Specification for

Microprocessor based Power Factor Correction Controller

LV/MV application at 50Hz or 60Hz

1. GENERAL

This article specifies the requirements for the design, manufacturing, testing of low voltage power factor correction controller.

The three phase automatic power factor correction controller shall be installed indoor. Installation will be carried out by a qualified contractor and all relative information to enable proper installation shall be provided by the manufacturer.

2. APPLICABLE STANDARDS

Supplier must comply to the following standards while supplying the power factor correction controller.

IEC 61010-1 (2010) ed.3
UL61010-1(2012) ed 3
CAN/CSA C22.2 N°61010-1 (2012) ed 3
Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

IEC61010-2-30 (2010) ed.1
UL61010-2-30 (2012) ed 1
CAN/CSA C22.2 N° 61010-2-30 (2012) ed 1
Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for testing and measuring circuits

IEC 61326-1 (2012)
Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

IEC 61000 6-2 (2005) ed 2
Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

IEC 61000 6-4(2006) ed.2
Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments

3. MECHANICAL SPECIFICATIONS

Minimum Degree of Protection : IP31 in the front & IP20 in the rear

Product Size : 144 X 144 preferred

Mounting : Flush mounting

4. Storage & Operation conditions

Temperature for operation: -20 °C +60 °C

Storage temperature : -40 °C +85 °C

Humidity : 0 % – 95 %, without condensation for operation and storage

Maximum pollution degree : class 2 according to IEC 61010-1

Maximum altitude : <= 2000M

5. Input & Control supplies

The Power factor controller has to be made suitable for direct connection in low voltage system up to 480V and through a PT for above 480V. There should be a provision for inputting either 1A or 5A secondary CT to the PFC controller.

The controller has to be self powered. There should not be any dedicated control supply needed for the operation of controller.

6. Communication

The Controller must have a inbuilt RS485 port in Modbus Protocol. Manufacturer has to provide the detail registry map of the Modbus device for the future reference. There should not be any dedicated power supply or wiring to be done for the RS485 communication except the normal communication cable wiring.

7. Power Factor Correction intelligence

7.1 Input supplies correction

The controller should be able to detect and correct abnormalities in wirings such as reversed CT, PT on a wrong phase etc.

7.2 Automatic step size detection

The PFC controller should be able to detect the step sizes by automatic recognition. It should detect the connected step and the power factor correction should not be affected if one or more steps failed provided there is enough remaining steps in PFC bank to do operations.

The PFC controller should detect the capacitor bank size if in case the present capacitor is replaced by a new capacitor of different rating.

7.3 No Step sequence

The controller should not have any specific sequences to follow for successful operation. It should be also possible to connect smaller or bigger capacitors after the first step in the controller. There should not be any restriction in replacing the failed capacitor with any new rating and detecting the new capacitor which replaced the failed one.

7.4 Switching program intelligence

The PFC controller programming intelligence should make sure the minimum switching of contactors while maintaining the target power factor.

There has to be provisions in configuration of the controller to program the individual steps for Fixed ON, Fixed Off or Automatic.

The Controller should be able to detect the number of steps connected automatically with out any programming.

7.5 Dual Cos Phi – The Controller should have programmable dual cos phi to differentiate the need in compensation (Cos Phi) when the operating condition changes. Like Power factor correction needs with a utility supply changes when the input power is from a in house Generator. There should be dedicated connecting terminal for providing this input.

7.6 Power Factor correction range

0.7 Lag to 0.7 Lead

8. Measurement & Display

8.1 Measurement of Power

The controller should be able to measurement and display of Active, reactive and apparent energy

The controller should be able to project the reactive energy required to attain teh target power factor in the display

8.2 Measurement of Power and Harmonics

The controller should be able to measure and display the following

1. Active, reactive and apparent energy
2. Reactive energy required to attain the target power factor in the display
3. Network voltage, Current
4. Total Harmonic distortion of Voltage
5. Individual voltage harmonic distortion up to 19^{th} harmonic.

8.3 Temperature measurement

The controller should have a inbuilt temperature sensor with programmable offset limits to measure and display the cabinet temperature.

The controller should display the maximum temperature recorded from the last reset.

8.4 Connected Step Database.

The controller should be able to measure and display the following

1. Step Status – Step is Connected or Not
2. Step power in Kvar for all the connected steps
3. Number of switching operation for every step
4. Available power per step as a % of initial power.

8.5 Type of Display has to be LCD with backlit with a minimum screen size of 50X20

8.6 The Controller should be enabled for doing Measurement and power factor correction in four quadrant operations

9. Manual Switching of steps

The controller has to have a provision of connecting the steps manually also. User must be able to connect or disconnect the steps manually.

10. Safety features

10.1 Step re connection delay

The default configuration of the controller must be in such a way that it should not connect a step before 50sec after it got disconnected. This parameter can be programmable for the user to configure the controller for special applications.

10.2 Safety certification –

The controller need to complied with IEC 61010-1 (2010) ed.3 / UL61010-1(2012) ed 3 / CAN/CSA C22.2 N°61010-1 (2012) ed 3
(Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements)

And with IEC61010-2-30 (2010) ed.1 / UL61010-2-30 (2012) ed 1 / CAN/CSA C22.2 N° 61010-2-30 (2012) ed 1
(Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for testing and measuring circuits)

10.3 Thermal safety

The Controller should have a dedicated Fan control contact to switch on the fan when the cabinet temperature exceeds 30 degrees. The controller also should operate alarm contact when the temperature exceeds 50 degrees. These limits have to be programmable and user should be able to program a offset temperature if required.

10.4 Safety against harmonic amplification

The controller should have a voltage harmonic distortion alarm and it should automatically disconnect connected steps to reduce the harmonic which is generated due to parallel resonance due to capacitors. This harmonics limits has to be programmable and by default value can be 7%.

11. Alarms

11.1 Alarm contact

The Controller should have a dedicated alarm contact which will make users to wire it to trip the PFC bank.

11.2 Alarms

Following alarms has to be incorporated in the PFC Controller

1, Over /Under Voltage alarm

2. Low Current Alarm

3. Under/Over compensation alarm

4. Faulty Step alarm – Indication of faulty step with step number

5. Derating alarm – Individual step de rating of capacitor indicator.

6. High temperature alarm – Through the internal thermal sensor. User need not have to connect any external sensor to enable this alarm.

7. Total Harmonic distortion alarm at 7% THDu.

11.3 Alarm Logs

The Controller must be able to display at least last 5 alarm logs.

12. Type Tests

The type tests should be done in compliance with

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UL61010-1(2012) ed 3
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