Auto Power Factor Control Relay

# SAC-E12

## SMARTRIC Automatic PF Controller
## Automatic Relay for Power Factor

## User Manual


SMARTRIC

## 1. Safety Tips

Installation, connection and commissioning of SAC-E12TM should be done in accordance with methods and steps provided in this manual. Before installing and operating SAC-12ETM, please read this carefully.

SAC-12ETM is connected to PT secondary and CT secondary source in order to provide the main power and calculate power factor. Thus, the work must be performed by a qualified person and not be done under voltage.

## 2. Product Description

### 2.1 Features of SAC-E12TM

SAC-E12TM is the device to control power factor as switching automatically capacitor banks.

If current power factor is below than target value set by operator, SAC-E12TM send the output signal to switch on capacitor banks step by step. Operator can switch on/off them manually as changing the operation mode from auto to manual.

Features are as below.

1) Human interface with a large-screen liquid crystal display
2) Modular assembly with exterior flow line shape
3) Display power factor, voltage, current, active power, reactive power, total harmonic distortion(voltage/current), frequency, average switching status of capacitor banks and other information
4) Setting parameters expressed in English and inputted as numeral
5) Operation mode selection (Manual / Automatic)
6) Sampling physical quantity of reactive power with harmonic measurement
7) RS-485 communication port with MODBUS protocol (Optional)

Through SAC-E management software, the real-time data and the history of load curve on the system can be observed in the computer and reported for the user. SAC-E12TM can provide the energy-effective field data quickly and conveniently.

## 3. Ordering Number

**SAC - E□□①□□②□③**

| | | | |
|---|---|---|---|
| ① | Rated voltage | : | 38 (300V ~ 480V) |
| ② | Step number | : | 12 (12 steps) |
| ③ | Contactor | : | M (Static) for Magnetic Contactor |
| | | | T (Dynamic) for Thyristor |

## 4. Construction


Figure 1. Front view of SAC-E12TM

The construction of SAC-E12TM is same with Figure 1.

| | |
|---|---|
| DISPLAY WINDOW | full LCD type and display setting parameters, system information |
| MENU BUTTON | Entering user the setting mode |
| DIRECTION BUTTON | Moving the curser to up and down-side |
| NAME PLATE | Describing type, manufacturing number and ratings |
| MODE SELECTION BUTTON | Selecting auto and manual mode |

## 5. Specification

### 5.1 Environmental Condition

| Description | Rating |
|---|---|
| Altitude | ≤2500m |
| Ambient temperature | -20 ℃ ~ +60 ℃ |
| Storage temperature | -40 ℃ ~ +70 ℃ |
| * The surrounding environment without corrosive gas, non-conductive dust, non-inflammable and explosive media presence, non-violent vibration area, no rain and snow erosion | |

### 5.2 Technical Data

| Description | Rating |
|---|---|
| **Measurement** | |
| Power supply | 160~240V, 45~65Hz |
| Voltage measuring | 100V ~ 500V, 45~65Hz |
| Current measuring | 1~6000A |
| Power Factor measuring | 0.200(leg) ~ 0.200(lead) |

| Description | Rating |
|---|---|
| **Display Performance** | |
| LCD data refresh cycle | ≦ 1s |
| Display version | 2.0 |
| Active power indication | 0 ~ 6553kW |
| Reactive power indication | 0 ~ 6553kvar |
| voltage total harmonic distortion rate indication | 0.0 ~ 100.0% |
| current total harmonic distortion rate indication | 0.0 ~ 100.0% |
| | |
| **Input/Output Signal** | |
| Voltage input | 400V (Line voltage) |
| Current input | 0~5A, sensitivity 50mA |
| Control output | 250V, 5A (static)<br>12V, 30mA (dynamic) |
| * Sampling voltage and current source should not be connected from same phase | |
| | |
| **Communication** | |
| Communication Interface | RS-485 (MODBUS protocol) |
| Communication speed | 4800 ~ 38400bps (no parity bit) |
| The controller has the communication interface to support MODBUS protocol. Items include ID numbers and RS-485 communication interface communication rate set, ID number describe the machine in the system in the network add ress of No. 001 ~ 255. Communication rate is 4800 ~ 38400bps. | |
| | |
| **Measurement Accuracy** | |
| Voltage | ± 0.5% Active Power: ± 1.0% |
| Current | ± 0.5% of reactive power: ± 1.0% |
| Power Factor | ± 1.0% Frequency: ± 0.1Hz |
| * Above accuracy is guaranteed to one year after 10 minutes which the controller is warmed on. | |
| | |
| **Setting** | |
| CT ratio | 01~6000 |
| Delay time | 5~100s (static), 0.1~30s (dynamic) |
| Target power factor | 0.80(leg)~-0.80(Lead), 0.01step |
| Over-voltage | 420~480V, 4V step |
| Switching threshold | 0.1~2 (set value for input threshold), 0.1 step |
| Excision threshold | 1.2 - Current setting |
| Harmonic protection | HV : 0.0~50.0, 0.5 step<br>HI : 0.0~100, 0.5 step |
| ID Number | 001~255 |
| Baud rate | 4800, 9600, 19200, 38400bps |
| Capacitor preset | 0~999kvar/step, 1 step |

# 6. Installation

## 6.1 Mounting

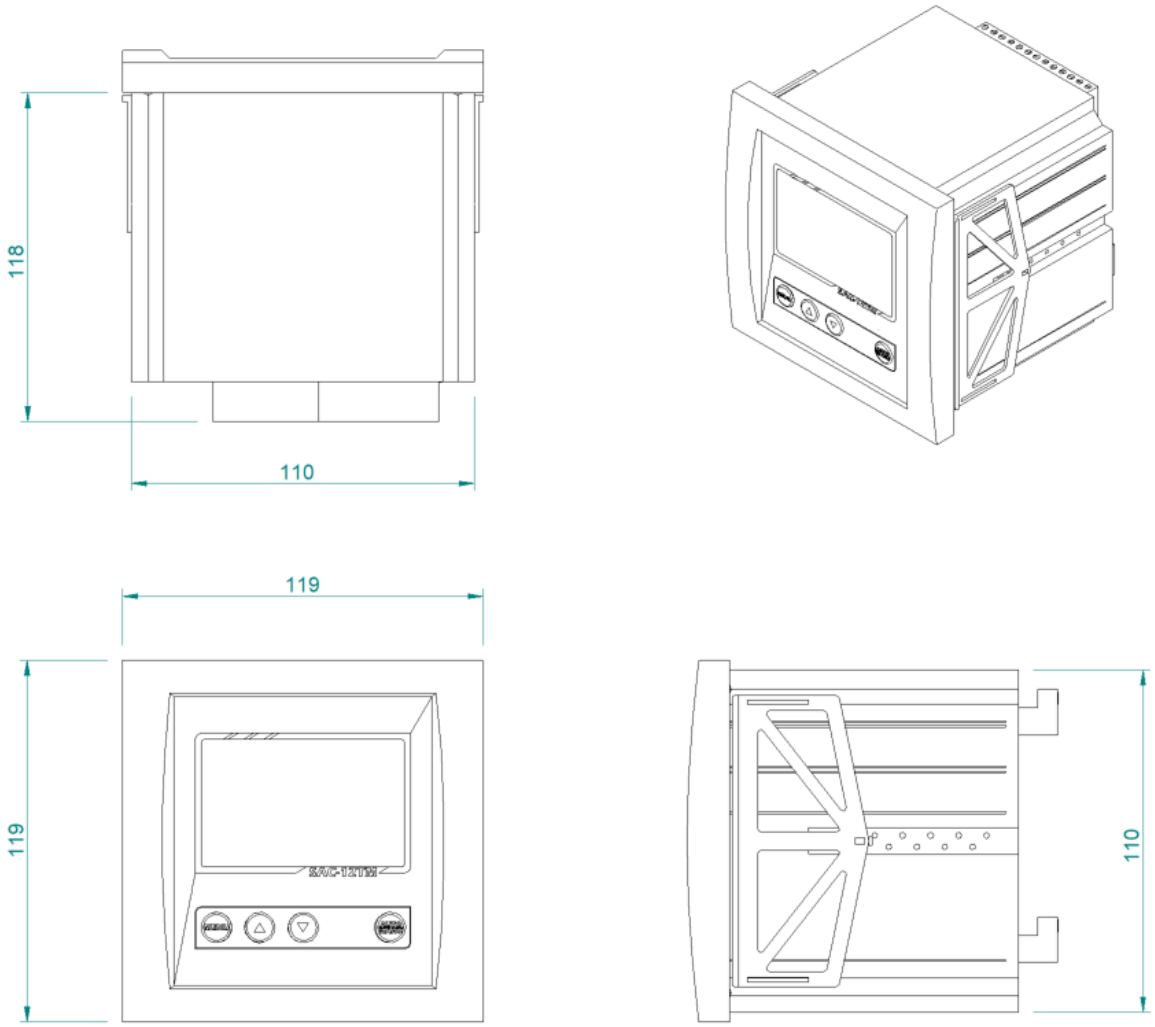


Figure 6.1 Installation Procedure

Please refer to dimension described on Figure 5.1 when making a hole of the door which the controller is installed on.

After punching a hole, please follow below steps in order to install the controller on the cubicle.

Step 1) Remove mounting bracket on both side of the controller

Step 2) Put on the controller into the hole.

Step 3) Insert mounting brackets and push them to the door.

## 6. Installation

### 6.2 Wiring

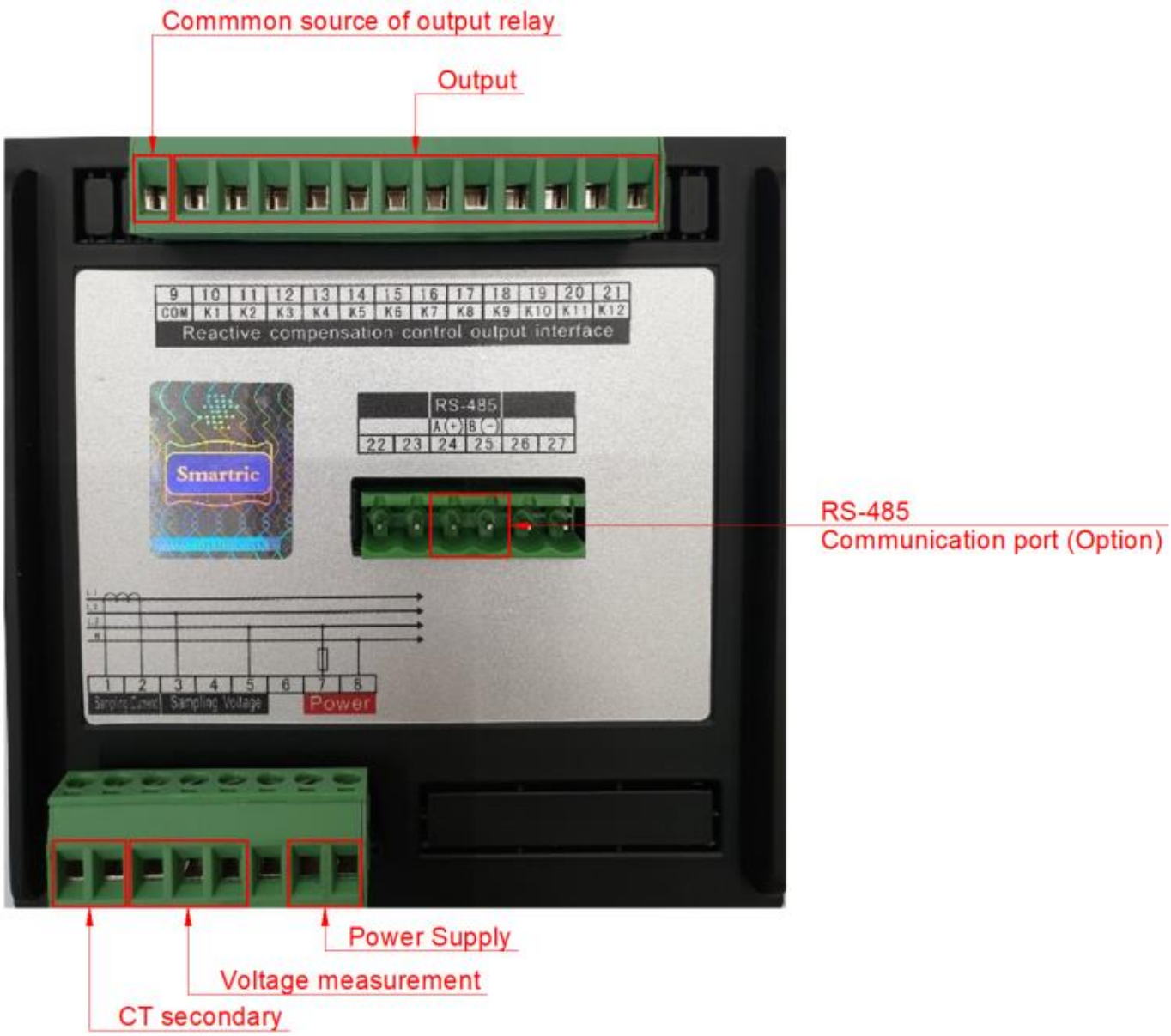


Figure 6.2 Rear view of SAC-E12TM

The rated voltage of power supply is 220VAC±20%. If the distribution line having 380VAC of system voltage is constructed to 3phases 4wires (3P4W), the power can be supplied by using line to neutral voltage on the system. In case of 3phase 3wires, the user should drop the voltage to 220VAC by step-down transformer.

SAC-E12TM can be applied to both switching type - Static type(for magnetic contactor) & Dynamic type(for thyristor).

Thus, It has a different connection according to switching type. There are two kinds of wiring diagrams as below.

Static switching (for magnetic contactor)

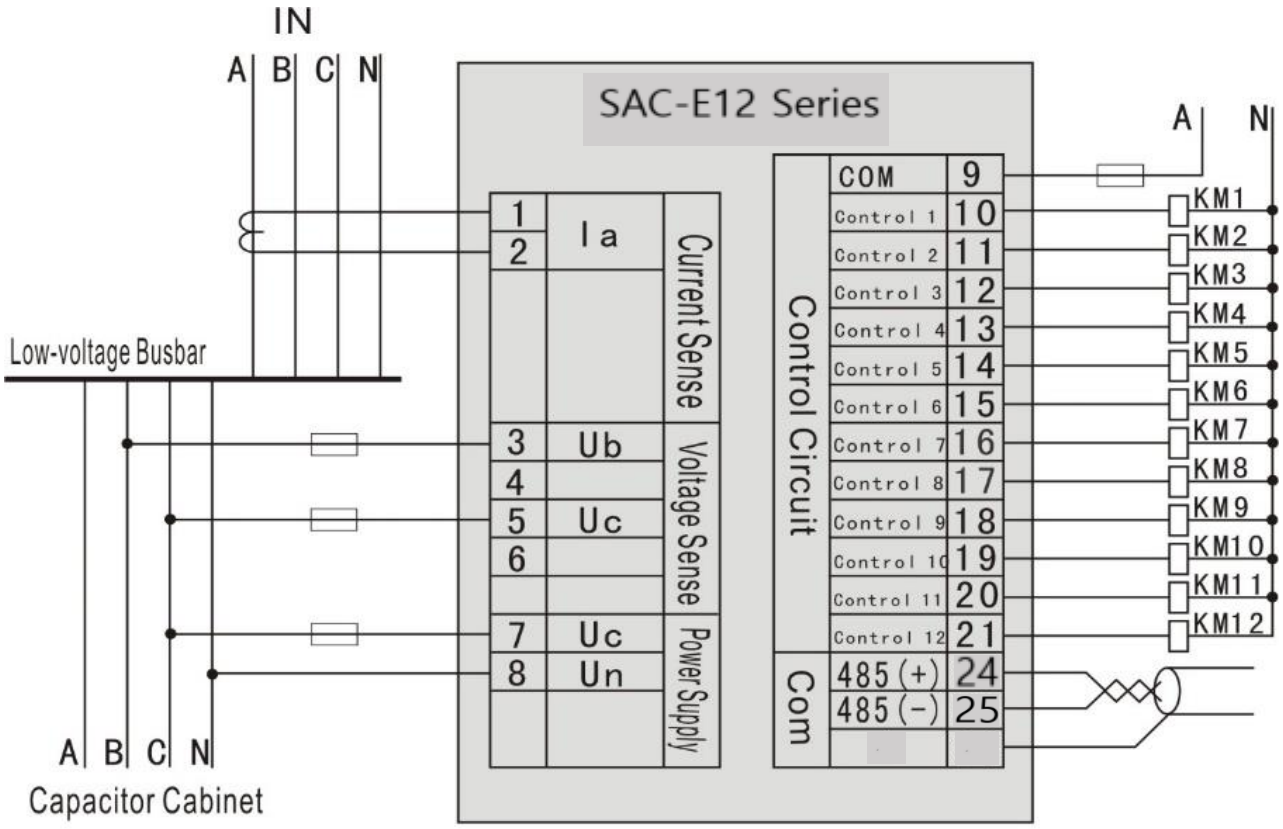


Figure 6.2 Wiring diagram for static switching

For static switching type, magnetic contactor is typically used in order to automatically switch a capacitor bank.

Shielded twisted-pair cable should be connected to each terminal for communication. Shield layer allows only one point to earth, (A-line is equivalent to -, B-line is equivalent to +).

<Terminal Description>

| No. of terminal | Condition | Instruction | Remark |
|---|---|---|---|
| 1.2 | Input | CT secondary input for measuring | Take self-screen A-phase |
| 3.5 | Input | voltage input for measuring | Take self-screen B-phase and C-phase |
| 4.6 | | | Empty terminal |
| 7.8 | Input | Power Supply input | 220VAC ± 20% |
| 9 | Output | Common terminal for control output | Connecting live line |
| 10 ~ 21 | Output | Control output from 1st to 12th group | |
| 22 ~ 23 | | | Empty terminal |
| 24 ~ 25 | | RS-485 Communication interface with MODBUS protocol | Option |
| 26 ~ 27 | | | Empty terminal |

Dynamic type (for thyristor)

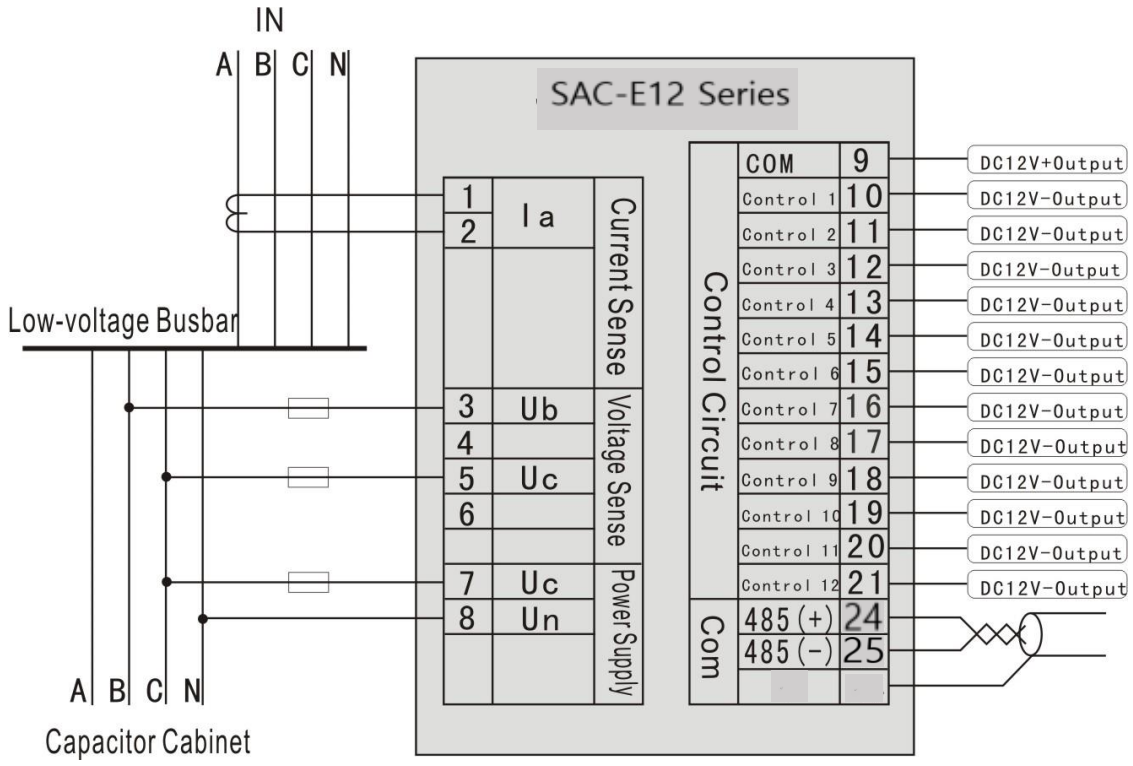


Figure 6.3 Wiring diagram for dynamic switching

For dynamic switching type, thyristor switch shall be applied to switching the capacitor bank.

Shielded twisted-pair cable should be connected to each terminal for communication. Shield layer allows only one point to earth, (A-line is equivalent to -, B-line is equivalent to +).

<Terminal Description>

| No. of terminal | Condition | Instruction | Remark |
|---|---|---|---|
| 1.2 | Input | CT secondary input for measuring | Line Current : A phase |
| 3.5 | Input | voltage input for measuring | Line voltage : B-C phase |
| 4.6 | | | Empty terminal |
| 7.8 | Input | Power Supply input | 220VAC ± 20% |
| 9 | Output | Common terminal for control output (12VDC+ power output) | Connect to 12VDC+ terminal of thyristor trigger module |
| 10 ~ 21 | Output | Control output from 1st to 12th group (12VDC- power output) | Connect to 12VDC– terminal of thyristor trigger module |
| 22 ~ 23 | | | Empty terminal |
| 24 ~ 25 | | RS-485 Communication interface with MODBUS protocol | Option |
| 26 ~ 27 | | | Empty terminal |