0	--	--	--	--	
30290	7652	2S_Max	Phase 2 apparent power rms max. value	R	1	1	0	0	--	--	--	--	
30292	7654	3S_Max	Phase 3 apparent power rms max. value	R	1	1	0	0	--	--	--	--	
30294	7656	S_Max	Total apparent power rms max. value	R	1	1	1	1	--	--	--	--	
30296	7658	1S1_Max	Phase 1 apparent power fund. Max. value	R	1	1	0	0	--	--	--	--	
30298	765A	2S1_Max	Phase 2 apparent power fund. Max. value	R	1	1	0	0	--	--	--	--	
30300	765C	3S1_Max	Phase 3 apparent power fund. Max. value	R	1	1	0	0	--	--	--	--	
30302	765E	S1_Max	Total apparent power fund. Max. value	R	1	1	1	1	--	--	--	--	
30352	7690	MDW	Maximum Demand recorded in Watt	R	1	1	1	1	--	--	--	--	
30354	7692	MDV	Maximum Demand recorded in VA	R	1	1	1	1	--	--	--	--	
30356	7694	FB1	Fault Double-Word Record 1	R	1	1	1	1	1	1	1	1	
30358	7696	FB2	Fault Double-Word Record 2	R	1	1	1	1	1	1	1	1	
30360	7698	FB3	Fault Double-Word Record 3	R	1	1	1	1	1	1	1	1	
30362	769A	FB4	Fault Double-Word Record 4	R	1	1	1	1	1	1	1	1	
30364	769C	CVAR1	Step 1 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30366	769E	CVAR2	Step 2 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30368	76A0	CVAR3	Step 3 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30370	76A2	CVAR4	Step 4 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30372	76A4	CVAR5	Step 5 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30374	76A6	CVAR6	Step 6 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30376	76A8	CVAR7	Step 7 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	

ANNEXURE-D

MODBUS Address Table Continued …….

Read Addresses: (Continued)

M: Meas. Config. C: Cap. Config.

Display Parameters													
3XXXX		Read From Registers											
All Registers: Floating type					1=Valid Value, 0=Invalid Value,-- =irrelevant								
Address		**SYM**	**Description**	R / W	M 1	M 2	M 3	M 4	C 3	C 2	C 1	C 0	
Dec	**Hex**				S-Measurement Configuration				C-Measurement Configuration				
30378	76AA	CVAR8	Step 8 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30380	76AC	CVAR9	Step 9 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30382	76AE	CVAR10	Step 10 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30384	76B0	CVAR11	Step 11 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30386	76B2	CVAR12	Step 12 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30388	76B4	CVAR13	Step 13 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30390	76B6	CVAR14	Step 14 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30392	76B8	CVAR15	Step 15 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30394	76BA	CVAR16	Step 16 Cap. Bank recorded VAR value	R	1	1	1	1	1	1	1	1	
30396	76BC	UC1	Step 1 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30398	76BE	UC2	Step 2 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30400	76C0	UC3	Step 3 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30402	76C2	UC4	Step 4 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30404	76C4	UC5	Step 5 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30406	76C6	UC6	Step 6 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30408	76C8	UC7	Step 7 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30410	76CA	UC8	Step 8 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30412	76CC	UC9	Step 9 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30414	76CE	UC10	Step 10 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30416	76D0	UC11	Step 11 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30418	76D2	UC12	Step 12 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30420	76D4	UC13	Step 13 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30422	76D6	UC14	Step 14 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30424	76D8	UC15	Step 15 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30426	76DA	UC16	Step 16 Cap. Bank Utilization counter	R	1	1	1	1	1	1	1	1	
30428	76DC	SCp1	Status Of Capacitor Step 1	R	1	1	1	1	--	--	--	--	
30430	76DE	SCp2	Status Of Capacitor Step 2	R	1	1	1	1	--	--	--	--	
30432	76E0	SCp3	Status Of Capacitor Step 3	R	1	1	1	1	--	--	--	--	
30434	76E2	SCp4	Status Of Capacitor Step 4	R	1	1	1	1	--	--	--	--	
30436	76E4	SCp5	Status Of Capacitor Step 5	R	1	1	1	1	--	--	--	--	
30438	76E6	SCp6	Status Of Capacitor Step 6	R	1	1	1	1	--	--	--	--	
30440	76E8	SCp7	Status Of Capacitor Step 7	R	1	1	1	1	--	--	--	--	
30442	76EA	SCp8	Status Of Capacitor Step 8	R	1	1	1	1	--	--	--	--	
30444	76EC	SCp9	Status Of Capacitor Step 9	R	1	1	1	1	--	--	--	--	
30446	76EE	SCp10	Status Of Capacitor Step 10	R	1	1	1	1	--	--	--	--	
30448	76F0	SCp11	Status Of Capacitor Step 11	R	1	1	1	1	--	--	--	--	
30450	76F2	SCp12	Status Of Capacitor Step 12	R	1	1	1	1	--	--	--	--	
30452	76F4	SCp13	Status Of Capacitor Step 13	R	1	1	1	1	--	--	--	--	
30454	76F6	SCp14	Status Of Capacitor Step 14	R	1	1	1	1	--	--	--	--	
30456	76F8	SCp15	Status Of Capacitor Step 15	R	1	1	1	1	--	--	--	--	
30458	76FA	SCp16	Status Of Capacitor Step 16	R	1	1	1	1	--	--	--	--	
30460	76FC	ACV	Auxiliary Input AC voltage value	R	1	1	1	1	1	1	1	1	
30462	76FE	ACVS	Auxiliary Input Digital status (Logic "0"or"1")	R	1	1	1	1	1	1	1	1	
30464	7700	GPRS_SIG	GPRS Modem Signal Strength Indication	R	1	1	1	1	--	--	--	--	

ANNEXURE-D

MODBUS Address Table Continued …….

Read Addresses: (Continued)

M: Meas. Config. C: Cap. Config.

Display Parameters													
3XXXX		Read From Registers											
All Registers: Floating type					1=Valid Value, 0=Invalid Value,-- =irrelevant								
Address		**SYM**	**Description**	R / W	M 1	M 2	M 3	M 4	C 3	C 2	C 1	C 0	
Dec	**Hex**				S-Measurement Configuration				C-Measurement Configuration				
30466	7702	INTR_PTR	Data log Interval pointer	R	1	1	1	1	--	--	--	--	
30468	7704	EVT_PTR	Data log Event / Fault pointer	R	1	1	1	1	--	--	--	--	
30470	7706	DAY_PTR	Data log Daily Rec. Ptr.(For future versions)	R	1	1	1	1	--	--	--	--	
30472	7708	GPRS_INTR_PTR	GPRS Interval Records Pointer	R	1	1	1	1	--	--	--	--	
30474	770A	GPRS_EVT_PTR	GPRS Event / Fault Records Pointer	R	1	1	1	1	--	--	--	--	
30476	770C	GPRS_DAY_PTR	GPRS Daily Rec. Ptr. (For future versions)	R	1	1	1	1	--	--	--	--	
30478	770E	MCU_T	Micro-Controller Internal Temperature	R	1	1	1	1	1	1	1	1	
30480	7710	EXT_T	APFC Ext. Temp. sensed by PT-100	R	1	1	1	1	1	1	1	1	
30482	7712	1V_THDF	Phase 1 Voltage THD-F value in volts	R	1	0	0	0	--	--	--	--	
30484	7714	2V_THDF	Phase 2 Voltage THD-F value in volts	R	1	0	0	0	--	--	--	--	
30486	7716	3V_THDF	Phase 3 Voltage THD-F value in volts	R	1	0	0	0	--	--	--	--	
30488	7718	V_THDF	Average Voltage THD-F value in volts	R	1	0	0	1	--	--	--	--	
30490	771A	12V_THDF	Phase 1-2 Voltage THD-F value in volts	R	1	1	0	0	--	--	--	--	
30492	771C	23V_THDF	Phase 2-3 Voltage THD-F value in volts	R	1	1	0	0	--	--	--	--	
30494	771E	31V_THDF	Phase 3-1 Voltage THD-F value in volts	R	1	1	0	0	--	--	--	--	
30496	7720	VL_THDF	L-L average Voltage THD-F value in volts	R	1	1	1	0	--	--	--	--	
30498	7722	1A_THDF	Phase 1- Current THD-F value in ampere	R	1	1	0	0	--	--	--	--	
30500	7724	2A_THDF	Phase 2- Current THD-F value in ampere	R	1	1	0	0	--	--	--	--	
30502	7726	3A_THDF	Phase 3- Current THD-F value in ampere	R	1	1	0	0	--	--	--	--	
30504	7728	A_THDF	Average Current THD-F value in ampere	R	1	1	1	1	--	--	--	--	
30508	772C	1CA_THDF	Capacitor Phase 1 current THD-F in Amp.	R	--	--	--	--	1	1	0	--	
30510	772E	2CA_THDF	Capacitor Phase 2 current THD-F in Amp.	R	--	--	--	--	1	1	0	--	
30512	7730	3CA_THDF	Capacitor Phase 3 current THD-F in Amp.	R	--	--	--	--	1	1	0	--	
30514	7732	CA_THDF	Capacitor average current THD-F in Amp.	R	--	--	--	--	1	1	1	--	
30516	7734	NCA_THDF	Cap. Earth/N current THD-F amp. (not now)	R	--	--	--	--	1	0	0	--	
30518	7736	1D	Phase 1 Distortion Power (VA)	R	1	1	0	0	--	--	--	--	
30520	7738	2D	Phase 2 Distortion Power (VA)	R	1	1	0	0	--	--	--	--	
30522	773A	3D	Phase 3 Distortion Power (VA)	R	1	1	0	0	--	--	--	--	
30524	773C	D	Three phase Distortion Power (VA)	R	1	1	1	1	--	--	--	--	
30526	773E	1Dx	Phase 1 Cross Distortion Power (VA)	R	1	1	0	0	--	--	--	--	
30528	7740	2Dx	Phase 2 Cross Distortion Power (VA)	R	1	1	0	0	--	--	--	--	
30530	7742	3Dx	Phase 3 Cross Distortion Power (VA)	R	1	1	0	0	--	--	--	--	
30532	7744	Dx	Total 3 phases Cross Distortion Power (VA)	R	1	1	1	1	--	--	--	--	
30534	7746	1V_%THDF	Phase 1 Voltage THD-F %	R	1	0	0	0	--	--	--	--	
30536	7748	2V_%THDF	Phase 2 Voltage THD-F %	R	1	0	0	0	--	--	--	--	
30538	774A	3V_%THDF	Phase 3 Voltage THD-F %	R	1	0	0	0	--	--	--	--	
30540	774C	V_%THDF	Average Ph-N Voltage THD-F %	R	1	0	0	1	--	--	--	--	
30542	774E	12V_%THDF	Phase 1-2 Voltage THD-F %	R	1	1	0	0	--	--	--	--	
30544	7750	23V_%THDF	Phase 2-3 Voltage THD-F %	R	1	1	0	0	--	--	--	--	
30546	7752	31V_%THDF	Phase 3-1 Voltage THD-F %	R	1	1	0	0	--	--	--	--	
30548	7754	VL_%THDF	Average L-L Voltage THD-F %	R	1	1	1	0	--	--	--	--	
30550	7756	1A_%THDF	Phase 1 Current THD-F %	R	1	1	0	0	--	--	--	--	
30552	7758	2A_%THDF	Phase 2 Current THD-F %	R	1	1	0	0	--	--	--	--	
30554	775A	3A_%THDF	Phase 3 Current THD-F %	R	1	1	0	0	--	--	--	--	

ANNEXURE-D

MODBUS Address Table Continued …….

Read Addresses: (Continued)

M: Meas. Config. C: Cap. Config.

Display Parameters													
3XXXX		Read From Registers											
All Registers: Floating type					1=Valid Value, 0=Invalid Value,-- =irrelevant								
Address		**SYM**	**Description**	R / W	M 1	M 2	M 3	M 4	C 3	C 2	C 1	C 0	
Dec	**Hex**				S-Measurement Configuration				C-Measurement Configuration				
30556	775C	A_%THDF	Average Current THD-F %	R	1	1	1	1	--	--	--	--	
30560	7760	1CA_%THDF	Capacitor Phase 1 current THD-F %	R	--	--	--	--	1	1	0	0	
30562	7762	2CA_%THDF	Capacitor Phase 2 current THD-F %	R	--	--	--	--	1	1	0	0	
30564	7764	3CA_%THDF	Capacitor Phase 3 current THD-F %	R	--	--	--	--	1	1	0	0	
30566	7766	CA_%THDF	Capacitor average current THD-F %	R	--	--	--	--	1	1	1	1	
30570	776A	1A_%TDD	Phase 1 Current TDD%	R	1	1	0	0	--	--	--	--	
30572	776C	2A_%TDD	Phase 2 Current TDD%	R	1	1	0	0	--	--	--	--	
30574	776E	3A_%TDD	Phase 3 Current TDD%	R	1	1	0	0	--	--	--	--	
30576	7770	A_%TDD	Average Current TDD%	R	1	1	1	1	--	--	--	--	
30578	7772	NA_%TDD	Neutral Current TDD%	R	1	0	0	0	--	--	--	--	
30580	7774	1CA_%TDD	Cap. Phase 1 Current TDD%	R	--	--	--	--	1	1	0	0	
30582	7776	2CA_%TDD	Cap. Phase 2 Current TDD%	R	--	--	--	--	1	1	0	0	
30584	7778	3CA_%TDD	Cap. Phase 3 Current TDD%	R	--	--	--	--	1	1	0	0	
30586	777A	CA_%TDD	Cap. Average Current TDD%	R	--	--	--	--	1	1	1	1	

Capacitor Bank Status	
0	Not Used
1	Bank OFF
2	Bank ON
3	Bank Discharging
4	Faulty
5	Fix OFF
6	FIX ON
7	FIX Discharging
8	FIX Faulty

ANNEXURE-D

MODBUS Address Table Continued …….

Read / Write Addresses:

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	**Hex**			
40000	9C40	ES_EnDs	Easy Setup Enable/Disable Config	RW
40002	9C42	ES_RV_LL	Easy Setup Rated Voltage Line to Line	RW
40004	9C44	ES_Freq	Easy Setup Rated Frequency	RW
40006	9C46	ES_SPri	Easy Setup Supply CT Primary Amps	RW
40008	9C48	ES_SSec	Easy Setup Supply CT Secondary Amps	RW
40010	9C4A	ES_CPri	Easy Setup Capacitor CT Primary Amps	RW
40012	9C4C	ES_CSec	Easy Setup Capacitor CT Secondary Amps	RW
40014	9C4E	ES_STEP1	Easy Setup Step 1 kVAr	RW
40016	9C50	ES_STEP2	Easy Setup Step 2 kVAr	RW
40018	9C52	ES_STEP3	Easy Setup Step 3 kVAr	RW
40020	9C54	ES_STEP4	Easy Setup Step 4 kVAr	RW
40022	9C56	ES_STEP5	Easy Setup Step 5 kVAr	RW
40024	9C58	ES_STEP6	Easy Setup Step 6 kVAr	RW
40026	9C5A	ES_STEP7	Easy Setup Step 7 kVAr	RW
40028	9C5C	ES_STEP8	Easy Setup Step 8 kVAr	RW
40030	9C5E	ES_STEP9	Easy Setup Step 9 kVAr	RW
40032	9C60	ES_STEP10	Easy Setup Step 10 kVAr	RW
40034	9C62	ES_STEP11	Easy Setup Step 11 kVAr	RW
40036	9C64	ES_STEP12	Easy Setup Step 12 kVAr	RW
40038	9C66	ES_STEP13	Easy Setup Step 13 kVAr	RW
40040	9C68	ES_STEP14	Easy Setup Step 14 kVAr	RW
40042	9C6A	ES_STEP15	Easy Setup Step 15 kVAr	RW
40044	9C6C	ES_STEP16	Easy Setup Step 16 kVAr	RW
40046	9C6E	ES_Target	Easy Setup Target DPF	RW
40048	9C70	ES_Target_Sign	Easy Setup Target DPF Sign(0-Capacitive, 1-Inductive)	RW
40050	9C72	Step_Control1	Manual Mode Step Control	RW
40052	9C74	STEP1_UsageR	Step 1 Usages Reset	RW
40054	9C76	STEP2_UsageR	Step 2 Usages Reset	RW
40056	9C78	STEP3_UsageR	Step 3 Usages Reset	RW
40058	9C7A	STEP4_UsageR	Step 4 Usages Reset	RW
40060	9C7C	STEP5_UsageR	Step 5 Usages Reset	RW
40062	9C7E	STEP6_UsageR	Step 6 Usages Reset	RW
40064	9C80	STEP7_UsageR	Step 7 Usages Reset	RW
40066	9C82	STEP8_UsageR	Step 8 Usages Reset	RW
40068	9C84	STEP9_UsageR	Step 9 Usages Reset	RW
40070	9C86	STEP10_UsageR	Step 10 Usages Reset	RW
40072	9C88	STEP11_UsageR	Step 11 Usages Reset	RW
40074	9C8A	STEP12_UsageR	Step 12 Usages Reset	RW
40076	9C8C	STEP13_UsageR	Step 13 Usages Reset	RW
40078	9C8E	STEP14_UsageR	Step 14 Usages Reset	RW
40080	9C90	STEP15_UsageR	Step 15 Usages Reset	RW
40082	9C92	STEP16_UsageR	Step 16 Usages Reset	RW
40084	9C94	STEP1_ValR	Step 1 Value Reset	RW
40086	9C96	STEP2_ValR	Step 2 Value Reset	RW

ANNEXURE-D

MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	**Hex**			
40088	9C98	STEP3_ValR	Step 3 Value Reset	RW
40090	9C9A	STEP4_ValR	Step 4 Value Reset	RW
40092	9C9C	STEP5_ValR	Step 5 Value Reset	RW
40094	9C9E	STEP6_ValR	Step 6 Value Reset	RW
40096	9CA0	STEP7_ValR	Step 7 Value Reset	RW
40098	9CA2	STEP8_ValR	Step 8 Value Reset	RW
40100	9CA4	STEP9_ValR	Step 9 Value Reset	RW
40102	9CA6	STEP10_ValR	Step 10 Value Reset	RW
40104	9CA8	STEP11_ValR	Step 11 Value Reset	RW
40106	9CAA	STEP12_ValR	Step 12 Value Reset	RW
40108	9CAC	STEP13_ValR	Step 13 Value Reset	RW
40110	9CAE	STEP14_ValR	Step 14 Value Reset	RW
40112	9CB0	STEP15_ValR	Step 15 Value Reset	RW
40114	9CB2	STEP16_ValR	Step 16 Value Reset	RW
40116	9CB4	Energy_Rst	Energy Reset	RW
40118	9CB6	Energy_RHr	Energy Reset Hr	RW
40120	9CB8	Energy_RMn	Energy Reset Min	RW
40122	9CBA	Energy_Rday	Energy Reset Date	RW
40124	9CBC	MD_Rst	Max. Demand Reset	RW
40126	9CBE	MD_RHr	Max. Demand Reset Hr	RW
40128	9CC0	MD_RMn	Max. Demand Reset Min	RW
40130	9CC2	MD_Rday	Max. Demand Reset Date	RW
40132	9CC4	MAX_Rst	Max. Value Reset	RW
40134	9CC6	MAX_RHr	Max. Value Reset Hr	RW
40136	9CC8	MAX_RMn	Max. Value Reset Min	RW
40138	9CCA	MAX_Rday	Max. Value Reset Date	RW
40140	9CCC	Data_LogR	Data Logging Erase	RW
40142	9CCE	Fact_R	Factory Default	RW
40144	9CD0	WP1	Phase 1 Wiring Position	RW
40146	9CD2	WP1_Sign	Phase 1 Wiring Position Sign	RW
40148	9CD4	WP2	Phase 2 Wiring Position	RW
40150	9CD6	WP2_Sign	Phase 2 Wiring Position Sign	RW
40152	9CD8	WP3	Phase 3 Wiring Position	RW
40154	9CDA	WP3_Sign	Phase 3 Wiring Position Sign	RW
40156	9CDC	WP1	Phase 1 Cap. Wiring Position	RW
40158	9CDE	WP1_Sign	Phase 1 Cap. Wiring Position Sign	RW
40160	9CE0	WP2	Phase 2 Cap. Wiring Position	RW
40162	9CE2	WP2_Sign	Phase 2 Cap. Wiring Position Sign	RW
40164	9CE4	WP3	Phase 3 Cap. Wiring Position	RW
40166	9CE6	WP3_Sign	Phase 3 Cap. Wiring Position Sign	RW
40168	9CE8	Auto Setup	Auto Sync. Start	RW
40170	9CEA	EX_RV	Expert Setup Mains VA Config	RW
40172	9CEC	EX_RV_Type	Expert Setup Cap. CT Config	RW
40174	9CEE	EX_RV	Expert Setup Rated Voltage	RW

ANNEXURE-D

MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	**Hex**			
40176	9CF0	EX_RV_Type	Expert Setup Rated Voltage Type	RW
40178	9CF2	EX_PTR	Expert Setup PT Ratio	RW
40180	9CF4	EX_DTR	Expert Setup DT Ratio	RW
40182	9CF6	EX_SPri	Expert Setup Supply CT Primary Amps	RW
40184	9CF8	EX_SSec	Expert Setup Supply CT Secondary Amps	RW
40186	9CFA	EX_CPri	Expert Setup Capacitor CT Primary Amps	RW
40188	9CFC	EX_CSec	Expert Setup Capacitor CT Secondary Amps	RW
40190	9CFE	EX_Freq	Expert Setup Rated Frequency	RW
40192	9D00	VECTER_GP	VA-Vector Group	RW
40194	9D02	MD_WT	MD_Window Time (Min)	RW
40196	9D04	EX_MTarget	Expert Setup Mains Target DPF	RW
40198	9D06	EX_MTarget_Sign	Expert Setup Mains Target DPF Sign (0-Capacitive, 1-Inductive)	RW
40200	9D08	EX_GTarget	Expert Setup Generator Target DPF	RW
40202	9D0A	EX_GTarget_Sign	Expert Setup Generator Target DPF Sign (0-Cap., 1-Ind.)	RW
40204	9D0C	RES	Correction Resolution (multiplying factor to smallest bank)	RW
40206	9D0E	OFF	Offeset	RW
40208	9D10	CRR_Time	Correction Time	RW
40210	9D12	CRR_Type	Correction Type	RW
40212	9D14	DIS_Time	Discharge Time	RW
40214	9D16	INT_Time	Interleaving Time	RW
40216	9D18	CFG_Type	Step Config Type	RW
40218	9D1A	EX_STEP1	Expert Setup Step 1 VAr	RW
40220	9D1C	EX_STEP2	Expert Setup Step 2 VAr	RW
40222	9D1E	EX_STEP3	Expert Setup Step 3 VAr	RW
40224	9D20	EX_STEP4	Expert Setup Step 4 VAr	RW
40226	9D22	EX_STEP5	Expert Setup Step 5 VAr	RW
40228	9D24	EX_STEP6	Expert Setup Step 6 VAr	RW
40230	9D26	EX_STEP7	Expert Setup Step 7 VAr	RW
40232	9D28	EX_STEP8	Expert Setup Step 8 VAr	RW
40234	9D2A	EX_STEP9	Expert Setup Step 9 VAr	RW
40236	9D2C	EX_STEP10	Expert Setup Step 10 VAr	RW
40238	9D2E	EX_STEP11	Expert Setup Step 11 VAr	RW
40240	9D30	EX_STEP12	Expert Setup Step 12 VAr	RW
40242	9D32	EX_STEP13	Expert Setup Step 13 VAr	RW
40244	9D34	EX_STEP14	Expert Setup Step 14 VAr	RW
40246	9D36	EX_STEP15	Expert Setup Step 15 VAr	RW
40248	9D38	EX_STEP16	Expert Setup Step 16 VAr	RW
40250	9D3A	EX_STEP1_Unit	Expert Setup Step 1 VAr Unit	RW
40252	9D3C	EX_STEP2_Unit	Expert Setup Step 2 VAr Unit	RW
40254	9D3E	EX_STEP3_Unit	Expert Setup Step 3 VAr Unit	RW
40256	9D40	EX_STEP4_Unit	Expert Setup Step 4 VAr Unit	RW
40258	9D42	EX_STEP5_Unit	Expert Setup Step 5 VAr Unit	RW
40260	9D44	EX_STEP6_Unit	Expert Setup Step 6 VAr Unit	RW
40262	9D46	EX_STEP7_Unit	Expert Setup Step 7 VAr Unit	RW

ANNEXURE-D

MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	**Hex**			
40264	9D48	EX_STEP8_Unit	Expert Setup Step 8 VAr Unit	RW
40266	9D4A	EX_STEP9_Unit	Expert Setup Step 9 VAr Unit	RW
40268	9D4C	EX_STEP10_Unit	Expert Setup Step 10 VAr Unit	RW
40270	9D4E	EX_STEP11_Unit	Expert Setup Step 11 VAr Unit	RW
40272	9D50	EX_STEP12_Unit	Expert Setup Step 12 VAr Unit	RW
40274	9D52	EX_STEP13_Unit	Expert Setup Step 13 VAr Unit	RW
40276	9D54	EX_STEP14_Unit	Expert Setup Step 14 VAr Unit	RW
40278	9D56	EX_STEP15_Unit	Expert Setup Step 15 VAr Unit	RW
40280	9D58	EX_STEP16_Unit	Expert Setup Step 16 VAr Unit	RW
40282	9D5A	EX_STEP1_Type	Expert Setup Step 1 Type	RW
40284	9D5C	EX_STEP2_Type	Expert Setup Step 2 Type	RW
40286	9D5E	EX_STEP3_Type	Expert Setup Step 3 Type	RW
40288	9D60	EX_STEP4_Type	Expert Setup Step 4 Type	RW
40290	9D62	EX_STEP5_Type	Expert Setup Step 5 Type	RW
40292	9D64	EX_STEP6_Type	Expert Setup Step 6 Type	RW
40294	9D66	EX_STEP7_Type	Expert Setup Step 7 Type	RW
40296	9D68	EX_STEP8_Type	Expert Setup Step 8 Type	RW
40298	9D6A	EX_STEP9_Type	Expert Setup Step 9 Type	RW
40300	9D6C	EX_STEP10_Type	Expert Setup Step 10 Type	RW
40302	9D6E	EX_STEP11_Type	Expert Setup Step 11 Type	RW
40304	9D70	EX_STEP12_Type	Expert Setup Step 12 Type	RW
40306	9D72	EX_STEP13_Type	Expert Setup Step 13 Type	RW
40308	9D74	EX_STEP14_Type	Expert Setup Step 14 Type	RW
40310	9D76	EX_STEP15_Type	Expert Setup Step 15 Type	RW
40312	9D78	EX_STEP16_Type	Expert Setup Step 16 Type	RW
40314	9D7A	HLT1_CHK	Step 1 Health Check Enable	RW
40316	9D7C	HLT1_CHK_ULimit	Step 1 Health Check Upper Limit	RW
40318	9D7E	HLT1_CHK_LLimit	Step 1 Health Check Lower Limit	RW
40320	9D80	HLT2_CHK	Step 2 Health Check Enable	RW
40322	9D82	HLT2_CHK_ULimit	Step 2 Health Check Upper Limit	RW
40324	9D84	HLT2_CHK_LLimit	Step 2 Health Check Lower Limit	RW
40326	9D86	HLT3_CHK	Step 3 Health Check Enable	RW
40328	9D88	HLT3_CHK_ULimit	Step 3 Health Check Upper Limit	RW
40330	9D8A	HLT3_CHK_LLimit	Step 3 Health Check Lower Limit	RW
40332	9D8C	HLT4_CHK	Step 4 Health Check Enable	RW
40334	9D8E	HLT4_CHK_ULimit	Step 4 Health Check Upper Limit	RW
40336	9D90	HLT4_CHK_LLimit	Step 4 Health Check Lower Limit	RW
40338	9D92	HLT5_CHK	Step 5 Health Check Enable	RW
40340	9D94	HLT5_CHK_ULimit	Step 5 Health Check Upper Limit	RW
40342	9D96	HLT5_CHK_LLimit	Step 5 Health Check Lower Limit	RW
40344	9D98	HLT6_CHK	Step 6 Health Check Enable	RW
40346	9D9A	HLT6_CHK_ULimit	Step 6 Health Check Upper Limit	RW
40348	9D9C	HLT6_CHK_LLimit	Step 6 Health Check Lower Limit	RW
40350	9D9E	HLT7_CHK	Step 7 Health Check Enable	RW

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MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	**Hex**			
40352	9DA0	HLT7_CHK_ULimit	Step 7 Health Check Upper Limit	RW
40354	9DA2	HLT7_CHK_LLimit	Step 7 Health Check Lower Limit	RW
40356	9DA4	HLT8_CHK	Step 8 Health Check Enable	RW
40358	9DA6	HLT8_CHK_ULimit	Step 8 Health Check Upper Limit	RW
40360	9DA8	HLT8_CHK_LLimit	Step 8 Health Check Lower Limit	RW
40362	9DAA	HLT9_CHK	Step 9 Health Check Enable	RW
40364	9DAC	HLT9_CHK_ULimit	Step 9 Health Check Upper Limit	RW
40366	9DAE	HLT9_CHK_LLimit	Step 9 Health Check Lower Limit	RW
40368	9DB0	HLT10_CHK	Step 10 Health Check Enable	RW
40370	9DB2	HLT10_CHK_ULimit	Step 10 Health Check Upper Limit	RW
40372	9DB4	HLT10_CHK_LLimit	Step 10 Health Check Lower Limit	RW
40374	9DB6	HLT11_CHK	Step 11 Health Check Enable	RW
40376	9DB8	HLT11_CHK_ULimit	Step 11 Health Check Upper Limit	RW
40378	9DBA	HLT11_CHK_LLimit	Step 11 Health Check Lower Limit	RW
40380	9DBC	HLT12_CHK	Step 12 Health Check Enable	RW
40382	9DBE	HLT12_CHK_ULimit	Step 12 Health Check Upper Limit	RW
40384	9DC0	HLT12_CHK_LLimit	Step 12 Health Check Lower Limit	RW
40386	9DC2	HLT13_CHK	Step 13 Health Check Enable	RW
40388	9DC4	HLT13_CHK_ULimit	Step 13 Health Check Upper Limit	RW
40390	9DC6	HLT13_CHK_LLimit	Step 13 Health Check Lower Limit	RW
40392	9DC8	HLT14_CHK	Step 14 Health Check Enable	RW
40394	9DCA	HLT14_CHK_ULimit	Step 14 Health Check Upper Limit	RW
40396	9DCC	HLT14_CHK_LLimit	Step 14 Health Check Lower Limit	RW
40398	9DCE	HLT15_CHK	Step 15 Health Check Enable	RW
40400	9DD0	HLT15_CHK_ULimit	Step 15 Health Check Upper Limit	RW
40402	9DD2	HLT15_CHK_LLimit	Step 15 Health Check Lower Limit	RW
40404	9DD4	HLT16_CHK	Step 16 Health Check Enable	RW
40406	9DD6	HLT16_CHK_ULimit	Step 16 Health Check Upper Limit	RW
40408	9DD8	HLT16_CHK_LLimit	Step 16 Health Check Lower Limit	RW
40410	9DDA	USG1_CHK	Step 1 Usage Check Enable/Disable	RW
40412	9DDC	USG1_CHK_Limit	Step 1 Usage Check Limit	RW
40414	9DDE	USG2_CHK	Step 2 Usage Check Enable/Disable	RW
40416	9DE0	USG2_CHK_Limit	Step 2 Usage Check Limit	RW
40418	9DE2	USG3_CHK	Step 3 Usage Check Enable/Disable	RW
40420	9DE4	USG3_CHK_Limit	Step 3 Usage Check Limit	RW
40422	9DE6	USG4_CHK	Step 4 Usage Check Enable/Disable	RW
40424	9DE8	USG4_CHK_Limit	Step 4 Usage Check Limit	RW
40426	9DEA	USG5_CHK	Step 5 Usage Check Enable/Disable	RW
40428	9DEC	USG5_CHK_Limit	Step 5 Usage Check Limit	RW
40430	9DEE	USG6_CHK	Step 6 Usage Check Enable/Disable	RW
40432	9DF0	USG6_CHK_Limit	Step 6 Usage Check Limit	RW
40434	9DF2	USG7_CHK	Step 7 Usage Check Enable/Disable	RW
40436	9DF4	USG7_CHK_Limit	Step 7 Usage Check Limit	RW
40438	9DF6	USG8_CHK	Step 8 Usage Check Enable/Disable	RW
40440	9DF8	USG8_CHK_Limit	Step 8 Usage Check Limit	RW

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MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	Hex			
40442	9DFA	USG9_CHK	Step 9 Usage Check Enable/Disable	RW
40444	9DFC	USG9_CHK_Limit	Step 9 Usage Check Limit	RW
40446	9DFE	USG10_CHK	Step 10 Usage Check Enable/Disable	RW
40448	9E00	USG10_CHK_Limit	Step 10 Usage Check Limit	RW
40450	9E02	USG11_CHK	Step 11 Usage Check Enable/Disable	RW
40452	9E04	USG11_CHK_Limit	Step 11 Usage Check Limit	RW
40454	9E06	USG12_CHK	Step 12 Usage Check Enable/Disable	RW
40456	9E08	USG12_CHK_Limit	Step 12 Usage Check Limit	RW
40458	9E0A	USG13_CHK	Step 13 Usage Check Enable/Disable	RW
40460	9E0C	USG13_CHK_Limit	Step 13 Usage Check Limit	RW
40462	9E0E	USG14_CHK	Step 14 Usage Check Enable/Disable	RW
40464	9E10	USG14_CHK_Limit	Step 14 Usage Check Limit	RW
40466	9E12	USG15_CHK	Step 15 Usage Check Enable/Disable	RW
40468	9E14	USG15_CHK_Limit	Step 15 Usage Check Limit	RW
40470	9E16	USG16_CHK	Step 16 Usage Check Enable/Disable	RW
40472	9E18	USG16_CHK_Limit	Step 16 Usage Check Limit	RW
40474	9E1A	USG_CDIV	Step Usage Calculation - Step ON/OFF Count Div Fact	RW
40476	9E1C	USG_TDIV	Step Usage Calculation - Step ON Time Div Fact	RW
40478	9E1E	EVT1_EnDs	Fault 1 Enable/Disable	RW
40480	9E20	EVE1_ACT	Fault 1 Action	RW
40482	9E22	EVE1_LMT	Fault 1 Set Limit	RW
40484	9E24	EVE1_RES	Fault 1 Resume Limit	RW
40486	9E26	EVE1_TYPE	Fault 1 Resume Method	RW
40488	9E28	EVE1_DLY	Fault 1 Resume Delay in Sec	RW
40490	9E2A	EVT2_EnDs	Fault 2 Enable/Disable	RW
40492	9E2C	EVE2_ACT	Fault 2 Action	RW
40494	9E2E	EVE2_LMT	Fault 2 Set Limit	RW
40496	9E30	EVE2_RES	Fault 2 Resume Limit	RW
40498	9E32	EVE2_TYPE	Fault 2 Resume Method	RW
40500	9E34	EVE2_DLY	Fault 2 Resume Delay in Sec	RW
40502	9E36	EVT3_EnDs	Fault 3 Enable/Disable	RW
40504	9E38	EVE3_ACT	Fault 3 Action	RW
40506	9E3A	EVE3_LMT	Fault 3 Set Limit	RW
40508	9E3C	EVE3_RES	Fault 3 Resume Limit	RW
40510	9E3E	EVE3_TYPE	Fault 3 Resume Method	RW
40512	9E40	EVE3_DLY	Fault 3 Resume Delay in Sec	RW
40514	9E42	EVT4_EnDs	Fault 4 Enable/Disable	RW
40516	9E44	EVE4_ACT	Fault 4 Action	RW
40518	9E46	EVE4_LMT	Fault 4 Set Limit	RW
40520	9E48	EVE4_RES	Fault 4 Resume Limit	RW
40522	9E4A	EVE4_TYPE	Fault 4 Resume Method	RW
40524	9E4C	EVE4_DLY	Fault 4 Resume Delay in Sec	RW
40526	9E4E	EVT5_EnDs	Fault 5 Enable/Disable	RW
40528	9E50	EVE5_ACT	Fault 5 Action	RW

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MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	Hex			
40530	9E52	EVE5_LMT	Fault 5 Set Limit	RW
40532	9E54	EVE5_RES	Fault 5 Resume Limit	RW
40534	9E56	EVE5_TYPE	Fault 5 Resume Method	RW
40536	9E58	EVE5_DLY	Fault 5 Resume Delay in Sec	RW
40538	9E5A	EVT6_EnDs	Fault 6 Enable/Disable	RW
40540	9E5C	EVE6_ACT	Fault 6 Action	RW
40542	9E5E	EVE6_LMT	Fault 6 Set Limit	RW
40544	9E60	EVE6_RES	Fault 6 Resume Limit	RW
40546	9E62	EVE6_TYPE	Fault 6 Resume Method	RW
40548	9E64	EVE6_DLY	Fault 6 Resume Delay in Sec	RW
40550	9E66	EVT7_EnDs	Fault 7 Enable/Disable	RW
40552	9E68	EVE7_ACT	Fault 7 Action	RW
40554	9E6A	EVE7_LMT	Fault 7 Set Limit	RW
40556	9E6C	EVE7_RES	Fault 7 Resume Limit	RW
40558	9E6E	EVE7_TYPE	Fault 7 Resume Method	RW
40560	9E70	EVE7_DLY	Fault 7 Resume Delay in Sec	RW
40562	9E72	EVT8_EnDs	Fault 8 Enable/Disable	RW
40564	9E74	EVE8_ACT	Fault 8 Action	RW
40566	9E76	EVE8_LMT	Fault 8 Set Limit	RW
40568	9E78	EVE8_RES	Fault 8 Resume Limit	RW
40570	9E7A	EVE8_TYPE	Fault 8 Resume Method	RW
40572	9E7C	EVE8_DLY	Fault 8 Resume Delay in Sec	RW
40574	9E7E	EVT9_EnDs	Fault 9 Enable/Disable	RW
40576	9E80	EVE9_ACT	Fault 9 Action	RW
40578	9E82	EVE9LMT	Fault 9 Set Limit	RW
40580	9E84	EVE9_RES	Fault 9 Resume Limit	RW
40582	9E86	EVE9_TYPE	Fault 9 Resume Method	RW
40584	9E88	EVE9_DLY	Fault 9 Resume Delay in Sec	RW
40586	9E8A	EVT10_EnDs	Fault 10 Enable/Disable	RW
40588	9E8C	EVE10_ACT	Fault 10 Action	RW
40590	9E8E	EVE10_LMT	Fault 10 Set Limit	RW
40592	9E90	EVE10_RES	Fault 10 Resume Limit	RW
40594	9E92	EVE10_TYPE	Fault 10 Resume Method	RW
40596	9E94	EVE10_DLY	Fault 10 Resume Delay in Sec	RW
40598	9E96	EVT11_EnDs	Fault 11 Enable/Disable	RW
40600	9E98	EVE11_ACT	Fault 11 Action	RW
40602	9E9A	EVE11_LMT	Fault 11 Set Limit	RW
40604	9E9C	EVE11_RES	Fault 11 Resume Limit	RW
40606	9E9E	EVE11_TYPE	Fault 11 Resume Method	RW
40608	9EA0	EVE11_DLY	Fault 11 Resume Delay in Sec	RW
40610	9EA2	EVT12_EnDs	Fault 12 Enable/Disable	RW
40612	9EA4	EVE12_ACT	Fault 12 Action	RW
40614	9EA6	EVE12_LMT	Fault 12 Set Limit	RW
40616	9EA8	EVE12_RES	Fault 12 Resume Limit	RW
40618	9EAA	EVE12_TYPE	Fault 12 Resume Method	RW

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MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	Hex			
40620	9EAC	EVE12_DLY	Fault 12 Resume Delay in Sec	RW
40622	9EAE	EVT13_EnDs	Fault 13 Enable/Disable	RW
40624	9EB0	EVE13_ACT	Fault 13 Action	RW
40626	9EB2	EVE13_LMT	Fault 13 Set Limit	RW
40628	9EB4	EVE13_RES	Fault 13 Resume Limit	RW
40630	9EB6	EVE13_TYPE	Fault 13 Resume Method	RW
40632	9EB8	EVE13_DLY	Fault 13 Resume Delay in Sec	RW
40634	9EBA	EVT14_EnDs	Fault 14 Enable/Disable	RW
40636	9EBC	EVE14_ACT	Fault 14 Action	RW
40638	9EBE	EVE14_LMT	Fault 14 Set Limit	RW
40640	9EC0	EVE14_RES	Fault 14 Resume Limit	RW
40642	9EC2	EVE14_TYPE	Fault 14 Resume Method	RW
40644	9EC4	EVE14_DLY	Fault 14 Resume Delay in Sec	RW
40646	9EC6	EVT15_EnDs	Fault 15 Enable/Disable	RW
40648	9EC8	EVE15_ACT	Fault 15 Action	RW
40650	9ECA	EVE15_LMT	Fault 15 Set Limit	RW
40652	9ECC	EVE15_RES	Fault 15 Resume Limit	RW
40654	9ECE	EVE15_TYPE	Fault 15 Resume Method	RW
40656	9ED0	EVE15_DLY	Fault 15 Resume Delay in Sec	RW
40658	9ED2	EVT16_EnDs	Fault 16 Enable/Disable	RW
40660	9ED4	EVE16_ACT	Fault 16 Action	RW
40662	9ED6	EVE16_LMT	Fault 16 Set Limit	RW
40664	9ED8	EVE16_RES	Fault 16 Resume Limit	RW
40666	9EDA	EVE16_TYPE	Fault 16 Resume Method	RW
40668	9EDC	EVE16_DLY	Fault 16 Resume Delay in Sec	RW
40670	9EDE	EVT17_EnDs	Fault 17 Enable/Disable	RW
40672	9EE0	EVE17_ACT	Fault 17 Action	RW
40674	9EE2	EVE17_LMT	Fault 17 Set Limit	RW
40676	9EE4	EVE17_RES	Fault 17 Resume Limit	RW
40678	9EE6	EVE17_TYPE	Fault 17 Resume Method	RW
40680	9EE8	EVE17_DLY	Fault 17 Resume Delay in Sec	RW
40682	9EEA	EVT18_EnDs	Fault 18 Enable/Disable	RW
40684	9EEC	EVE18_ACT	Fault 18 Action	RW
40686	9EEE	EVE18_LMT	Fault 18 Set Limit	RW
40688	9EF0	EVE18_RES	Fault 18 Resume Limit	RW
40690	9EF2	EVE18_TYPE	Fault 18 Resume Method	RW
40692	9EF4	EVE18_DLY	Fault 18 Resume Delay in Sec	RW
40694	9EF6	EVT19_EnDs	Fault 19 Enable/Disable	RW
40696	9EF8	EVE19_ACT	Fault 19 Action	RW
40698	9EFA	EVE19_LMT	Fault 19 Set Limit	RW
40700	9EFC	EVE19_RES	Fault 19 Resume Limit	RW
40702	9EFE	EVE19_TYPE	Fault 19 Resume Method	RW
40704	9F00	EVE19_DLY	Fault 19 Resume Delay in Sec	RW
40706	9F02	EVT20_EnDs	Fault 20 Enable/Disable	RW

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MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	Hex			
40708	9F04	EVE20_ACT	Fault 20 Action	RW
40710	9F06	EVE20_LMT	Fault 20 Set Limit	RW
40712	9F08	EVE20_RES	Fault 20 Resume Limit	RW
40714	9F0A	EVE20_TYPE	Fault 20 Resume Method	RW
40716	9F0C	EVE20_DLY	Fault 20 Resume Delay in Sec	RW
40718	9F0E	EVT21_EnDs	Fault 21 Enable/Disable	RW
40720	9F10	EVE21_ACT	Fault 21 Action	RW
40722	9F12	EVE21_LMT	Fault 21 Set Limit	RW
40724	9F14	EVE21_RES	Fault 21 Resume Limit	RW
40726	9F16	EVE21_TYPE	Fault 21 Resume Method	RW
40728	9F18	EVE21_DLY	Fault 21 Resume Delay in Sec	RW
40730	9F1A	EVT22_EnDs	Fault 22 Enable/Disable	RW
40732	9F1C	EVE22_ACT	Fault 22 Action	RW
40734	9F1E	EVE22_LMT	Fault 22 Set Limit	RW
40736	9F20	EVE22_RES	Fault 22 Resume Limit	RW
40738	9F22	EVE22_TYPE	Fault 22 Resume Method	RW
40740	9F24	EVE22_DLY	Fault 22 Resume Delay in Sec	RW
40742	9F26	EVT23_EnDs	Fault 23 Enable/Disable	RW
40744	9F28	EVE23_ACT	Fault 23 Action	RW
40746	9F2A	EVE23_LMT	Fault 23 Set Limit	RW
40748	9F2C	EVE23_RES	Fault 23 Resume Limit	RW
40750	9F2E	EVE23_TYPE	Fault 23 Resume Method	RW
40752	9F30	EVE23_DLY	Fault 23 Resume Delay in Sec	RW
40754	9F32	EVT24_EnDs	Fault 24 Enable/Disable	RW
40756	9F34	EVE24_ACT	Fault 24 Action	RW
40758	9F36	EVE24_LMT	Fault 24 Set Limit	RW
40760	9F38	EVE24_RES	Fault 24 Resume Limit	RW
40762	9F3A	EVE24_TYPE	Fault 24 Resume Method	RW
40764	9F3C	EVE24_DLY	Fault 24 Resume Delay in Sec	RW
40766	9F3E	EVT25_EnDs	Fault 25 Enable/Disable	RW
40768	9F40	EVE25_ACT	Fault 25 Action	RW
40770	9F42	EVE25_LMT	Fault 25 Set Limit	RW
40772	9F44	EVE25_RES	Fault 25 Resume Limit	RW
40774	9F46	EVE25_TYPE	Fault 25 Resume Method	RW
40776	9F48	EVE25_DLY	Fault 25 Resume Delay in Sec	RW
40778	9F4A	EVT26_EnDs	Fault 26 Enable/Disable	RW
40780	9F4C	EVE26_ACT	Fault 26 Action	RW
40782	9F4E	EVE26_LMT	Fault 26 Set Limit	RW
40784	9F50	EVE26_RES	Fault 26 Resume Limit	RW
40786	9F52	EVE26_TYPE	Fault 26 Resume Method	RW
40788	9F54	EVE26_DLY	Fault 26 Resume Delay in Sec	RW
40790	9F56	EVT27_EnDs	Fault 27 Enable/Disable	RW
40792	9F58	EVE27_ACT	Fault 27 Action	RW
40794	9F5A	EVE27_LMT	Fault 27 Set Limit	RW

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MODBUS Address Table Continued …….

Read / Write Addresses: (Continued)

User Setting Parameters (Easy/Expert Edit)				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	Hex			
40796	9F5C	EVE27_RES	Fault 27 Resume Limit	RW
40798	9F5E	EVE27_TYPE	Fault 27 Resume Method	RW
40800	9F60	EVE27_TYPE	Fault 27 Resume Delay in Sec	RW
40802	9F62	AUX_IN1_Fun	Aux. Input 1 Function	RW
40804	9F64	AUX_OUT1_Fun	Aux. Output 1 Function	RW
40806	9F66	AUX_OUT2_Fun	Aux. Output 2 Function	RW
40808	9F68	AUX_OUT3_Fun	Aux. Output 3 Function	RW
40810	9F6A	COM1_PROTOCOL	Com1 RS232 Protocol	RW
40812	9F6C	COM1_BUAD	Com1 RS232 Baud rate	RW
40814	9F6E	COM1_ID	Com1 RS232 ID	RW
40816	9F70	APN_SEL	GPRS APN FIX APN Select	RW
40818	9F72	APN_OTHR	APN Other than Pre-Fix List	RW
40820	9F74	MDN	Main Domain Name	RW
40822	9F76	SDN	Sub Domain Name	RW
40824	9F78	IP_ADD	IP Address	RW
40826	9F7A	PORT	Port Number	RW
40828	9F7C	BUST_MODE	Bust Data Mode Enable/Disable	RW
40830	9F7E	BUST_MODE_IN	Bust Data Mode Interval Time(Speed)	RW
40832	9F80	COM2_PROTOCOL	Com2 RS485 Protocol	RW
40834	9F82	COM2_BUAD	Com2 RS485 Baud rate	RW
40836	9F84	COM2_ID	Com2 RS485 ID	RW
40838	9F86	DL_INT_Time	Data Logging Interval Time	RW
40840	9F88	LOG_LEN	Log Frame Length	RW
40842	9F8A	PASS_EnDs	Password Enable/Disable	RW
40844	9F8C	PASS	Password	RW
40846	9F8E	SET_Date	Set Date	RW
40848	9F90	SET_MM	Set Month	RW
40850	9F92	SET_YYYY	Set Year	RW
40852	9F94	SET_CAL	Set Enable/Disable	RW
40854	9F96	SET_HR	Set Hour	RW
40856	9F98	SET_MN	Set Min	RW
40858	9F9A	SET_YYYY	Set Sec	RW
40860	9F9C	SET_TIME	Set Enable/Disable	RW
40862	9F9E	REM_UPDATE	Remote Update Enable/Disable	RW
40864	9FA0	POR_MODE	Power Up Mode	RW
40866	9FA2	POR_ASYN_RY	Power On Sync.. Number of Retry	RW
40868	9FA4	POR_ASYN_FLACT	Power On Sync. Action on Failure	RW
40870	9FA6	REM_MODE	Remote Operation Mode	RW
40872	9FA8	REM_TIMEOUT	Remote Operation TIMEOUT	RW
40874	9FAA	REM_TMACT	Remote Operation Timeout Action	RW
40876	9FAC	LNG	Language Select	RW
40878	9FAE	SAVE	Save Parameters	RW
40880	9FB0	SAVE_Satus	Save Parameters Ack	RW

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MODBUS Address Table Continued …….

Read / Write Addresses: Remote Mode

REMOTE MODE PARAMETERS				
4XXXX		Read/Write from/to Registers (RW)		R/W
All Registers are Floating type				
Register		Symbol	Description	Access
Decimal	Hex			
42000	A410	RM1_FRQ	Remote Mode 1 Freq	RW
42004	A414	RM1_1V1	Remote Mode 1 Phase 1 to Neutral Fundamental Voltage	RW
42008	A418	RM1_2V1	Remote Mode 1 Phase 2 to Neutral Fundamental Voltage	RW
42012	A41C	RM1_3V1	Remote Mode 1 Phase 3 to Neutral Fundamental Voltage	RW
42016	A420	RM1_12V1	Remote Mode 1 Phase 1 to Phase 2 Fundamental Voltage	RW
42020	A424	RM1_23V1	Remote Mode 1 Phase 2 to Neutral Fundamental Voltage	RW
42024	A428	RM1_31V1	Remote Mode 1 Phase 3 to Neutral Fundamental Voltage	RW
42028	A42C	RM1_1P1	Remote Mode 1 Phase 1 Fundamental Active Power	RW
42032	A430	RM1_2P1	Remote Mode 1 Phase 2 Fundamental Active Power	RW
42036	A434	RM1_3P1	Remote Mode 1 Phase 3 Fundamental Active Power	RW
42040	A438	RM1_1Q1	Remote Mode 1 Phase 1 Fundamental Reactive Power	RW
42044	A43C	RM1_2Q1	Remote Mode 1 Phase 2 Fundamental Reactive Power	RW
42048	A440	RM1_3Q1	Remote Mode 1 Phase 3 Fundamental Reactive Power	RW

Remote Mode:

This is set in User Parameter Settings. Part of previous Modbus table is to be set accordingly

40870	9FA6	REM_MODE	Remote Operation Mode	RW
40872	9FA8	REM_TIMEOUT	Remote Operation TIMEOUT	RW
40874	9FAA	REM_TMACT	Remote Operation Timeout Action	RW

Once the parameters Setting is carried out, the PF correction action would depend upon the Remote mode parameters written.

BR 5600 T power factor controller for LV High-Speed Capacitor switching

Operations manual

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule, we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
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