Power Factor Controller RVT
The smart PFC for automatic capacitor bank
Distinct features

**Power factor correction for both balanced and unbalanced loads**

In modern day installations, unbalanced loads are increasingly common, especially in residential or commercial buildings. RVT addresses your power factor issues from both single phase loads (L-L or L-N) and three phase balanced/unbalanced loads. RVT is capable of compensation to each phase individually or compensation to three phases globally. Another distinct feature of RVT is individual phase measurements and energy calculations.

**Complete three phase measurements**
- Active power (kW) - 3ph/1ph
- Apparent power (kVA) -3ph/1ph
- Reactive power (kvar) -3ph/1ph
- Reactive power (kvar) to reach the target $\cos \varphi$ -3ph/1ph
- Voltage (V) -3ph/1ph
- Current (A) -3ph/1ph
- $\cos \varphi$-3ph/1ph
- Total Harmonic Distortion on Voltage/Current : THD V/I (%)
- Voltage/Current Harmonics : H2 up to H49 (%-spectrum)

**Touch Screen**
3.5 inch colorful QVGA touch screen eases your parameter settings.

**Ethernet connection**
With ABB PQ Link software, you may easily plug an RJ-45 to RVT and communicate with the controller through a 10/100BASE-T interface anywhere in the world.

**USB connection**
RVT supports USB2.0 connection; which makes it possible to connect to a computer via a widely used USB cable to access all RVT parameters.

**Up to 8 Temperature alarm outputs**
RVT can monitor 8 hot spots in your bank through eight daisy-chain connected temperature probes.

**Real time clock**
RVT real time clock tracks and logs date and moment of each alarm and event.

**Hardware and software lock**
Both hardware and software locks are equipped in the RVT for bank setting protections from any unauthorized access.
Other powerful features

RVT is also a MV and HV bank controller
By connecting a PT to the RVT voltage measurements inputs, and setting the proper [V scaling] according to the PT ratio, the RVT is able to control a MV or HV capacitor bank just like a LV capacitor bank.

Network information and capacitor bank monitoring
The RVT computes and displays network and capacitor bank information such as voltage, current, harmonics spectra and much more.

Multi-language support
The RVT allows you to choose its working language between English, French, German, Spanish and Chinese.

Easy commissioning
The fully automatic set-up of the RVT parameters totally eases the bank commissioning process.

Multi-voltage and multi-frequency
The RVT may be connected to network voltages in the range 100-460Vac, 50/60Hz. RVT’s measurement voltage is up to 690Vac without connecting any additional PT.

High ambient temperature rating
The RVT is suitable for harsh ambient environments thanks to its maximum ambient temperature rating of 70°C.

Guided navigation and programming
Online help information guides you step by step in the menu navigation and RVT programming.

Works with 5A and 1A CT’s
Both 5A and 1A CT’s may be connected to the RVT.

Communication
RVT has versatile communication interfaces: in addition to Ethernet 10/100BASE-T and USB2.0, the RVT supports RS485 connection as well. All parameters settings and measurements are accessible remotely.

Digital inputs
Two digital inputs can be used for day/night power factor and external alarm respectively.

Fully automatic set-up
C/k (sensitivity), active outputs, switching sequence and phase shift can be automatically set-up.

On-line help
A click to this button at the right top of the touch screen, it will give you an instant access to a online help system which will guide you through all RVT operation/commissioning step by step.

Programmable protection thresholds
Programmable thresholds allow you to protect the capacitor bank against over- and under-voltage, over-temperature and excessive harmonic distortions.

Menu navigation
The clever organization of menus and sub-menus ensures menu navigation easy and intuitive.

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Programmable thresholds allow you to protect the capacitor bank against over- and under-voltage, over-temperature and excessive harmonic distortions.
Touch screen
Ease your menu navigation

The touch screen eases capacitor bank setting in an intuitive way and provides a versatile interactive interface to users.

Start screen

A typical setting screen

Harmonics spectrum display

Legend:

- **1** active output
- **b** unlock (software)
- **l** locked (software)
- **c** communication locked
- **u** communication unlocked
- **w** warning
- **r** on demand
- **o** off demand
- **m** manual mode
- **s** setting mode
- **a** auto mode
- **t** temperature alarm
- **n** temperature normal
- **h** locked (hardware)
- **i** unlock (hardware)
- **d** alarm active
- **p** alarm inactive
- **x** mode change
- **?** online help
- **c** close window
- **v** validation
- **n** next page

Numeric keypad

1. Touch screen - Ease your menu navigation
2. Power Factor Controller RVT
A typical auto commissioning process is illustrated below.

1. Select “Settings” in the start screen

2. Validate “Commissioning”

3. Validate “Automatic”

4. Press OK

5. Press OK

6. Select the type of connection and press OK

7. Press OK

8. Lock or unlock the “Bank Settings” and press OK

9. Press OK

10. Press OK

11. Press OK

12. Input CT scaling: 50

13. Press OK

14. Press OK

15. Press OK

16. Press OK

17. Press OK

18. Press OK

19. Press OK

20. Press OK

21. Automatic commissioning completed
Connection types

The type of connection defines ways of RVT measuring current and voltage. RVT allows eight different types of connection topologies based on the type of installation and number of current and voltage transformers:

- 3Ph: three phase network (L-N or L-L)
- 1Ph: single phase network
- 1: one CT connection
- 2: two CTs connections
- 3: three CTs connections
- LN: V measurement between L and N
- LL: V measurement between phases
- 1: one V measurement
- 3: three V measurements

3Ph - 3 LN 3

Detailed wiring and direct current & voltage measurements capabilities are shown on next page, which facilitates the selection of different types of connection in terms of installation types and requirements on voltage and current measurements.

For RVT6 and RVT12, only type 1, 2 and 3 are available; RVT12-3P is able to connect in all eight different types of connection.

<table>
<thead>
<tr>
<th>Type</th>
<th>RVT6/RVT12</th>
<th>RVT12-3P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>1Ph-1LL1</td>
<td>1Ph-1LL1</td>
</tr>
<tr>
<td>Type 2</td>
<td>3Ph-1LL1</td>
<td>3Ph-1LL1</td>
</tr>
<tr>
<td>Type 3</td>
<td>3Ph-1LN1</td>
<td>3Ph-1LN1</td>
</tr>
<tr>
<td>Type 4</td>
<td>N.A.</td>
<td>3Ph-3LL3</td>
</tr>
<tr>
<td>Type 5</td>
<td>N.A.</td>
<td>3Ph-3LL2</td>
</tr>
<tr>
<td>Type 6</td>
<td>N.A.</td>
<td>3Ph-3LN3</td>
</tr>
<tr>
<td>Type 7</td>
<td>N.A.</td>
<td>3Ph-1LL3</td>
</tr>
<tr>
<td>Type 8</td>
<td>N.A.</td>
<td>3Ph-1LN3</td>
</tr>
</tbody>
</table>

Before commissioning (both auto and guided), please make sure that:
- RVT is unlocked (both soft and hardware lock)
- RVT is in SET mode
- CTs are properly connected

<table>
<thead>
<tr>
<th>Parameters to set</th>
<th>Guided commissioning</th>
<th>Auto commissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Ph/3Ph (CT and voltage connection type)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Phase rotation only</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>CT ratio before phase shift</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CT redirection</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>Phase shift</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>PT ratio (for MV banks)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>V Nominal</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ON-Delay</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>OFF-Delay</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>Output status and size</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>Q step (minimal step size)</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>C/k (start current)</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>Target cos θ</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

X: Manual setting required
O: Automatic setting
### Connection types

#### Single and three phase PFC control types

<table>
<thead>
<tr>
<th>Connection type</th>
<th>Schematics</th>
<th>RVT 12 - 3P</th>
<th>RVT 6 / RVT 12</th>
<th>Phase shift adjustment</th>
<th>Voltages</th>
<th>Currents</th>
<th>Compensation type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td></td>
<td>Connection</td>
<td>Connection</td>
<td></td>
<td>L12</td>
<td>L13</td>
<td>L1N/N</td>
</tr>
<tr>
<td>1Ph-1LL1</td>
<td></td>
<td>L1 L2</td>
<td>L3 CT</td>
<td></td>
<td>s s s</td>
<td>s s s</td>
<td>s s s</td>
</tr>
<tr>
<td>3Ph-1LL1</td>
<td></td>
<td>L1 L2 L3</td>
<td>N CT</td>
<td></td>
<td>s s s</td>
<td>s s s</td>
<td>s s s</td>
</tr>
<tr>
<td>3Ph-1LN1</td>
<td></td>
<td>L1 L2 L3</td>
<td>N CT</td>
<td></td>
<td>s s s</td>
<td>s s s</td>
<td>s s s</td>
</tr>
<tr>
<td>3Ph-3LL3</td>
<td></td>
<td>L1 L2 L3</td>
<td>N CT</td>
<td>0° by default (Adjust)</td>
<td>s s s</td>
<td>s s s</td>
<td>s s s</td>
</tr>
<tr>
<td>3Ph-3LL2</td>
<td></td>
<td>L1 L2 L3</td>
<td>N CT</td>
<td>0° by default (Adjust)</td>
<td>s s s</td>
<td>s s s</td>
<td>s s s</td>
</tr>
<tr>
<td>3Ph-3LN3</td>
<td></td>
<td>L1 L2 L3</td>
<td>N CT</td>
<td>0° by default (Adjust)</td>
<td>s s s</td>
<td>s s s</td>
<td>s s s</td>
</tr>
</tbody>
</table>

1. C3: three-phase capacitor control
2. C1: single-phase capacitor control
Accessories

**RS485 Modbus adapter**
All RVT controllers are Modbus communication enabled. The Modbus adapter is an optional item which allows communication with a monitoring system. All RVT parameters are available (including harmonic spectrum and tables) through an RS485 Modbus adapter. All RVT parameters are accessible and locking parameters allows limiting their access through the Modbus communication only.

*The RVT RS485 interface (3.3V power supply) is not compatible with previous RS485 adapter (5V power supply).*

**External probes for temperature measurements**
Up to eight temperature probes may be connected to the RVT. The eight temperature probes are connected in daisy chain. Connection details are shown in the manual. The RVT will close the fan relay if any of the eight temperature thresholds is exceeded. Information on temperature may be recorded with the event logging function.

**IP54**
The RVT front plate offers an IP43 protection degree in standard version. The gasket accessory enhances the standard RVT protection degree to IP54.
**Wiring diagram**

**Base model**

![Base model diagram]

PS1 - PS2: power supply
ML1-3: voltage measurements
N: neutral connection
k1-3, I1-3: CT connection
canH, canL: CAN bus
Earth: grounding
Temp: temperature probe connection
RS485: RS485 adapter interface
N1-2+/-: digital inputs
A: common source for output relay
1-12: outputs
NO/NC: output contacts of alarm relay
AL: common source for alarm relay
FAN/Warning 1-2: FAN output relay
USB: USB connection
RJ45: Ethernet
LOCK: hardware lock

**Three-phase model**

![Three-phase model diagram]
### Technical specifications

<table>
<thead>
<tr>
<th>Measuring system</th>
<th>Micro-processor system for balanced three-phase/single-phase networks and unbalanced network. Individual phase power factor control is available.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>From 100Vac up to 460 Vac.</td>
</tr>
<tr>
<td>Consumption</td>
<td>15 VA max.</td>
</tr>
<tr>
<td>Connection type for measuring circuit and power supply</td>
<td>Phase-phase or phase-neutral for balanced and unbalanced network.</td>
</tr>
<tr>
<td>Voltage tolerance</td>
<td>±10% on indicated supply voltages.</td>
</tr>
<tr>
<td>Measurement category (according to IEC 61010-1)</td>
<td>CAT III.</td>
</tr>
<tr>
<td>Voltage measurement</td>
<td>Up to 690Vac or higher with voltage transformer.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1% full scale.</td>
</tr>
<tr>
<td>Frequency range</td>
<td>45 or 65 Hz (automatic adjustments to network frequency).</td>
</tr>
<tr>
<td>Current input</td>
<td>5A or 1A (RMS) (class 1 C.T.).</td>
</tr>
<tr>
<td>Current input impedance</td>
<td>&lt;0.1 Ohm.</td>
</tr>
<tr>
<td>Power outage release</td>
<td>Automatic disconnection of all capacitors in case of a power outage longer than 20ms.</td>
</tr>
<tr>
<td>Number of outputs</td>
<td>RVT6/RVT12 Base Model: programmable up to 6 or 12 outputs. RVT12-3P Three Phase Model: programmable up to 12 outputs.</td>
</tr>
<tr>
<td>Output contact rating</td>
<td>Max. continuous current: 1.5A (ac) – 0.3A (110V dc). Max. peak current: 5A. Max. voltage: 440 Vac. Terminal A-A are rated for a continuous current of 18A (9A/terminal).</td>
</tr>
<tr>
<td>Alarm contact rating</td>
<td>One normally closed contact and one normally open contact. Max. continuous current: 1.5A (ac). Rated voltage: 250Vac (max. breaking voltage: 440Vac).</td>
</tr>
<tr>
<td>Fan contact rating</td>
<td>Normally open contact. Max. continuous current: 1.5A (ac). Rated voltage: 250Vac (max. breaking voltage: 440Vac).</td>
</tr>
<tr>
<td>Power factor setting</td>
<td>From 0.7 inductive to 0.7 capacitive.</td>
</tr>
<tr>
<td>Starting current setting (C/k)</td>
<td>0.01 to 5A. Automatic measurement of C/k.</td>
</tr>
<tr>
<td>Modbus baud rate</td>
<td>300 - 600 - 1200 - 2400 - 4800 - 9600 - 19200 - 38400 – 57600 bps.</td>
</tr>
<tr>
<td>CAN connection</td>
<td>Support CAN 2.0B interface (for future use).</td>
</tr>
<tr>
<td>USB host connection</td>
<td>For future use.</td>
</tr>
<tr>
<td>USB device connection</td>
<td>Available</td>
</tr>
<tr>
<td>Temperature probe input connection</td>
<td>Only 2 contacts using 1-wire protocol. - Parasitic supply mode (no need of external power supply) - Connection to more nodes in a daisy chain network - 8 temperature probes connection - 8 meters maximum between RVT to temperature probe or between probes - 64 meters maximum length</td>
</tr>
<tr>
<td>Step configuration</td>
<td>Automatic, fixed, disabled.</td>
</tr>
<tr>
<td>Display</td>
<td>QVGA 320 x 240 pixels colorful touch-screen.</td>
</tr>
<tr>
<td>Adjustable display backlighting</td>
<td>Available</td>
</tr>
<tr>
<td>Switching time between steps</td>
<td>Programmable from 1s to 18h.</td>
</tr>
<tr>
<td>Saving-function</td>
<td>All programmed parameters and modes are saved in a non-volatile memory.</td>
</tr>
<tr>
<td>Auto adaptation to the connection and phase-rotation of the network</td>
<td></td>
</tr>
</tbody>
</table>
Technical specifications

Auto adaptation to the CT-terminals

Power Factor correction operation is insensitive to the presence of harmonics.

Working with passive and regenerative loads (four-quadrant operation).

Operating temperature
-20° C to 70° C.

Storage temperature
-30° C to 85° C.

Mounting position
Vertical panel mounting.

Dimensions
Front plate: 146 x 146 mm (h x w).
Rear side: 205 x 135 mm.
Overall: 146 x 211 x 67 mm (h x w x d).
Cut out dimensions: 138 x 138 mm (h x w)

Weight
650 g (unpacked).

Connector
Cage clamp type (2.5mm² single core cable).

Front plate protection
IP 43 (IP54: on request).

Relative humidity
Maximum 95%, non-condensing.

CE and UL marked

Product line-up

<table>
<thead>
<tr>
<th>Features</th>
<th>RVT6/RVT12</th>
<th>RVT12 - 3P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article number</td>
<td>RVT-6TS</td>
<td>RVT-12TS-3P</td>
</tr>
<tr>
<td>1 / 3 phase measurements</td>
<td>1 voltage measurement input</td>
<td>3 voltage measurement inputs</td>
</tr>
<tr>
<td></td>
<td>1 current measurement input</td>
<td>3 current measurement inputs</td>
</tr>
<tr>
<td>Real time clock</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Energy measurements</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Ethernet connection</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>USB host connection</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>USB device connection</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Digital inputs</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Alarm / fan relays</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Output relays</td>
<td>6 or 12</td>
<td>12</td>
</tr>
<tr>
<td>Lock switch</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>RS485 Modbus connection</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>External temperature probes</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>
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