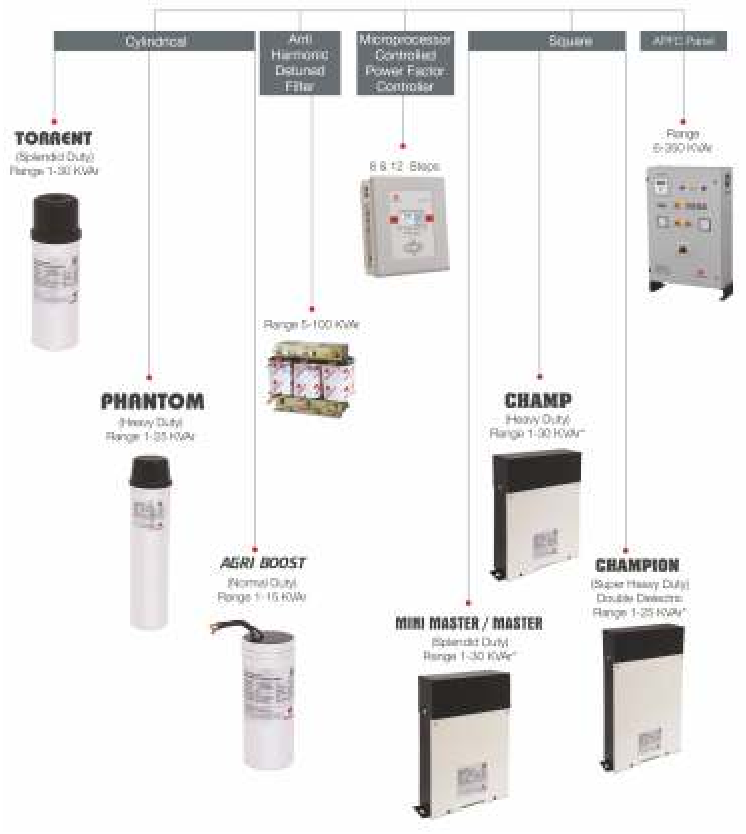
HAVELLS

Operating Instruction
IPFC CS 1003

Range of Power Factor Correction Capacitors & Components



Specifications

Display	:	Liquid crystal display with dual color backlight 3 line, 4 digits to show electrical parameters.
Wiring input	:	3 Ø 4 wire, 3 Ø 3 wire, 1 Ø 2 wire, 2 Ø 2 wire
Rated input voltage	:	11 to 300V AC (L-N) ; 50 to 520V AC (L-L)
Rated input current	:	Nominal 5A AC (MIN-11mA, MAX-6A)
Burden	:	20 mOhms
Frequency range	:	45-65 Hz
CT primary	:	1A / 5A to 9999A (programmable for any value)

Note : 1A to 9999A if CT Secondary is 1 else CT Primary is 5A to 9999A

CT Secondary	:	1A or 5A (Programmable)
PT Primary	:	100V to 500kV (Programmable for any value)
PT Secondary	:	100V to 500V (Programmable for any value)
Display update time	:	1sec for all parameters
Display scrolling	:	Auto / Manual / Default (Programmable)
Display scrolling time	:	5 Sec.
Power Consumption	:	Max 15VA
Trip Indication	:	Backlight turns to orange
Controlling Range	:	Target PF : 0.800 lag to 0.800 lead Switching Program : Automatic / Linear / Rotational
Relay Output	:	Alarm mode : Over Voltage, Under Voltage, Over Compensate, Under Compensate, CT Polarity error, No Voltage, Step error, Over Temperature.
Temperature	:	0 to 100°C
Fan Output	:	ON / OFF / Temp controlled
LCD Indication	:	- Fault Occurs - Communication in Progress - Fan Mode DI - Digital Input
Environmental Conditions	:	Outdoor use Temperature: Operating : 0°C to 60°C Storage : -20°C to 60°C Humidity : 0% to 95% without moisture consideration
Mounting	:	Panel Mounting
Weight	:	IPFC CS 1003-312 : 460gms IPFC CS 1003-308 : 450gms

Order Code Information

Product Code	Product	Supply	CE	No. of Stages
QHOTBS5H0012	IPFC CS 1003-312-90/550V	90 to 550V AC, 50/60Hz	-	12 / 14*
QHOTBS5H0008	IPFC CS 1003-308-90/550V	90 to 550V AC, 50/60Hz	-	8

Note:* When 14 relay option selected FAN & ALARM Relay will be used for control Switching (Applicable only for IPFC CS 1003-312-90/550V)

Serial Communication [Applicable only for IPFC CS 1003-312]

Interface standard and protocol	Rs485 and MODBUS RTU
Communication address	1 to 255
Transmission Mode	Half duplex
Data types	Float and Integer
Transmission distance	500 Meter maximum
Transmission speed	300, 600,1200, 2400, 4800, 9600, 19200 (in bps)
Parity	None, Odd, Even
Stop bits	1 or 2

Resolution

PT Ratio x CT Ratio	kWh	PT Ratio x CT Ratio	kWh
<15	0.01K	<15000	0.01M
<150	0.1K	<150000	0.1M
<1500	1K	‡1500000	1M

Note: 1) For Voltage, Current, Power, resolution is automatically adjusted.
2) For power factor, resolution is 0.001 & for temperature resolution is 0.1

Accuracy

Measurement	Accuracy
Voltage V_{L-N}	±0.5% of Full Scale
Voltage V_{L-L}	±0.5% of Full Scale
Current	±0.5% of Full Scale
Frequency For L-N > 20V, For L-L > 35V	±0.1% of Full Scale
Temperature	±3°C of Full Scale

Measurement	Accuracy
Active Power	1%
Apparent Power	1%
Reactive Power	1%
Power Factor	±0.01
Active Energy	Class 1
Apparent Energy	Class 1
Reactive energy	Class 1

⚠ Safety Precautions

All safety related codification, symbols and instructions that appear in this operating manual or on the equipment must be strictly followed to ensure the safety of the operating personnel as well as the instrument.

If the equipment is not handled in a manner specified by the manufacturer, it might impair the protection provided by the equipment.

⚠ Caution : Read Complete instruction prior to installation and operation of the unit.

⚠ Warning : Risk of electric shock.

⚠ Wiring Guidelines

1. To prevent the risk of electric shock, power supply to the equipment must be kept OFF while doing the wiring arrangement. Do not touch the terminals while power is being supplied.
2. Wiring shall be done strictly according to the terminal layout. Confirm that all connections are correct.
3. Use pin type lugged terminals.
4. To eliminate electromagnetic interference, use wires with adequate ratings and twists of the same in equal size shall be made.
5. Cables used for connection to power source, must have a cross section of 1.5 mm^2. These wires shall have current carrying capacity of 5A.

Maintenance

1. The equipment should be cleaned regularly to avoid blockage of ventilating Parts.
2. Clean the equipment with a clean soft cloth. Do not use Isopropyl alcohol or any other cleaning agent.

Installation Guidelines

⚠ Caution

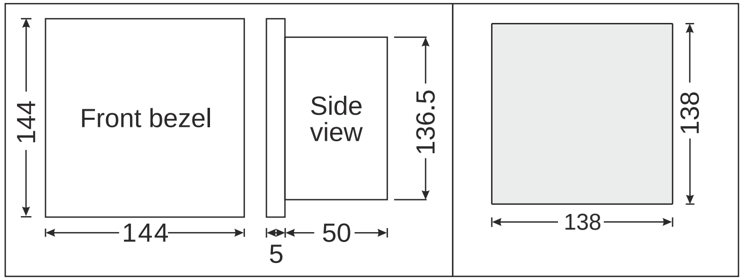
1. This equipment, being built-in type, normally becomes a part of main control panel and in such case the terminals do not remain accessible to the user end after installation and internal wiring.
2. Conductors must not come in contact with the internal circuitry of the equipment or else it may lead to a safety hazard that may in turn endanger life or cause electrical shock to the operator.
3. Before disconnecting the secondary of the external current transformer from the equipment, make sure that the current transformer is short circuited to avoid risk of electrical shock and injury.
4. The equipment shall not be installed in environmental condition other than those mentioned in this manual.

5. Thermal dissipation of equipment is met through ventilation holes provided on chasis of equipment. Such ventilation holes shall not be obstructed else it can lead to a safety hazard.
6. Connector screw must be tightened after installation.

Mechanical Installation / Dimensions

1. Prepare panel cut out with proper dimensions as shown in the figure.
2. Push the meter into the panel cutout. Secure the meter in its place by pushing the clamp on the rear side. The screw of the panel clamp must be in the farthest forward slot.
3. For proper sealing tighten the screw evenly with required torque.

Outline Dimensions (in mm) Panel Cutout (in mm)



⚠ Caution

The equipment in its installed state must not come in close proximity to any heating sources, caustic vapors, oils, steam or other unwanted process by product.

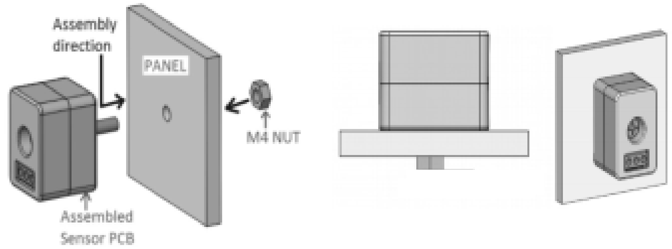
EMC Guidelines

1. Use proper input power cables with shortest connections and twisted type.
2. Layout of connecting cables shall be away from any internal EMI source.

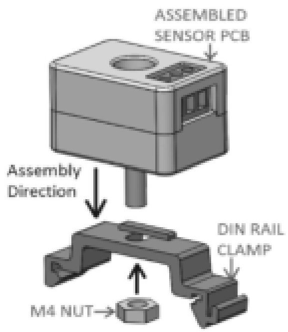
Sensor Clip Assembly

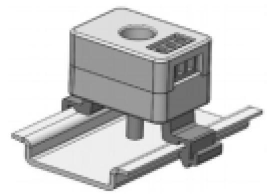
Assemble sensor on the panel /Din rail clamp by using center screw provision and M4 nut. As shown in below diagram.

1. Panel Mounting Assembly :

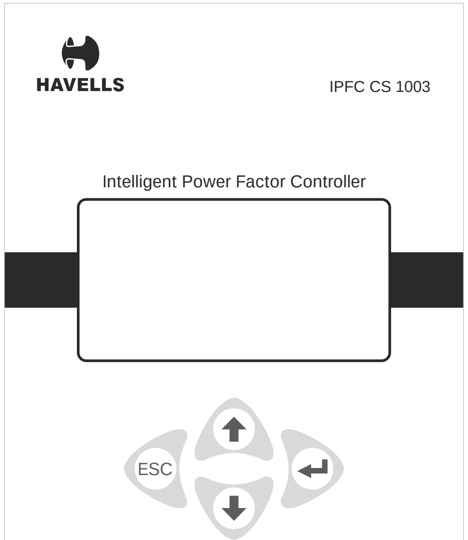


2. Din Rail Mounting Assembly :





Front Panel Description



Key Description

Press ↓ & ↵	For 3 sec to enter or exit from the configuration menu.
Press ↑	For increment
Press ↓	To move cursor right by one digit each time after last digit of display cursor shift at 1st digit of display.
Press ↵	To save the setting and move on to next page
Press ESC	To go back

Configuration

There are 4 dedicated keys ↵ ESC ↓ ↑

Use these 4 keys to enter into configuration menu / change setting.

Note : The setting should be done by a professional after going through this operating manual.

Online Page Description

Key Press	Parameter Key	Description For 3P4W
——	——	Displays line to neutral voltage of 3 phases.
	↑	Displays line to line voltage of 3 phases.
	↑	Displays % THD of line to neutral voltage of 3 phases.
	↑	Displays % THD of line to line voltage of 3 phases.
	↑	Displays current of 3 phases.
	↑	Displays % THD of current of 3 phases.
Press ↵ key (1st time)	——	Displays line to neutral avg. voltage, current & frequency.
	↑	Displays line to line avg. voltage, current & frequency.
	↑	Displays power factor of 3 phases.
Press ↵ key (2nd time)	——	Displays active power of 3 phases.
	↑	Displays reactive power of 3 phases.
	↑	Displays apparent power of 3 phases.
Press ↵ key (3rd time)	——	Displays active energy.
	↑	Displays apparent energy.
	↑	Displays reactive energy.
	↑	Displays temperature*.

Online Page Description

Key Press	Parameter Key	Description For 3P3W
——	——	Displays line to line voltage of 3 phases.
		Displays % THD of line to line voltage of 3 phases.
		Displays current of 3 phases.
		Displays % THD of current of 3 phases.
Press key (1st time)	——	Displays line to line avg. voltage, current & frequency
		Displays avg. power factor of 3 phases.
Press key (2nd time)	——	Displays total active power.
		Displays total reactive power.
		Displays total apparent power.
Press key (3nd time)	——	Displays active energy.
		Displays apparent energy.
		Displays reactive energy
		Displays temperature.*

Key Press	Parameter Key	Description For 1P2W
——	——	Displays line to neutral voltage of 1st phase.
		Displays % THD of line to neutral voltage of 1st phase.
		Displays current of 1st phase.
		Displays % THD of current of 1st phase.
Press key (1st time)	——	Displays power factor of 1st phase & frequency
Press key (2nd time)	——	Displays active power of 1st phase.
		Displays reactive power of 1st phase.
		Displays apparent power of 1st phase.
Press key (3nd time)	——	Displays active energy of 1st phase.
		Displays apparent energy of 1st phase.
		Displays reactive energy of 1st phase.
		Displays temperature.*

Online Page Description

Key Press	Parameter Key	Description For 2P2W
——	——	Displays line to line voltage.
		Displays % THD of line to line voltage.
		Displays current.
		Displays % THD of current.
Press key (1st time)	——	Displays power factor and frequency.
Press key (2nd time)	——	Displays total active power.
		Displays total reactive power.
		Displays total apparent power.
Press key (3nd time)	——	Displays active energy.
		Displays apparent energy.
		Displays reactive energy
		Displays temperature.*

Note: *Temperature will be displayed when over temp setting is 'ON'.

Backlight Indications

Backlight	Description
White	Capacitor Banks that are ON.
Orange	Fault condition occurred [Press ESC key to display trip parameter] Backlight turn to white again when user will press ESC key in fault condition. Trip parameters will be displayed for 3sec each.

Note : On occurrence of any new fault condition backlight turns Orange & on pressing ESC key all trip parameters will be displayed for 3sec each.

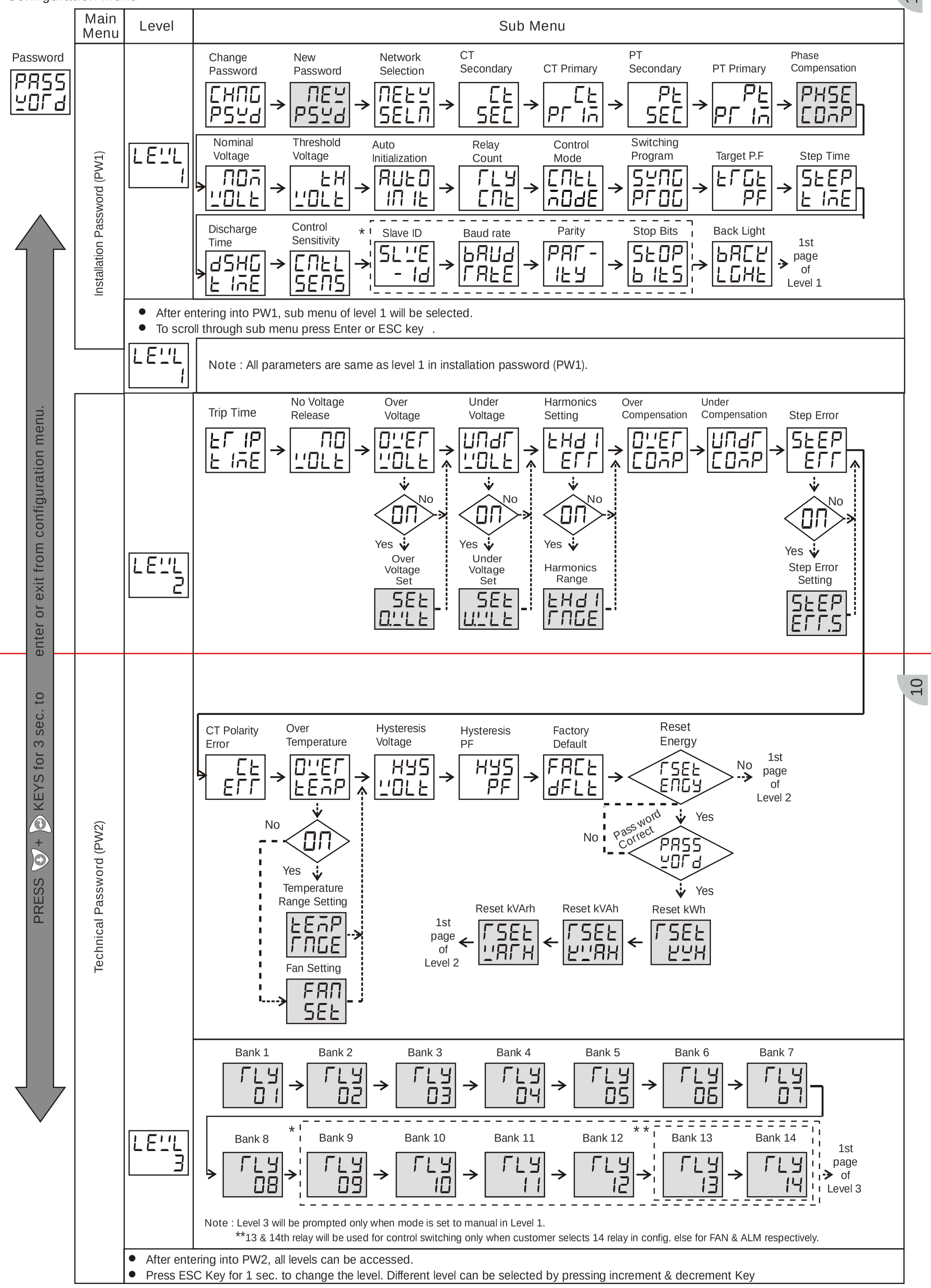
Serial Number Description

Press ESC key for 10sec. to display 8 digit serial number at 2nd & 3rd line of display.

Auto / Manual / Default Mode Description

Press Enter key for 3sec. to change online page mode.

Configuration Menu



Note: *Applicable only for IPFC CS 1003-312-90/550V.

Appearance of shaded menus dependent on selection of other parameters.

Level 1

Parameter	Display	Range	Default Value	Condition
Password	PASS WORD	0000 – 9998	1000 (PW1) ; 2000 (PW2)	Level 3 accessible only when control mode is 'Manual'
Change Password	CHNG PSWD	YES / NO	NO	
New Password	NEW PSWD	0000 – 9998	0	
Level Indication	LEVEL	–	LEVL 1	
Network Selection	NETW SELN	3P4W / 3P3W / 1P2W / 2P2W	3P4W	
CT Secondary	CT SEC	1A / 5A	5A	
CT Primary	CT PRIM	1A / 5A-9999A	5A	
PT Secondary	PT SEC	100V – 500V	350V	
PT Primary	PT PRIM	100V to 500KV	350V	
Phase Compensation Angle	PHSE COMP	0, 90, 120, 210, 240, 330	0	Only Valid for 1P2W & 2P2W
Nominal Voltage	NOM VOLT	50 – 550V	For 1P2W/3P4W-240V For 3P3W/2P2W-415V	
Threshold Voltage	TH VOLT	0 – 100%	0%	
Auto Initialization	AUTO INIT	YES / NO	YES	

Level 1

Parameter	Display	Range	Default Value	Condition
Relays Count	RLY CNT	3 – 8 / 12 / 14	08 or 12	IPFC CS 1003-308-8RL IPFC CS 1003-312-12 RL
Control Mode	CNTL MODE	Auto / Manual	Auto	
Switching Program	SWNG PROG	Auto / Linear / Rotational	Auto	
Target Power Factor	TRGT PF	0.800 to -0.800	1.000	
Step time	STEP TIME	5 S to 240 S	5 S	
Discharge Time (Reconnection time)	DSHG TIME	5 S to 9999 S	75 S	
Control Sensitivity settings	CNTL SENS	55% to 100%	60%	
Slave ID	SLVE ID	001 – 255	1	
Baud Rate	BAUD RATE	300/600/1200/ 2400/4800 / 9600/19K2	9600	
Parity	PAR-ITY	NONE / ODD / EVEN	NONE	
Stop Bits	STOP BITS	1 or 2	1	
Backlight	BACK LGHT	0 to 7200 Sec	0	

Level 2

Name of Parameter	Nomenclature	Range	Default Value
Trip time setting	TRIP TIME	ON / OFF	OFF
No Voltage Release	NO VOLT	ON / OFF	ON
Over Voltage	OVER VOLT	ON / OFF	ON
Over Voltage setting	SET O.VLT	250 - 290V (L-N) 490 - 520 (L-L)	290V (L-N) 520 (L-L)
Under Voltage	UNDR VOLT	ON / OFF	OFF
Under Voltage setting	SET U.VLT	195 - 210V (L-N) 400 - 415 (L-L)	210V (L-N) 415 (L-L)
Total Harmonic Distortion	THDI ERR	ON / OFF	ON
THD I Range	THDI RNGE	20 - 100%	50%
Over Compensate	OVER COMP	ON / OFF	ON
Under Compensate	UNDR COMP	ON / OFF	ON
Step Error	STEP ERR	ON / OFF	ON
Step Error Setting	STEP ERR.S	20 to 80%	20
CT Polarity error	CT ERR	ON / OFF	OFF
Over Temperature	OVER TEMP	ON / OFF	ON
Over Temperature Setting	TEMP RNGE	0-100	65 C
Fan Setting	FAN SET	ON / OFF	OFF
Hysteresis voltage	HYS VOLT	1 to 10%	2
Hysteresis PF	HYS PF	1 to 5%	1
Factory Default	FACT DFLT	YES / NO	NO
Reset Energy	RSET ENGY	YES / NO	NO
● Reset Energy Pass word	RSET ENGY	0001 – 9999	2001
Reset kWh	RSET kWh	YES / NO	NO
Reset kVAh	RSET kVAh	YES / NO	NO
Reset kVArh	RSET VArh	YES / NO	NO

● For resetting energy parameters user will be prompted the password.
This password will be value which will be greater than the technical password by 1.

Refer only if trip time setting is ON else all tripping are instantaneous.		
Activate	Deactivate	Action to be taken by APFC
When any phase is missing		Disconnect All steps
15min	7.5min	(For Nominal Voltage)
100 msec	5 msec	Disconnect All steps
5min	2.5min	Disconnect All steps
15min	7.5min	
15min	7.5min	
NA	NA	
		All capacitor banks are blocked
Inst	Inst	
5min	2.5min	FAN ON
		Prompted only if over TEMP is off
		Only Valid if customer wants to reset energy

Level 3

Name of Parameter	Nomenclature	Range	Default Value	Condition
Relay 1	RLY1	ON / OFF	OFF	Prompted only if mode is set to manual.
Relay 2	RLY2	ON / OFF	OFF	
Relay 3	RLY3	ON / OFF	OFF	
Relay 4	RLY4	ON / OFF	OFF	
Relay 5	RLY5	ON / OFF	OFF	
Relay 6	RLY6	ON / OFF	OFF	
Relay 7	RLY7	ON / OFF	OFF	
Relay 8	RLY8	ON / OFF	OFF	
* Relay 9	RLY9	ON / OFF	OFF	
* Relay 10	RLY10	ON / OFF	OFF	
* Relay 11	RLY11	ON / OFF	OFF	
* Relay 12	RLY12	ON / OFF	OFF	
* * Relay 13	RLY13	ON / OFF	OFF	
* * Relay 14	RLY14	ON / OFF	OFF	

*Applicable only for IPFC CS 1003-312-90/550V ;
**13 & 14th relay will be used for control switching only when customer selects 14 relay in config. else for FAN & ALM respectively.

Fan Settings

Setting	Description
None	Fan output permanently off.
Fixed On	Fan output permanently on.
Temperature ON/OFF (Setting range = 0^{0}C - 100^{0}C)	Fan output will turn on when the temperature exceed user set value.

Modbus Register Addresses List [applicable Only For IPFC CS 1003-312
Readable parameters for Communication Model Only : [Length (Register) : 2 ; Data Structure : Float]

Address	Hex Address	Parameter	Address	Hex Address	Parameter	Address	Hex Address	Parameter
30000	0x00	Voltage V1N	30036	0x24	kVAr1	30069	0x45	THD I Error
30002	0x02	Voltage V2N	30038	0x26	kVAr2	30070	0x46	Temperature Error
30004	0x04	Voltage V3N	30040	0x28	kVAr3	30071	0x47	Over compensate Error
30006	0x06	Average Voltage LN	30042	0x2A	Total kW	30072	0x48	Under compensate Error
30008	0x08	Voltage V12	30044	0x2C	Total kVA	30073	0x49	CT Error
30010	0x0A	Voltage V23	30046	0x2E	Total kVAr			Total Harmonic Distortion(THD)
30012	0x0C	Voltage V31	30048	0x30	PF1	30124	0x7C	THD of Voltage V1N
30014	0x0E	Average Voltage LL	30050	0x32	PF2	30126	0x7E	THD of Voltage V2N
30016	0x10	Current I1	30052	0x34	PF3	30128	0x80	THD of Voltage V3N
30018	0x12	Current I2	30054	0x36	Average PF	30130	0x82	THD of Voltage V12
30020	0x14	Current I3	30056	0x38	Frequency	30132	0x84	THD of Voltage V23
30022	0x16	Average Current	30058	0x3A	kWh	30134	0x86	THD of Voltage V31
30024	0x18	kW1	30060	0x3C	kVAh	30136	0x88	THD of Current I1
30026	0x1A	kW2	30062	0x3E	kVArh	30138	0x8A	THD of Current I2
30028	0x1C	kW3	30064	0x40	Temperature	30140	0x8C	THD of Current I3
30030	0x1E	kVA1	30066	0x42	No Voltage Error	30684	0x2AC	Serial number of unit
30032	0x20	kVA2	30067	0x43	Under Voltage Error			
30034	0x22	kVA3	30068	0x44	Over Voltage Error			

[Note : 0-No Error; 1 - Error Present]

Formula to find address of individual Harmonic

Constant Parameter	Meaning
0	Voltage V1N
1	Voltage V2N
2	Voltage V3N
3	Voltage V12
4	Voltage V23
5	Voltage V31
6	Current I1
7	Current I2
8	Current I3

{142 + [(Harmonic no-2) x 2]+ 60 x Constant Parameter }

For Example,

To find the 14th Harmonic address of Voltage V31 following formula can be used:

Formula with the parameter :
{142 + [(Harmonic no-2) x 2] + 60 x C P}
Eg. {142 + [(14-2) x 2] + 60 x 5} = 466
So, Check the 14th Harmonic of Voltage V31 at 466 address.

Readable / writable parameters for Communication Model Only :

Address	Hex Address	Parameter	Range		Length (Register)	Data Structure
40000	0x00	Password-1	Min value:0	Max value : 9998	1	Integer
40001	0x01	N/W selection	Value : 0	Meaning : 3P4W	1	Integer
			Value : 1	Meaning : 3P3W	1	Integer
			Value : 2	Meaning : 1P2W	1	Integer
			Value : 3	Meaning : 2P2W	1	Integer
			Min value	Max value		
40002	0x02	CT Secondary (A)	1	5	1	Integer
40003	0x03	CT primary (A) (CT Secondary=5)	5	5 - 9999	1	Integer
		CT primary (A) (CT Secondary=1)	1	1 - 9999		
40004	0x04	PT Secondary (V)	100	500	1	Integer
40005	0x05	PT primary (V)	100	500000	2	Integer
40007	0x07	Slave id	1	255	1	Integer
			Value	Meaning		
40008	0x08	Baud rate (bps)	0x0000	300	1	Integer
			0x0001	600		
			0x0002	1200		
			0x0003	2400		
			0x0004	4800		
			0x0005	9600		
			0x0006	19200		
40009	0x09	Parity	0x0000	None	1	Integer
			0x0001	Odd		
			0x0002	Even		
40010	0x0A	Stop bit	0x0000	1	1	Integer
			0x0001	2		
40011	0x0B	Backlight OFF(Sec.)	0	7200	1	Integer
40012	0x0C	Factory Default	1	Set to factory setting range	1	Integer
40013	0x0D	Reset kWh	1	Reset Total Active Energy	1	Integer
40014	0x0E	Reset kVAh	1	Reset Total Apparent Energy	1	Integer
40015	0x0F	Reset kVArh	1	Reset Total Reactive Energy	1	Integer
			Min value	Max value		
40016	0x10	Password-2	0	9998	1	Integer
40017	0x11	Phase Compensation (^{0})	0-0, 1-90, 2-120, 3-210, 4-240, 5-330		1	Integer
40018	0x12	Nominal Voltage(V)	50	50 - 550	1	Integer
40019	0x13	Threshold Voltage (%)	0	0 - 100	1	Integer
40020	0x14	Auto Initialization	0 : NO ; 1 : YES		1	Integer
40021	0x15	Relay Count	3	*12 / 14	1	Integer
40022	0x16	Control Mode	0 - MANUAL ; 1 - AUTO		1	Integer
40023	0x17	Switching Program	0 - Auto ; 1 - Rotation ; 2 - Linear		1	Integer

*13 & 14th relay will be used for control switching only when customer selects 14 relay in config. else for FAN & ALM respectively.

Readable / writable parameters for Communication Model Only :

Address	Hex Address	Parameter	Range		Length (Register)	Data Structure
40024	0x18	Target Power Factor (PF)	800	-800	1	Signed Integer
40025	0x19	Step time (Sec.)	5	5 - 240	1	Integer
40026	0x1A	Discharge Time(Sec.)	5	5 - 9999	1	Integer
40027	0x1B	Control Sensitivity(%)	55	55 - 100	1	Integer
40028	0x1C	No Voltage	0 : OFF ; 1 : ON		1	Integer
40029	0x1D	Over Voltage	0 : OFF ; 1 : ON		1	Integer
40030	0x1E	Set Over Voltage(V)	250-290(LN) ; 490-520(LL)		1	Integer
40031	0x1F	Under Voltage	0 : OFF ; 1 : ON		1	Integer
40032	0x20	Set Under Voltage(V)	195-210(LN) ; 400-415(LL)		1	Integer
40033	0x21	Total Harmonic Distortion	0 : OFF ; 1 : ON		1	Integer
40034	0x22	Total Harmonic Distortion Range(%)	20	20 - 100	1	Integer
40035	0x23	Over Compensation	0 : OFF ; 1 : ON		1	Integer
40036	0x24	Under Compensation	0 : OFF ; 1 : ON		1	Integer
40037	0x25	Step Error	0 : OFF ; 1 : ON		1	Integer
40038	0x26	Set Step Error(%)	20	20 - 80	1	Integer
40039	0x27	CT Polarity error	0 : OFF ; 1 : ON		1	Integer

40040	0x28	Over Temperature	0 : OFF ; 1 : ON		1	Integer
40041	0x29	Set Over Temperature (^{0}C)	0	0 - 100	1	Integer
40042	0x2A	Fan Settings	0 : OFF ; 1 : ON		1	Integer
40043	0x2B	Hysteresis Voltage (%)	1	1 - 10	1	Integer
40044	0x2C	Hysteresis power factor (%)	1	1 - 5	1	Integer
40045	0x2D	Relay 1	0 : OFF ; 1 : ON		1	Integer
40046	0x2E	Relay 2	0 : OFF ; 1 : ON		1	Integer
40047	0x2F	Relay 3	0 : OFF ; 1 : ON		1	Integer
40048	0x30	Relay 4	0 : OFF ; 1 : ON		1	Integer
40049	0x31	Relay 5	0 : OFF ; 1 : ON		1	Integer
40050	0x32	Relay 6	0 : OFF ; 1 : ON		1	Integer
40051	0x33	Relay 7	0 : OFF ; 1 : ON		1	Integer
40052	0x34	Relay 8	0 : OFF ; 1 : ON		1	Integer
40053	0x35	Relay 9	0 : OFF ; 1 : ON		1	Integer
40054	0x36	Relay 10	0 : OFF ; 1 : ON		1	Integer
40055	0x37	Relay 11	0 : OFF ; 1 : ON		1	Integer
40056	0x38	Relay 12	0 : OFF ; 1 : ON		1	Integer
* 40057	0x39	Relay 13	0 : OFF ; 1 : ON		1	Integer
* 40058	0x3A	Relay 14	0 : OFF ; 1 : ON		1	Integer
40059	0x3B	Trip time setting	0 : OFF ; 1 : ON		1	Integer

User Guide

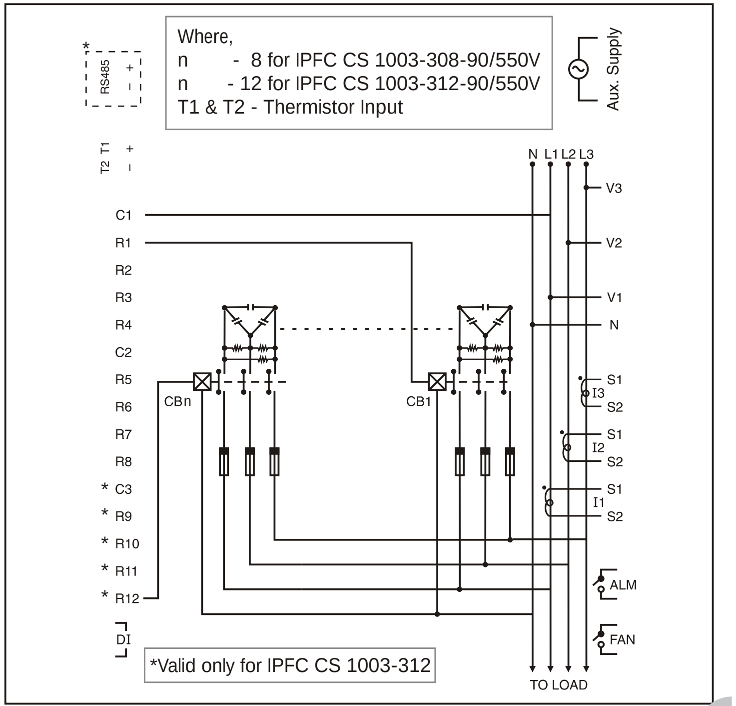
a) Manual switching (MANL) :

1) When this switching program is selected, the capacitor steps are controlled manually by the user.

2) DI : When user selects manual switching through Auto / Manual switch on the panel, then all the relays that are 'ON' through IPFC are turned 'OFF' and then user can manually turn every capacitor bank through push button available on panel for respective banks. In this case IPFC has no more control and it switches off all bank that it was earlier controlling.

Wiring Diagram

3 Phase - 4 Wire

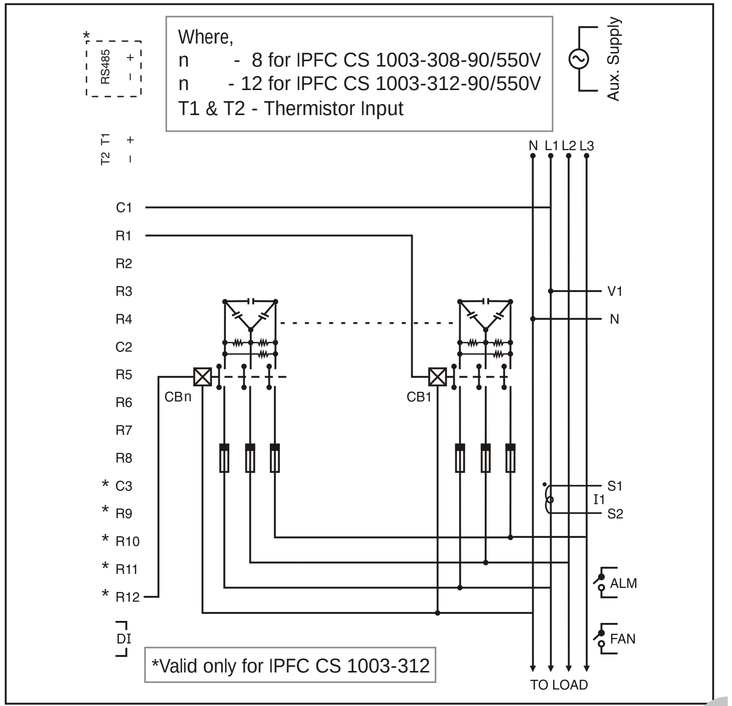


b) Rotational switching (ROTN) : This switching program is based on rotational first-in-first-out sequence. This option will automatically switch in and out the capacitors according to the targeted power factor, sensitivity setting and the re-connection time setting.

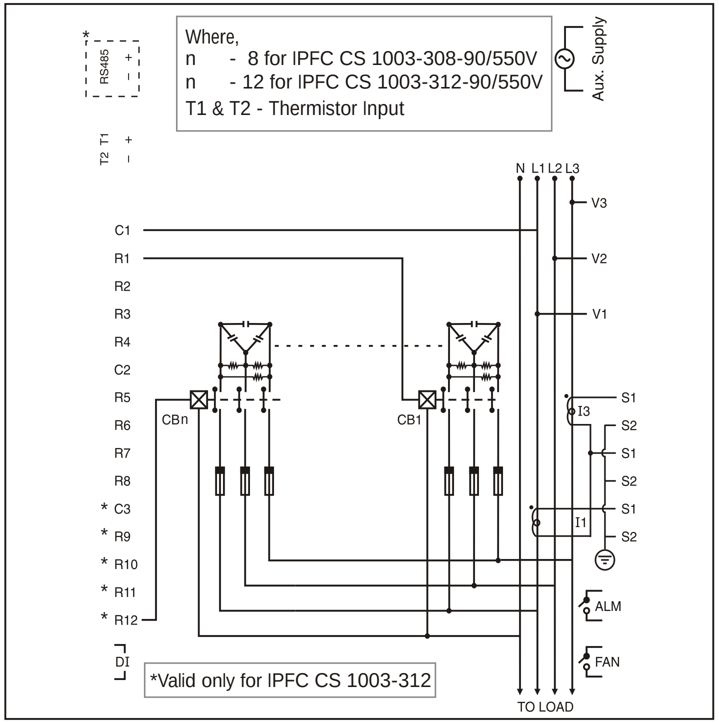
c) Automatic switching (AUTO) : This automatic switching program uses intelligent switching sequence. The step switching sequence is not fixed and the program automatically selects the most appropriate steps to switch in or out in order to achieve shortest reaction time with minimum number of steps.

d) Linear switching (LINR) : In this switching sequence it works in last in first out mode. This option will automatically switch in and out the capacitors according to the targeted power factor, sensitivity setting and the re-connection time setting.

1 Phase - 2 Wire



3 Phase - 3 Wire



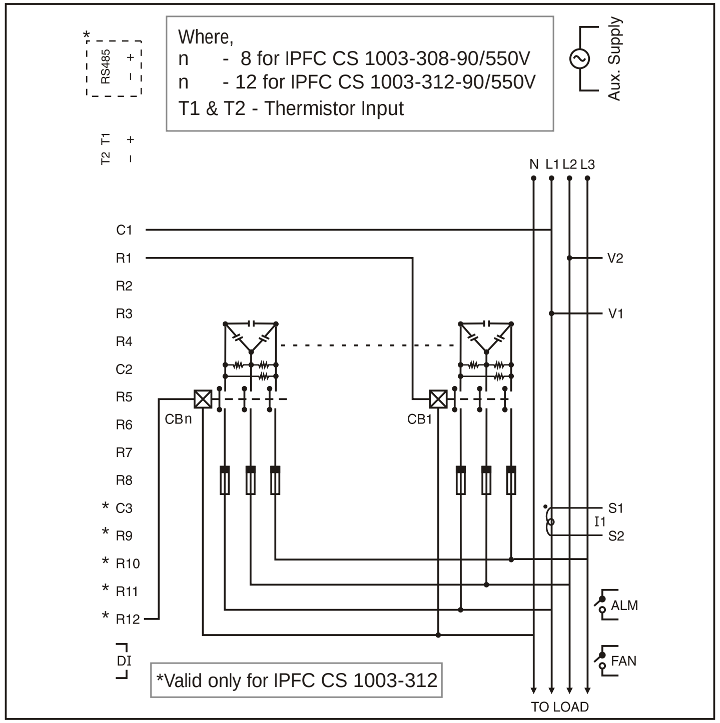
NOTE : • For N/W selection 2P2W voltage (V_{LL}) applied between V1 & V2 and connect CT for I1 [Do not use V3, N I2 & I3 terminal]

• For N/W selection 1P2W voltage (V_{LN}) applied between V1 & N and connect CT for I1 [Do not use V2, V3, I2 & I3 terminal]

Phase-angle Setting

Voltage	L1-N	L2-N	L3-N	L1-N	L2-N	L3-N	L1-N	L2-N	L3-N
CT	L1	L2	L3	L2	L3	L1	L3	L1	L2
Phase-Angle	0^0	0^0	0^0	240^0	240^0	240^0	120^0	120^0	120^0
Voltage	L2-L3	L3-L1	L1-L2	L2-L3	L3-L1	L1-L2	L2-L3	L3-L1	L1-L2
CT	L1	L2	L3	L2	L3	L1	L3	L1	L2
Phase-Angle	90^0	90^0	90^0	330^0	330^0	330^0	210^0	210^0	210^0

2 Phase - 2 Wire



(Specifications are subject to change, since development is a continuous process.)

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Operating Instruction
IPFC CS 1003

Specifications

Display	:	Liquid crystal display with dual color backlight 3 line, 4 digits to show electrical parameters.
Wiring input	:	3 Ø 4 wire, 3 Ø 3 wire, 1 Ø 2 wire, 2 Ø 2 wire
Rated input voltage	:	11 to 300V AC (L-N) ; 50 to 520V AC (L-L)
Rated input current	:	Nominal 5A AC (MIN-11mA, MAX-6A)
Burden	:	20 mOhms
Frequency range	:	45-65 Hz
CT primary	:	1A / 5A to 9999A (programmable for any value)

Note : 1A to 9999A if CT Secondary is 1 else CT Primary is 5A to 9999A

CT Secondary	:	1A or 5A (Programmable)
PT Primary	:	100V to 500kV (Programmable for any value)
PT Secondary	:	100V to 500V (Programmable for any value)
Display update time	:	1sec for all parameters
Display scrolling	:	Auto / Manual / Default (Programmable)
Display scrolling time	:	5 Sec.
Power Consumption	:	Max 15VA
Trip Indication	:	Backlight turns to orange
Controlling Range	:	Target PF : 0.800 lag to 0.800 lead Switching Program : Automatic / Linear / Rotational
Relay Output	:	Alarm mode : Over Voltage, Under Voltage, Over Compensate, Under Compensate, CT Polarity error, No Voltage, Step error, Over Temperature.
Temperature	:	0 to 100°C
Fan Output	:	ON / OFF / Temp controlled
LCD Indication	:	- Fault Occurs -Communication in Progress - Fan Mode - Digital Input
Environmental Conditions	:	Outdoor use Temperature: Operating : 0°C to 60°C Storage : -20°C to 60°C Humidity : 0% to 95% without moisture consideration
Mounting	:	Panel Mounting
Weight	:	IPFC CS 1003-312 : 460gms IPFC CS 1003-308 : 450gms

Order Code Information

Product	Supply	CE	No. of Stages
IPFC CS 1003-312-90/550V	90 to 550V AC, 50/60Hz	-	12 / 14*
IPFC CS 1003-308-90/550V	90 to 550V AC, 50/60Hz	-	8

Note : When 14 relay option selected FAN & ALARM Relay will be used for control Switching (Applicable only for IPFC CS 1003-312-90/550V)

Serial Communication [Applicable only for IPFC CS 1003-312]

Interface standard and protocol	Rs485 and MODBUS RTU
Communication address	1 to 255
Transmission Mode	Half duplex
Data types	Float and Integer
Transmission distance	500 Meter maximum
Transmission speed	300, 600,1200, 2400, 4800, 9600, 19200 (in bps)
Parity	None, Odd, Even
Stop bits	1 or 2

Resolution

PT Ratio x CT Ratio	kWh	PT Ratio x CT Ratio	kWh
<15	0.01K	<15000	0.01M
<150	0.1K	<150000	0.1M
<1500	1K	‡1500000	1M

Note: 1) For Voltage, Current, Power, resolution is automatically adjusted.
2) For power factor, resolution is 0.001 & for temperature resolution is 0.1

Accuracy

Measurement	Accuracy	Measurement	Accuracy
Voltage V_{L-N}	±0.5% of Full Scale	Active Power	1%
Voltage V_{L-L}	±0.5% of Full Scale	Apparent Power	1%
Current	±0.5% of Full Scale	Reactive Power	1%
Frequency For L-N > 20V, For L-L > 35V	±0.1% of Full Scale	Power Factor	±0.01
		Active Energy	Class 1
		Apparent Energy	Class 1
Temperature	±3°C of Full Scale	Reactive energy	Class 1

Safety Precautions

All safety related codification, symbols and instructions that appear in this operating manual or on the equipment must be strictly followed to ensure the safety of the operating personnel as well as the instrument.

If the equipment is not handled in a manner specified by the manufacturer, it might impair the protection provided by the equipment.

Caution : Read Complete instruction prior to installation and operation of the unit.

Warning : Risk of electric shock.

Wiring Guidelines

1. To prevent the risk of electric shock, power supply to the equipment must be kept OFF while doing the wiring arrangement. Do not touch the terminals while power is being supplied.
2. Wiring shall be done strictly according to the terminal layout. Confirm that all connections are correct.
3. Use pin type lugged terminals.
4. To eliminate electromagnetic interference, use wires with adequate ratings and twists of the same in equal size shall be made.
5. Cables used for connection to power source, must have a cross section of 1.5 mm^2. These wires shall have current carrying capacity of 5A.

Maintenance

1. The equipment should be cleaned regularly to avoid blockage of ventilating Parts.
2. Clean the equipment with a clean soft cloth. Do not use Isopropyl alcohol or any other cleaning agent.

Installation Guidelines

Caution

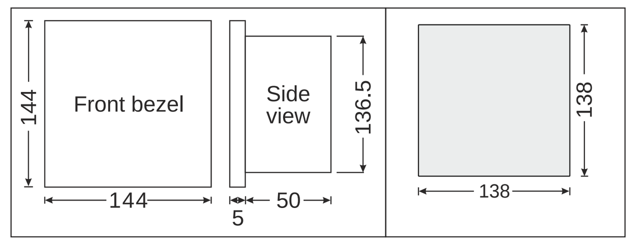
1. This equipment, being built-in type, normally becomes a part of main control panel and in such case the terminals do not remain accessible to the user end after installation and internal wiring.
2. Conductors must not come in contact with the internal circuitry of the equipment or else it may lead to a safety hazard that may in turn endanger life or cause electrical shock to the operator.
3. Before disconnecting the secondary of the external current transformer from the equipment, make sure that the current transformer is short circuited to avoid risk of electrical shock and injury.
4. The equipment shall not be installed in environmental condition other than those mentioned in this manual.

5. Thermal dissipation of equipment is met through ventilation holes provided on chasis of equipment. Such ventilation holes shall not be obstructed else it can lead to a safety hazard.
6. Connector screw must be tightened after installation.

Mechanical Installation / Dimensions

1. Prepare panel cut out with proper dimensions as shown in the figure.
2. Push the meter into the panel cutout. Secure the meter in its place by pushing the clamp on the rear side. The screw of the panel clamp must be in the farthest forward slot.
3. For proper sealing tighten the screw evenly with required torque.

Outline Dimensions (in mm) Panel Cutout (in mm)



Caution

The equipment in its installed state must not come in close proximity to any heating sources, caustic vapors, oils, steam or other unwanted process by product.

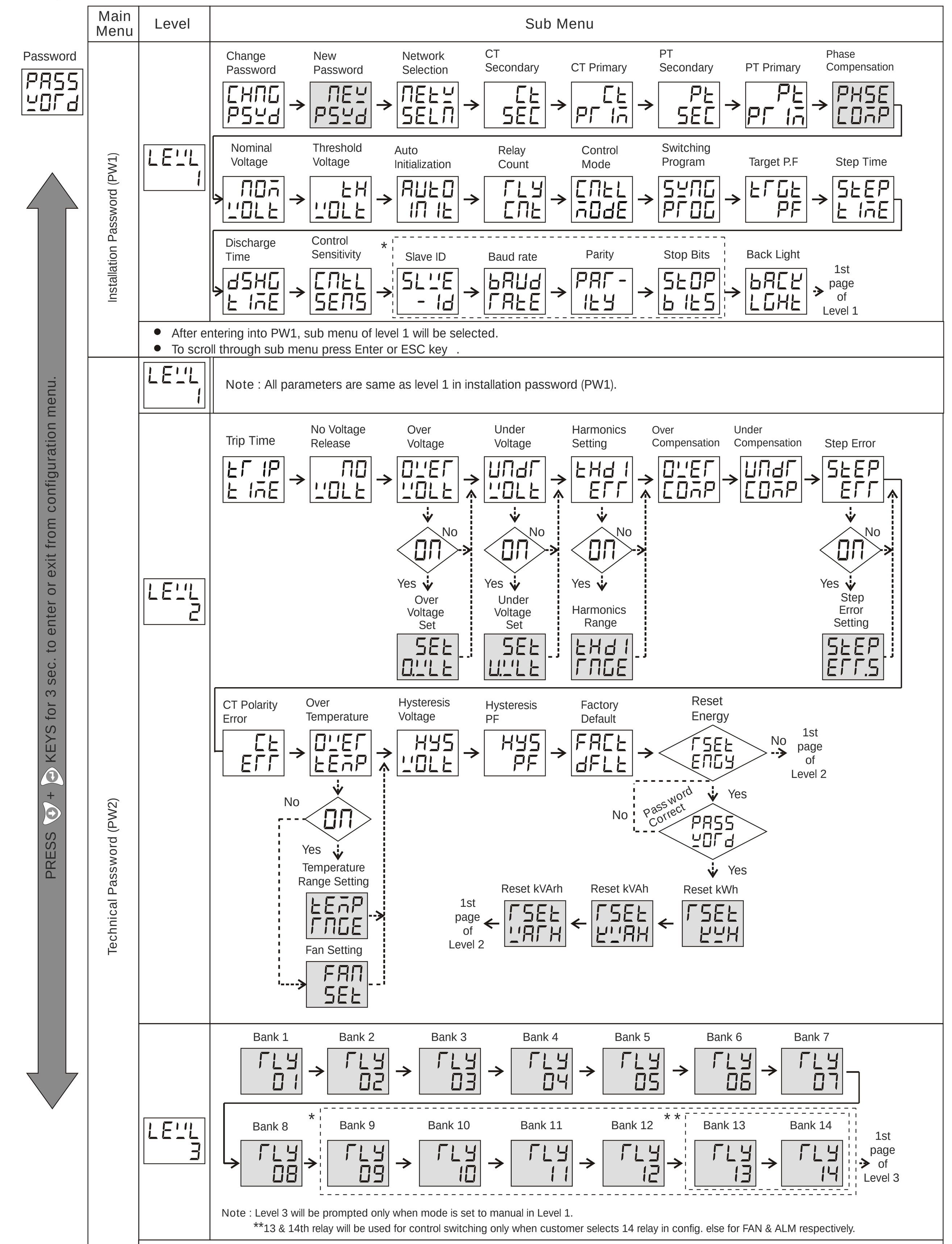
Emc Guidelines

1. Use proper input power cables with shortest connections and twisted type.
2. Layout of connecting cables shall be away from any internal EMI source.

Sensor Clip Assembly

Assemble sensor on the panel /Din rail clamp by using center screw provision and M4 nut. As shown in below diagram.

Configuration Menu



- After entering into PW1, sub menu of level 1 will be selected.
- To scroll through sub menu press Enter or ESC key.

Note : All parameters are same as level 1 in installation password (PW1).

Note : Level 3 will be prompted only when mode is set to manual in Level 1.
**13 & 14th relay will be used for control switching only when customer selects 14 relay in config. else for FAN & ALM respectively.

- After entering into PW2, all levels can be accessed.
- Press ESC Key for 1 sec. to change the level. Different level can be selected by pressing increment & decrement Key

Note: *Applicable only for IPFC CS 1003-312-90/550V.
Appearance of shaded menus dependent on selection of other parameters.

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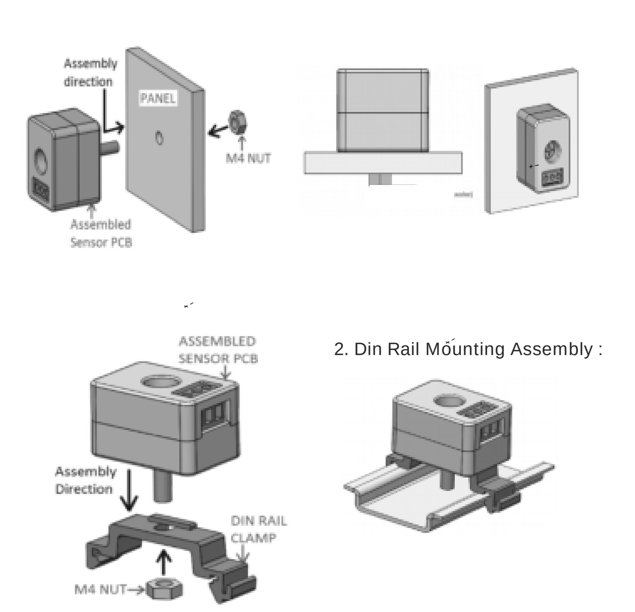
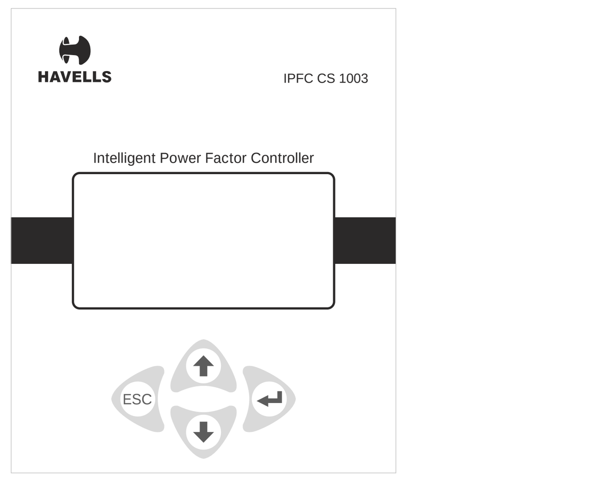
1. Panel Mounting Assembly :



2. Din Rail Mounting Assembly :

Front Panel Description



Key Description

Press &	For 3 sec to enter or exit from the configuration menu.
Press	For increment
	To move cursor right by one digit each time after last digit of display cursor shift at 1st digit of display.
Press	To save the setting and move on to next page
Press	To go back

Configuration

There are 4 dedicated keys

Use these 4 keys to enter into configuration menu / change setting.

Note : The setting should be done by a professional after going through this operating manual.

Online Page Description

Key Press	Parameter Key	Description For 3P4W
—	—	Displays line to neutral voltage of 3 phases.
		Displays line to line voltage of 3 phases.
		Displays % THD of line to neutral voltage of 3 phases.
		Displays % THD of line to line voltage of 3 phases.
		Displays current of 3 phases.
		Displays % THD of current of 3 phases.
Press key (1st time)	—	Displays line to neutral avg. voltage, current & frequency.
		Displays line to line avg. voltage, current & frequency.
		Displays power factor of 3 phases.
Press key (2nd time)	—	Displays active power of 3 phases.
		Displays reactive power of 3 phases.
		Displays apparent power of 3 phases.
Press key (3rd time)	—	Displays active energy.
		Displays apparent energy.
		Displays reactive energy.
		Displays temperature*.

*Note: Temperature will be displayed when over temp setting is 'ON'.

Key Press	Parameter Key	Description For 3P3W
—	—	Displays line to line voltage of 3 phases.
		Displays % THD of line to line voltage of 3 phases.
		Displays current of 3 phases.
		Displays % THD of current of 3 phases.
Press key (1st time)	—	Displays line to line avg. voltage, current & frequency
		Displays avg. power factor of 3 phases.
Press key (2nd time)	—	Displays total active power.
		Displays total reactive power.
		Displays total apparent power.
Press key (3nd time)	—	Displays active energy.
		Displays apparent energy.
		Displays reactive energy
		Displays temperature.*

Key Press	Parameter Key	Description For 1P2W
—	—	Displays line to neutral voltage of 1st phase.
		Displays % THD of line to neutral voltage of 1st phase.
		Displays current of 1st phase.
		Displays % THD of current of 1st phase.
Press key (1st time)	—	Displays power factor of 1st phase & frequency
Press key (2nd time)	—	Displays active power of 1st phase.
		Displays reactive power of 1st phase.
		Displays apparent power of 1st phase.
Press key (3nd time)	—	Displays active energy of 1st phase.
		Displays apparent energy of 1st phase.
		Displays reactive energy of 1st phase.
		Displays temperature.*

Key Press	Parameter Key	Description For 2P2W
—	—	Displays line to line voltage.
		Displays % THD of line to line voltage.
		Displays current.
		Displays % THD of current.
Press key (1st time)	—	Displays power factor and frequency.
Press key (2nd time)	—	Displays total active power.
		Displays total reactive power.
		Displays total apparent power.
Press key (3nd time)	—	Displays active energy.
		Displays apparent energy.
		Displays reactive energy
		Displays temperature.*

Backlight Indications

Backlight	Description
White	Capacitor Banks that are ON.
Orange	Fault condition occurred [Press ESC key to display trip parameter] Backlight turn to white again when user will press ESC key in fault condition. Trip parameters will be displayed for 3sec each.

Note : On occurrence of any new fault condition backlight turns Orange & on pressing ESC key all trip parameters will be displayed for 3sec each.

Serial Number Description

Press ESC key for 10sec. to display 8 digit serial number at 2nd & 3rd line of display.

Auto / Manual / Default Mode Description

Press Enter key for 3sec. to change online page mode.

Level 1

Parameter	Display	Range	Default Value	Condition
Password	PASS WORD	0000 – 9998	1000 (PW1) ; 2000 (PW2)	Level 3 accessible only when control mode is 'Manual'
Change Password	CHNG PSWD	YES / NO	NO	
New Password	NEW PSWD	0000 – 9998	0	
Level Indication	LEVEL	–	LEVL 1	
Network Selection	NETW SELN	3P4W / 3P3W / 1P2W / 2P2W	3P4W	
CT Secondary	CT SEC	1A / 5A	5A	
CT Primary	CT PRIM	1A / 5A-9999A	5A	
PT Secondary	PT SEC	100V – 500V	350V	
PT Primary	PT PRIM	100V to 500KV	350V	
Phase Compensation Angle	PHSE COMP	0, 90, 120, 210, 240, 330	0	Only Valid for 1P2W & 2P2W
Nominal Voltage	NOM VOLT	50 – 550V	For 1P2W/3P4W-240V For 3P3W/2P2W-415V	
Threshold Voltage	TH VOLT	0 – 100%	0%	
Auto Initialization	AUTO INIT	YES / NO	YES	

Level 1

Parameter	Display	Range	Default Value	Condition
Relays Count	RLY CNT	3 – 8 / 12 / 14	08 or 12	IPFC CS 1003-308-8RL IPFC CS 1003-312-12 RL
Control Mode	CNTL MODE	Auto / Manual	Auto	
Switching Program	SWNG PROG	Auto / Linear / Rotational	Auto	
Target Power Factor	TRGT PF	0.800 to -0.800	1.000	
Step time	STEP TIME	5 S to 240 S	5 S	
Discharge Time (Reconnection time)	DSHG TIME	5 S to 9999 S	75 S	
Control Sensitivity settings	CNTL SENS	55% to 100%	60%	
Slave ID	SLVE ID	001 – 255	1	
Baud Rate	BAUD RATE	300/600/1200/ 2400/4800 / 9600/19K2	9600	
Parity	PAR-ITY	NONE / ODD / EVEN	NONE	
Stop Bits	STOP BITS	1 or 2	1	
Backlight	BACK LGHT	0 to 7200 Sec	0	

Level 2

Refer only if trip time setting is ON else all tripping are instantaneous.

Name of Parameter	Nomenclature	Range	Default Value	Activate	Deactivate	Action to be taken by APFC
Trip time setting	TRIP TIME	ON / OFF	OFF			
No Voltage Release	NO VOLT	ON / OFF	ON	When any phase is missing		Disconnect All steps
Over Voltage	OVER VOLT	ON / OFF	ON			
Over Voltage setting	SET O.VLT	250 - 290V (L-N) 490 - 520 (L-L)	290V (L-N) 520 (L-L)	15min	7.5min	(For Nominal Voltage)
Under Voltage	UNDR VOLT	ON / OFF	OFF			
Under Voltage setting	SET U.VLT	195 - 210V (L-N) 400 - 415 (L-L)	210V (L-N) 415 (L-L)	100 msec	5 msec	Disconnect All steps
Total Harmonic Distortion	THDI ERR	ON / OFF	ON	5min	2.5min	Disconnect All steps
THD I Range	THDI RNGE	20 - 100%	50%			
Over Compensate	OVER COMP	ON / OFF	ON	15min	7.5min	
Under Compensate	UNDR COMP	ON / OFF	ON	15min	7.5min	
Step Error	STEP ERR	ON / OFF	ON	NA	NA	
Step Error Setting	STEP ERR.S	20 to 80%	20			All capacitor banks are blocked
CT Polarity error	CT ERR	ON / OFF	OFF	Inst	Inst	
Over Temperature	OVER TEMP	ON / OFF	ON			
Over Temperature Setting	TEMP RNGE	0-100	65 C	5min	2.5min	FAN ON
Fan Setting	FAN SET	ON / OFF	OFF			Prompted only if over TEMP is off
Hysteresis voltage	HYS VOLT	1 to 10%	2			
Hysteresis PF	HYS PF	1 to 5%	1			
Factory Default	FACT DFLT	YES / NO	NO			
Reset Energy	RSET ENGY	YES / NO	NO			
● Reset Energy Pass word	RSET ENGY	0001 – 9999	2001			Only Valid if customer wants to reset energy
Reset kWh	RSET kWh	YES / NO	NO			
Reset kVAh	RSET kVAh	YES / NO	NO			
Reset kVArh	RSET VArh	YES / NO	NO			

● For resetting energy parameters user will be prompted the password. This password will be value which will be greater than the technical password by 1.

Readable / writable parameters for Communication Model Only :

Address	Hex Address	Parameter	Range		Length (Register)	Data Structure
40000	0x00	Password-1	Min value:0	Max value : 9998	1	Integer
40001	0x01	N/W selection	Value : 0	Meaning : 3P4W	1	Integer
			Value : 1	Meaning : 3P3W	1	Integer
			Value : 2	Meaning : 1P2W	1	Integer
			Value : 3	Meaning : 2P2W	1	Integer
			Min value	Max value		
40002	0x02	CT Secondary (A)	1	5	1	Integer
40003	0x03	CT primary (A) (CT Secondary=5)	5	5 - 9999	1	Integer
		CT primary (A) (CT Secondary=1)	1	1 - 9999		
40004	0x04	PT Secondary (V)	100	500	1	Integer
40005	0x05	PT primary (V)	100	500000	2	Integer
40007	0x07	Slave id	1	255	1	Integer
			Value	Meaning		
40008	0x08	Baud rate (bps)	0x0000	300	1	Integer
			0x0001	600		
			0x0002	1200		
			0x0003	2400		
			0x0004	4800		
			0x0005	9600		
			0x0006	19200		
40009	0x09	Parity	0x0000	None	1	Integer
			0x0001	Odd		
			0x0002	Even		
40010	0x0A	Stop bit	0x0000	1	1	Integer
			0x0001	2		
40011	0x0B	Backlight OFF(Sec.)	0	7200	1	Integer
40012	0x0C	Factory Default	1	Set to factory setting range	1	Integer
40013	0x0D	Reset kWh	1	Reset Total Active Energy	1	Integer
40014	0x0E	Reset kVAh	1	Reset Total Apparent Energy	1	Integer
40015	0x0F	Reset kVArh	1	Reset Total Reactive Energy	1	Integer
			Min value	Max value		
40016	0x10	Password-2	0	9998	1	Integer
40017	0x11	Phase Compensation (°)	0-0, 1-90, 2-120, 3-210, 4-240, 5-330		1	Integer
40018	0x12	Nominal Voltage(V)	50	50 - 550	1	Integer
40019	0x13	Threshold Voltage (%)	0	0 - 100	1	Integer
40020	0x14	Auto Initialization	0 : NO ; 1 : YES		1	Integer
40021	0x15	Relay Count	3	12 / 14	1	Integer
40022	0x16	Control Mode	0 - MANUAL ; 1 - AUTO		1	Integer
40023	0x17	Switching Program	0 - Auto ; 1 - Rotation ; 2 - Linear		1	Integer

Address	Hex Address	Parameter	Range		Length (Register)	Data Structure
40024	0x18	Target Power Factor (PF)	800	-800	1	Signed Integer
40025	0x19	Step time (Sec.)	5	5 - 240	1	Integer
40026	0x1A	Discharge Time(Sec.)	5	5 - 9999	1	Integer
40027	0x1B	Control Sensitivity(%)	55	55 - 100	1	Integer
40028	0x1C	No Voltage	0 : OFF ; 1 : ON		1	Integer
40029	0x1D	Over Voltage	0 : OFF ; 1 : ON		1	Integer
40030	0x1E	Set Over Voltage(V)	250-290(LN) ; 490-520(LL)		1	Integer
40031	0x1F	Under Voltage	0 : OFF ; 1 : ON		1	Integer
40032	0x20	Set Under Voltage(V)	195-210(LN) ; 400-415(LL)		1	Integer
40033	0x21	Total Harmonic Distortion	0 : OFF ; 1 : ON		1	Integer
40034	0x22	Total Harmonic Distortion Range(%)	20	20 - 100	1	Integer
40035	0x23	Over Compensation	0 : OFF ; 1 : ON		1	Integer
40036	0x24	Under Compensation	0 : OFF ; 1 : ON		1	Integer
40037	0x25	Step Error	0 : OFF ; 1 : ON		1	Integer
40038	0x26	Set Step Error(%)	20	20 - 80	1	Integer
40039	0x27	CT Polarity error	0 : OFF ; 1 : ON		1	Integer
40040	0x28	Over Temperature	0 : OFF ; 1 : ON		1	Integer
40041	0x29	Set Over Temperature (C°)	0	0 - 100	1	Integer
40042	0x2A	Fan Settings	0 : OFF ; 1 : ON		1	Integer
40043	0x2B	Hysteresis Voltage (%)	1	1 - 10	1	Integer
40044	0x2C	Hysteresis power factor (%)	1	1 - 5	1	Integer
40045	0x2D	Relay 1	0 : OFF ; 1 : ON		1	Integer
40046	0x2E	Relay 2	0 : OFF ; 1 : ON		1	Integer
40047	0x2F	Relay 3	0 : OFF ; 1 : ON		1	Integer
40048	0x30	Relay 4	0 : OFF ; 1 : ON		1	Integer
40049	0x31	Relay 5	0 : OFF ; 1 : ON		1	Integer
40050	0x32	Relay 6	0 : OFF ; 1 : ON		1	Integer
40051	0x33	Relay 7	0 : OFF ; 1 : ON		1	Integer
40052	0x34	Relay 8	0 : OFF ; 1 : ON		1	Integer
40053	0x35	Relay 9	0 : OFF ; 1 : ON		1	Integer
40054	0x36	Relay 10	0 : OFF ; 1 : ON		1	Integer
40055	0x37	Relay 11	0 : OFF ; 1 : ON		1	Integer
40056	0x38	Relay 12	0 : OFF ; 1 : ON		1	Integer
* 40057	0x39	Relay 13	0 : OFF ; 1 : ON		1	Integer
* 40058	0x3A	Relay 14	0 : OFF ; 1 : ON		1	Integer
40059	0x3B	Trip time setting	0 : OFF ; 1 : ON		1	Integer

* 13 & 14th relay will be used for control switching only when customer selects 14 relay in config. else for FAN & ALM respectively.

User Guide

a) Manual switching (MANL) :
   1) When this switching program is selected, the capacitor steps are controlled manually by the user.
   2) DI : When user selects manual switching through Auto / Manual switch on the panel, then all the relays that are 'ON' through IPFC are turned 'OFF' and then user can manually turn every capacitor bank through push button available on panel for respective banks. In this case IPFC has no more control and it switches off all bank that it was earlier controlling.

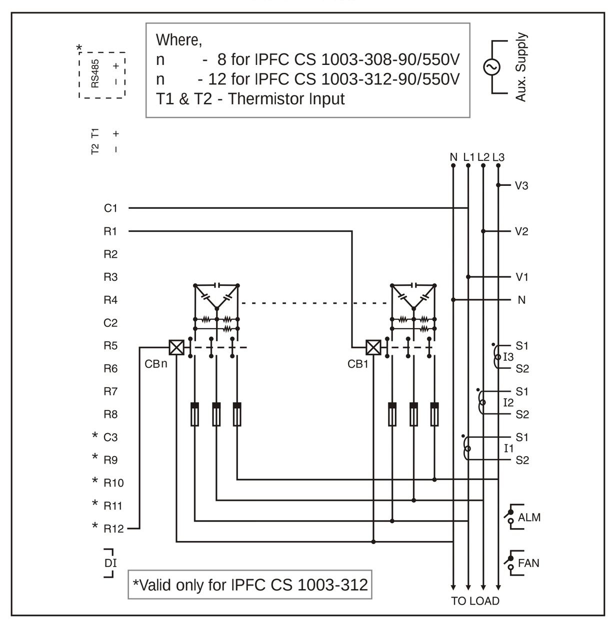
b) Rotational switching (ROTN) : This switching program is based on rotational first-in-first-out sequence. This option will automatically switch in and out the capacitors according to the targeted power factor, sensitivity setting and the re-connection time setting.

c) Automatic switching (AUTO) : This automatic switching program uses intelligent switching sequence. The step switching sequence is not fixed and the program automatically selects the most appropriate steps to switch in or out in order to achieve shortest reaction time with minimum number of steps.

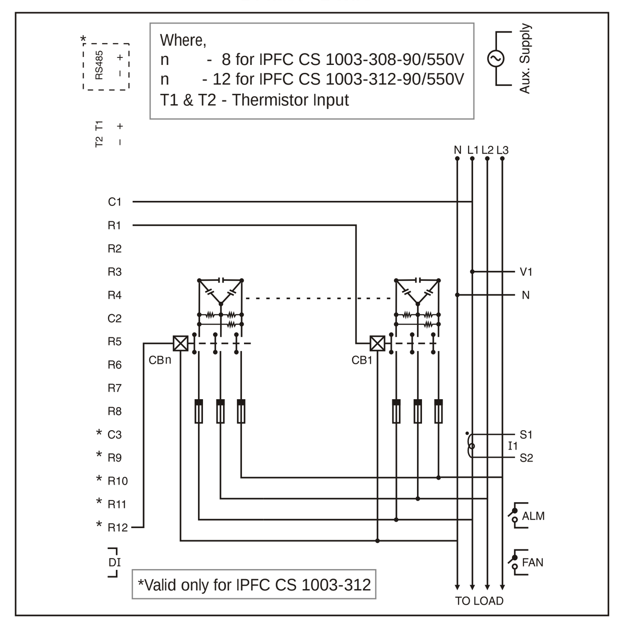
d) Linear switching (LINR) : In this switching sequence it works in last in first out mode. This option will automatically switch in and out the capacitors according to the targeted power factor, sensitivity setting and the re-connection time setting.

Wiring Diagram

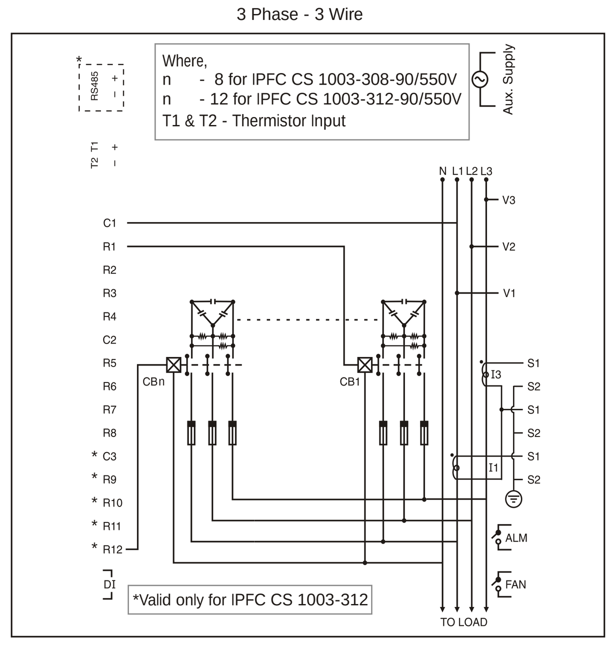
3 Phase - 4 Wire



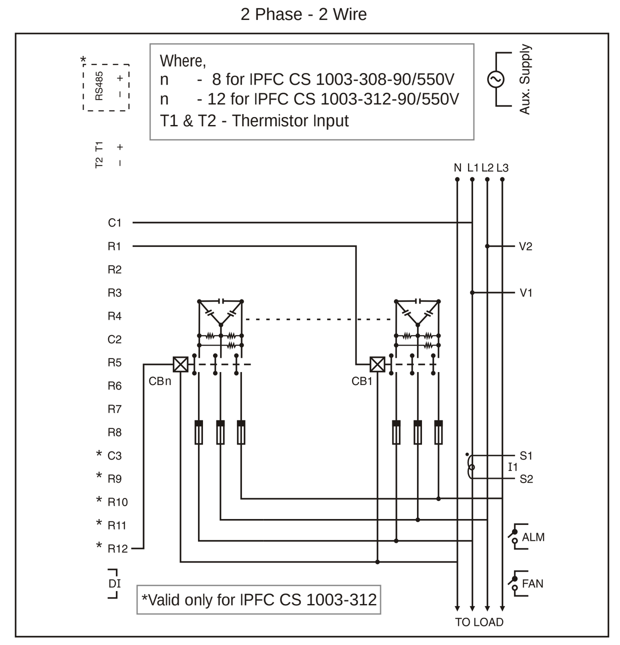
1 Phase - 2 Wire



3 Phase - 3 Wire



2 Phase - 2 Wire



NOTE : ● For N/W selection 2P2W voltage (V_{LL}) applied between V1 & V2 and connect CT for I1 [Do not use V3, N I2 & I3 terminal]
● For N/W selection 1P2W voltage (V_{LN}) applied between V1 & N and connect CT for I1 [Do not use V2, V3, I2 & I3 terminal]

Phase-angle Setting

Voltage	L1-N	L2-N	L3-N	L1-N	L2-N	L3-N	L1-N	L2-N	L3-N
CT	L1	L2	L3	L2	L3	L1	L3	L1	L2
Phase-Angle	0°	0°	0°	240°	240°	240°	120°	120°	120°
Voltage	L2-L3	L3-L1	L1-L2	L2-L3	L3-L1	L1-L2	L2-L3	L3-L1	L1-L2
CT	L1	L2	L3	L2	L3	L1	L3	L1	L2
Phase-Angle	90°	90°	90°	330°	330°	330°	210°	210°	210°

(Specifications are subject to change, since development is a continuous process.)

Level 3

Name of Parameter	Nomenclature	Range	Default Value	Condition
Relay 1	RLY1	ON / OFF	OFF	Prompted only if mode is set to manual.
Relay 2	RLY2	ON / OFF	OFF	
Relay 3	RLY3	ON / OFF	OFF	
Relay 4	RLY4	ON / OFF	OFF	
Relay 5	RLY5	ON / OFF	OFF	
Relay 6	RLY6	ON / OFF	OFF	
Relay 7	RLY7	ON / OFF	OFF	
Relay 8	RLY8	ON / OFF	OFF	
* Relay 9	RLY9	ON / OFF	OFF	
* Relay 10	RLY10	ON / OFF	OFF	
* Relay 11	RLY11	ON / OFF	OFF	
* Relay 12	RLY12	ON / OFF	OFF	
* * Relay 13	RLY13	ON / OFF	OFF	
* * Relay 14	RLY14	ON / OFF	OFF	

*Applicable only for IPFC CS 1003-312-90/550V ;
**13 & 14th relay will be used for control switching only when customer selects 14 relay in config. else for FAN & ALM respectively.

Fan Settings

Setting	Description
None	Fan output permanently off.
Fixed On	Fan output permanently on.
Temperature ON/OFF (Setting range = 0°C - 100°C)	Fan output will turn on when the temperature exceed user set value.

Modbus Register Addresses List [applicable Only For IPFC CS 1003-312

Readable parameters for Communication Model Only : [Length (Register) : 2 ; Data Structure : Float]

Address	Hex Address	Parameter	Address	Hex Address	Parameter	Address	Hex Address	Parameter
30000	0x00	Voltage V1N	30036	0x24	kVAr1	30069	0x45	THD I Error
30002	0x02	Voltage V2N	30038	0x26	kVAr2	30070	0x46	Temperature Error
30004	0x04	Voltage V3N	30040	0x28	kVAr3	30071	0x47	Over compensate Error
30006	0x06	Average Voltage LN	30042	0x2A	Total kW	30072	0x48	Under compensate Error
30008	0x08	Voltage V12	30044	0x2C	Total kVA	30073	0x49	CT Error
30010	0x0A	Voltage V23	30046	0x2E	Total kVAr			Total Harmonic Distortion(THD)
30012	0x0C	Voltage V31	30048	0x30	PF1	30124	0x7C	THD of Voltage V1N
30014	0x0E	Average Voltage LL	30050	0x32	PF2	30126	0x7E	THD of Voltage V2N
30016	0x10	Current I1	30052	0x34	PF3	30128	0x80	THD of Voltage V3N
30018	0x12	Current I2	30054	0x36	Average PF	30130	0x82	THD of Voltage V12
30020	0x14	Current I3	30056	0x38	Frequency	30132	0x84	THD of Voltage V23
30022	0x16	Average Current	30058	0x3A	kWh	30134	0x86	THD of Voltage V31
30024	0x18	kW1	30060	0x3C	kVAh	30136	0x88	THD of Current I1
30026	0x1A	kW2	30062	0x3E	kVArh	30138	0x8A	THD of Current I2
30028	0x1C	kW3	30064	0x40	Temperature	30140	0x8C	THD of Current I3
30030	0x1E	kVA1	30066	0x42	No Voltage Error	30684	0x2AC	Serial number of unit
30032	0x20	kVA2	30067	0x43	Under Voltage Error			
30034	0x22	kVA3	30068	0x44	Over Voltage Error			

[NOTE : 0 - No Error ; 1 - Error Present]

Formula to find address of individual Harmonic

Constant Parameter	Meaning
0	Voltage V1N
1	Voltage V2N
2	Voltage V3N
3	Voltage V12
4	Voltage V23
5	Voltage V31
6	Current I1
7	Current I2
8	Current I3

{142 + [(Harmonic no-2) x 2]+ 60 x Constant Parameter }

For Example,
To find the 14th Harmonic address of Voltage V31 following formula can be used:
Formula with the parameter :
{142 + [(Harmonic no-2) x 2] + 60 x C P}
Eg. {142 + [(14-2) x 2] + 60 x 5} = 466
So, Check the 14th Harmonic of Voltage V31 at 466 address.