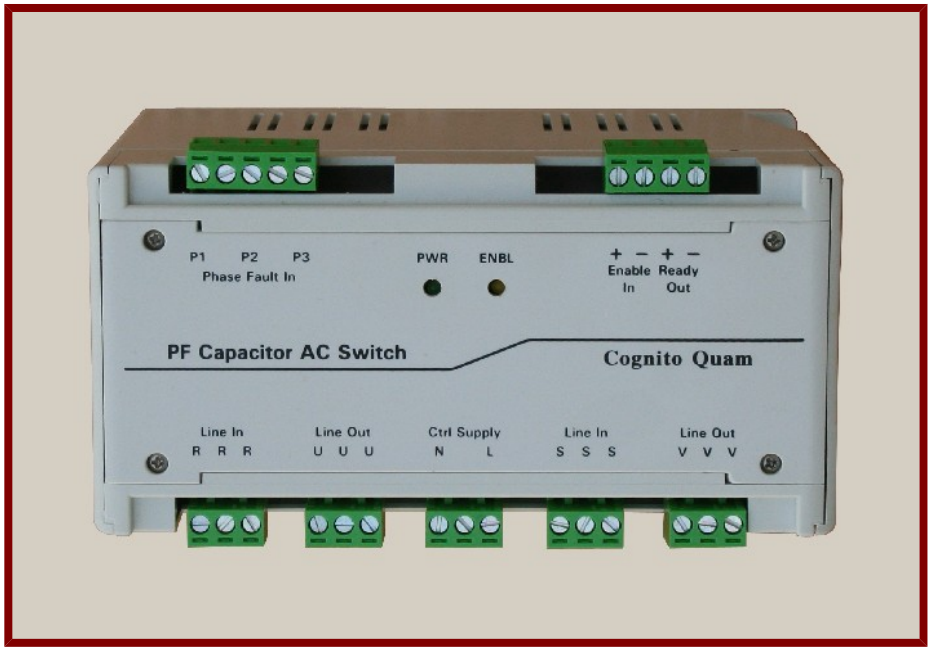
CACSW
Power Factor Capacitor
AC Switch
v1



Installation and Operation Manual

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1. Introduction

This manual covers the installation and operation of the version 1 CACSW power factor capacitor AC switch. Version 1 features a separate, isolated control voltage supply.

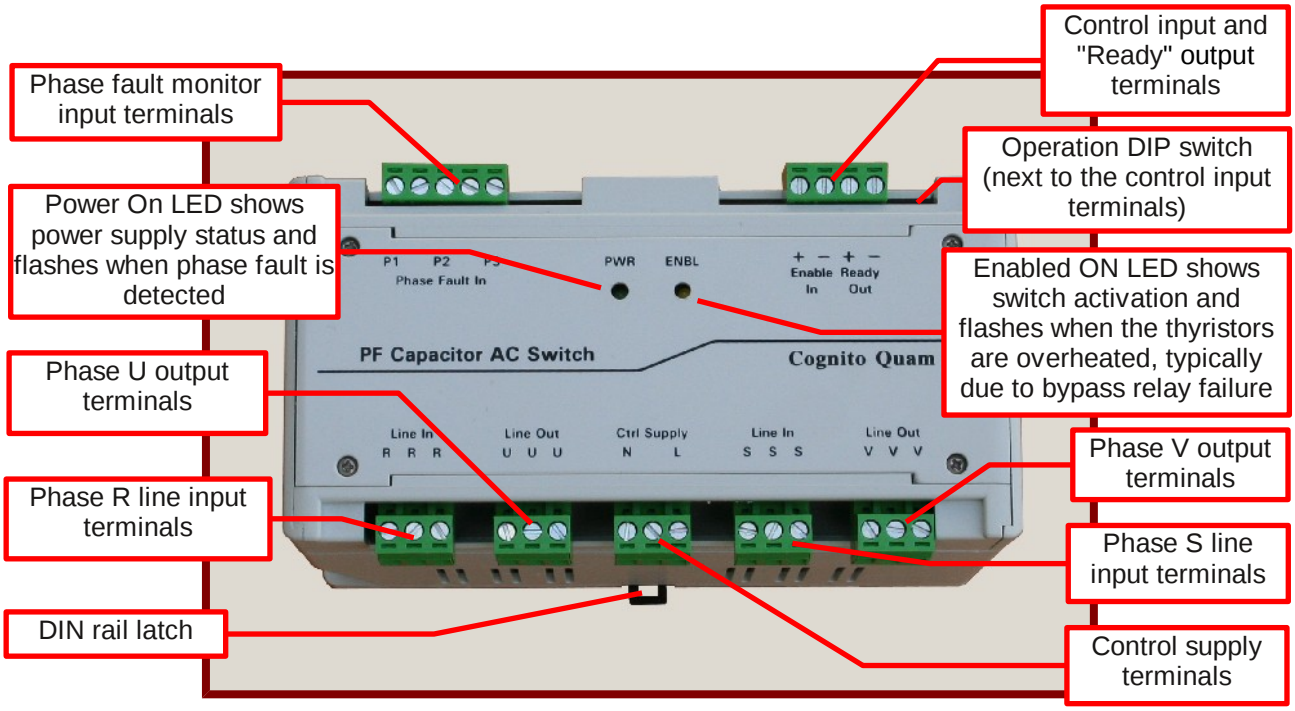
The CACSW is controlled by a 24 VDC current sink (NPN) signal to connect a three-phase, 3x25 A power factor capacitor bank to the line. In response, it activates its open collector "Ready" output to reflect system status.

The control input is digitally filtered to reject noise and responds within a maximum time of 2.5 seconds. The CACSW features a phase fault detector which when connected to the input can monitor the line for phase integrity and when connected to the capacitor bank can detect phase faults as well as a blown protective fuse.

The CACSW employs solid state thyristor switches which connect to the capacitor bank at zero voltage difference without any disturbing inrush currents. They are bypassed by a relay to eliminate all thyristor conduction losses and are protected against overheating, typically caused by failure of the relay contacts.

CACSW operation is set via the unit´s DIP switch.

The manual goes through the required installation steps after a technical overview.



The CACSW v1 PF capacitor AC switch

WARNING!

As the voltages involved are of a dangerous level, ALL connections must be made with the power OFF and by QUALIFIED personnel.

2. Overview

The CACSW is designed for most standard single- and three- phase line systems connecting up to 3x25 A capacitor banks. The characterizing features are as follows:

- **No neutral connection** is required,
- **Isolated control supply** enables its use in systems with separate power and control supply lines,
- **Overheat protected solid state relays** switch the 3x25 A compensating capacitors in and out of the line at every sampling instant,
- **Zero crossing type solid state relays** ensure that each capacitor is switched in when the line voltage equals the capacitor voltage thus eliminating capacitor inrush current and extending capacitor service life,
- **Switch bypass relay** eliminates solid state switch losses,
- **Sampling time** of at least 1 second gives a maximum 2.5 s response time,
- **Phase fault detector** monitors for phase faults and/or blown fuses,
- **DIP switch selectable slave mode** allows stand-alone or operation under an external master,
- **DIP switch selectable forced state** turns the switch on regardless of controlled input state,
- **Indicating LEDs** show the power supply state ("PWR", green) and the switch activation status ("ENBL", yellow). The "PWR" LED flashes when a phase fault (or blown fuse) has been detected while the "ENBL" flashes when the thyristor switches are overheated,
- **Isolated control supply circuit** enhances safety and noise immunity,
- **Protection** against line overvoltages, faults and power circuit overheating,
- **Removable terminal blocks** speed the installation process.

The table summarizes the maximum capacitor size which can be handled by each switch model:

CACSW Capacitor Sizes per Model			
Model	**Nominal Line System**	**Maximum Capacitor Size, KVAr**	**Recommended Capacitor Size, KVAr**
CACSW-xxx-1-115	1x115 VAC, 50-60 Hz	2.9	2.5
CACSW-xxx-1-230	1x230 VAC, 50-60 Hz	5.7	5.0
CACSW-xxx-3-115	3x115 VAC, 50-60 Hz	5.0	4.0
CACSW-xxx-3-230	3x230 VAC, 50-60 Hz	10.0	7.5
CACSW-xxx-3-400	3x400 VAC, 50-60 Hz	17.3	15.0
CACSW-xxx-3-480	3x480 VAC, 50-60 Hz	20.8	17.5

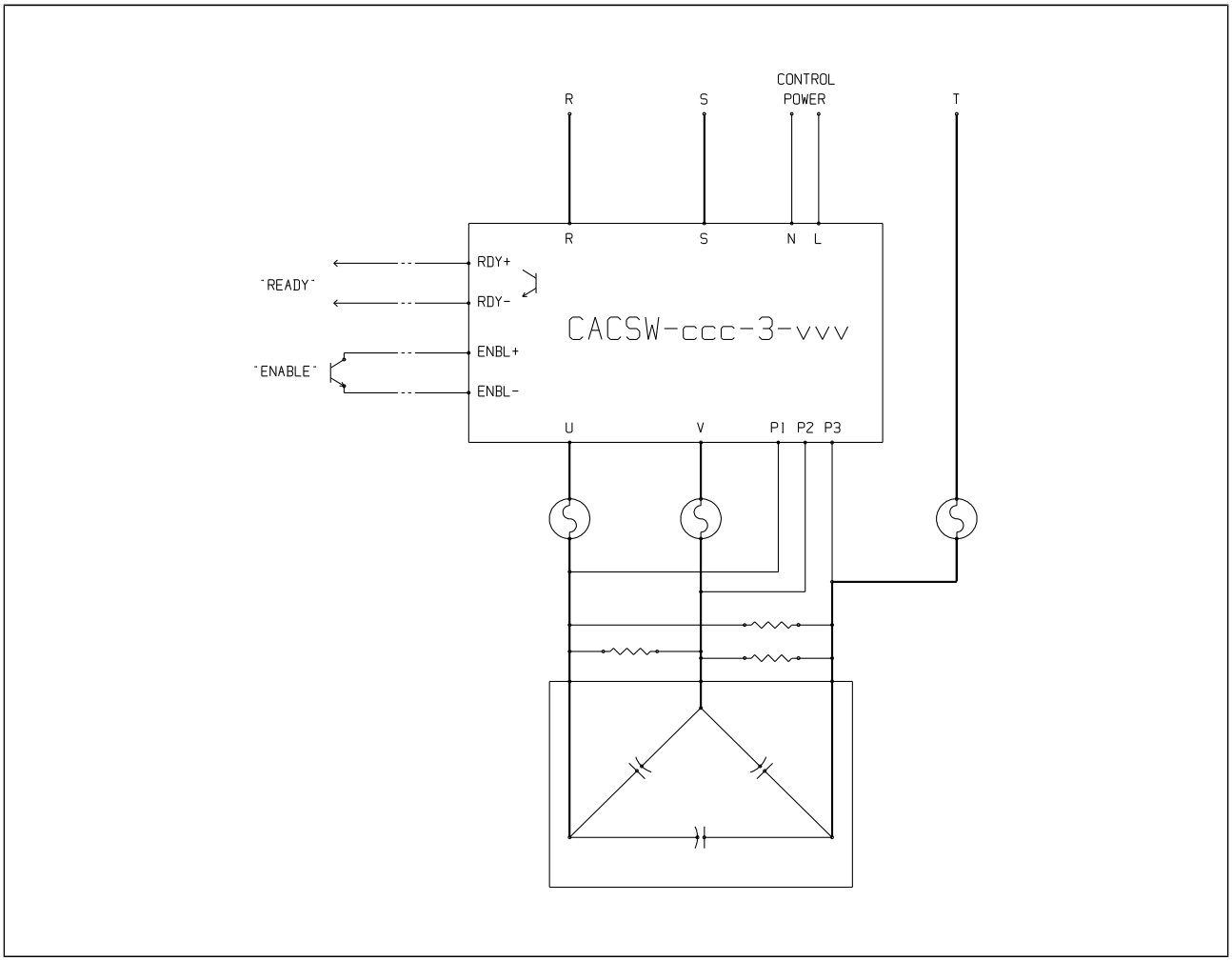
The recommended capacitor size is the nearest standard size allowing for a minimum 10% safety margin.

3. Connection Overview

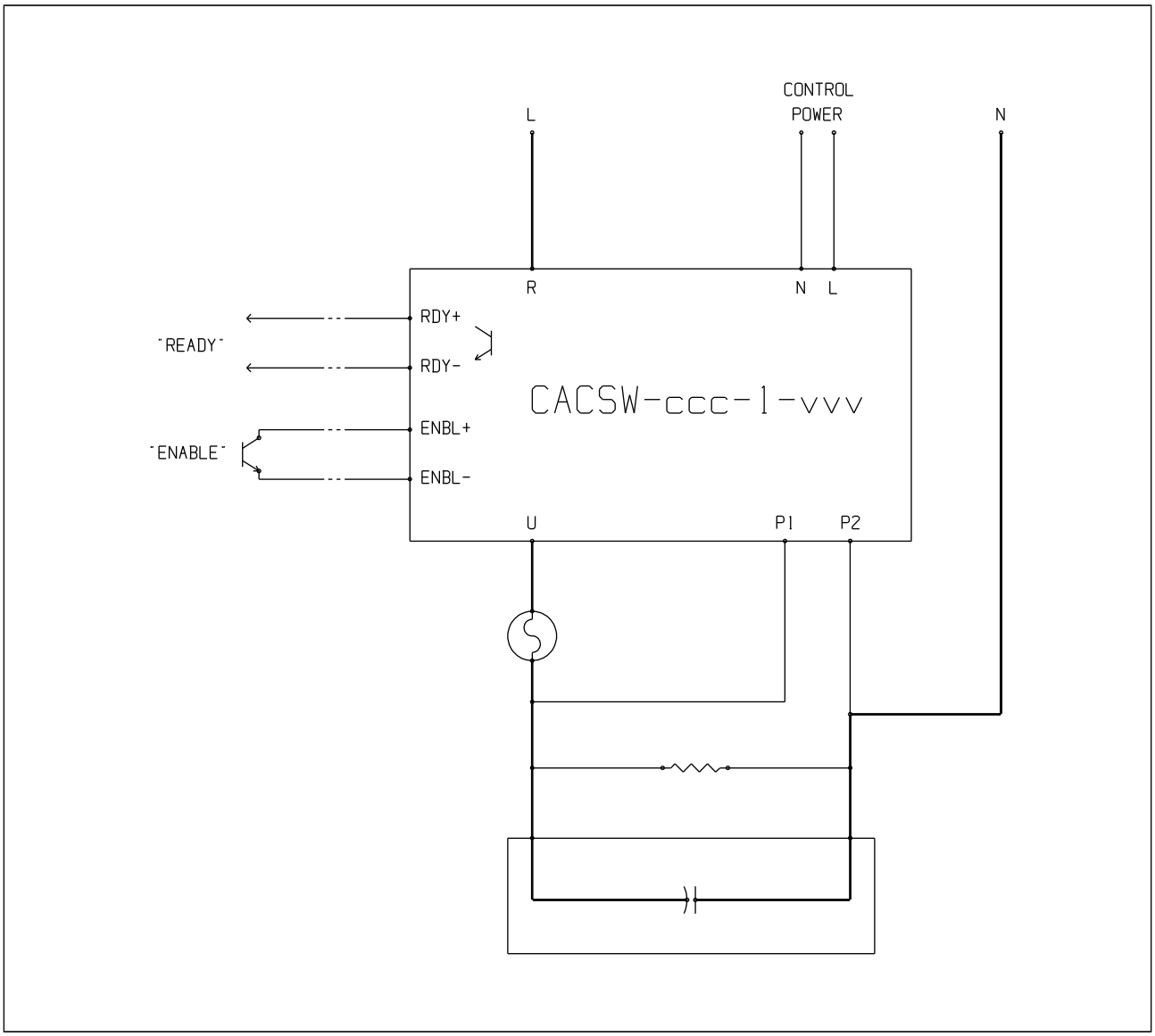
Each unit is connected at the line in and out connections, the control supply as well as at the phase monitor and control terminals. The table summarizes the connections:

RCCS3 Connection Overview	
Position	**Description**
R, S	Line voltage input, three positions each. With three-phase models, the third phase (T) is permanently connected to the bank. Single-phase models use only R.
U, V	Capacitor bank connection, three positions each. Single-phase models use only U.
N, L	Control power supply input. Internally protected by a fuse.
E+, E-	Enable control input. Driving signal must be 15 mA current sink type at 24 VDC.
R+, R-	"Ready" output. Optotransistor output can drive 20 mA at 24 VDC.
P1, P2, P3	Phase fault monitor inputs.

The current carrying capacity of each position at the R, S, U, V terminal blocks is 12 A and applications with >10 A capacitor phase current must use parallel wiring to accommodate the extra current.



Typical CACSW system switching a three-phase capacitor in and out of the line. The capacitor is protected by a fuse in each phase with the CACSW detecting their state at the P1, P2, P3 inputs. The bleed resistors can be any convenient value as the capacitor is connected at zero voltage difference with the line and no special discharge timing applies. The switch is activated at the ENBL control input and its status is reported by the READY output. The high capacitor current path is shown in bold.



Typical CACSW system switching a single-phase capacitor in and out of the line. The capacitor is protected by a fuse in the live phase with the CACSW detecting its state at the P1, P2 inputs. The bleed resistor can be any convenient value as the capacitor is connected at zero voltage difference with the line and no special discharge timing applies. The switch is activated at the ENBL control input and its status is reported by the READY output. The high capacitor current path is shown in bold.

4. Setting the DIP Switch Options

The operating parameters are selected by setting the four positions at the DIP switch next to the control I/O terminal block on the top side of the unit.

Positions 1 and 2 set the phase integrity monitor operation. The table summarizes the available options:

CACSW DIP Switch Phase Integrity Monitor Setting		
Position 1	**Position 2**	**Description**
OFF	OFF or ON	No phase monitoring. The "Ready" output is determined only by the internal overheating circuit.
ON	OFF	Phase monitoring is continuous, regardless of the "Enable" input. This setting allows for the continuous monitoring of the system line.
ON	ON	Phase monitoring is performed only while the switch is activated. This setting allows for the monitoring of the capacitor circuit protective fuses.

The switch can operate as a stand-alone or slave unit as determined by DIP switch position 3:

CACSW DIP Switch Mode Setting	
Position 3	**Description**
OFF	Stand-alone mode. The switch is activated at the "Enable" input and when a phase fault or thyristor overheating occurs the switch and the "Ready" output are turned off.
ON	Slave operation. The switch is activated at the "Enable" input and when a fault occurs only the "Ready" output is deactivated. In such a case it is up to the master to deactivate the switch via the the "Enable" input.

Position 4 activates the switches for testing. The table summarizes the available options:

CACSW DIP Switch Forced Activation Setting	
Position 4	**Description**
OFF	Normal operation. The switch is activated via the "Enable" input and a fault disables the switch and "Ready" output as determined by the mode setting at Position 3.
ON	Forced activation state. The switch is activated regardless of the "Enable" input and a fault disables the switch and "Ready" output as determined by the mode setting at Position 3.

5. CACSW Operation

The switch is activated via the "Enable" input and its status is reported by the "Ready" output. When a phase integrity fault (enabled at DIP switch positions 1 and 2) or thyristor overheating occurs the "Ready" output is deactivated and the switch is turned off in stand-alone operation mode (DIP switch position 3 OFF) only.

At power-on, both CACSW LEDs are momentarily turned on. Following this, they indicate the following conditions:

CACSW Indicating LEDs		
LED	**Colour**	**Description**
Power On	Green	Constantly ON, indicates the presence of line power. It flashes when a phase fault has been detected.
Enabled On	Yellow	It is constantly ON when the switch is activated or flashes when the power circuit has overheated (typically due to bypass relay failure).

In stand-alone mode there is no recovery from a phase or overheating fault. Both errors can be reset at power-on only. In slave mode the errors are reported until the next "Enable" input activation at which point they are reset only if the cause of the fault has been removed.

6. CACSW Maintenance

The CACSW should periodically be checked for conduction voltage drop across the line and capacitor terminals.

With the switch activated (DIP position 4 ON), the voltage between the R and U and S and V terminals should be well under 0.5 Vrms. If above, the bypass relay is worn and, depending on the conducted capacitor current, the increased switch losses may overheat the power circuit and the CACSW enclosure.

In such a case or after the power circuit has overheated ("Enabled On" LED flashes) the relay must be replaced by a new unit. Following replacement, the conduction voltage drop should be checked as above.

The CACSW internal power supply is protected by a 250 mA (CACSW-115-x-xxx models) or 100 mA (all others) fuse against control line faults. It is accessible by removing the CACSW front panel.

7. Recycling Information

This product has been designed to be readily recyclable under most jurisdictions. For further information contact us at Cognito Quam Electrotechnologies Ltd, PO Box 67212, Melissia, Athens, Greece 15102, Tel/fax: +30.210.8049475, e-mail: weee@cognitoquam.gr.

Dispose of in accordance with locally applicable laws and regulations.