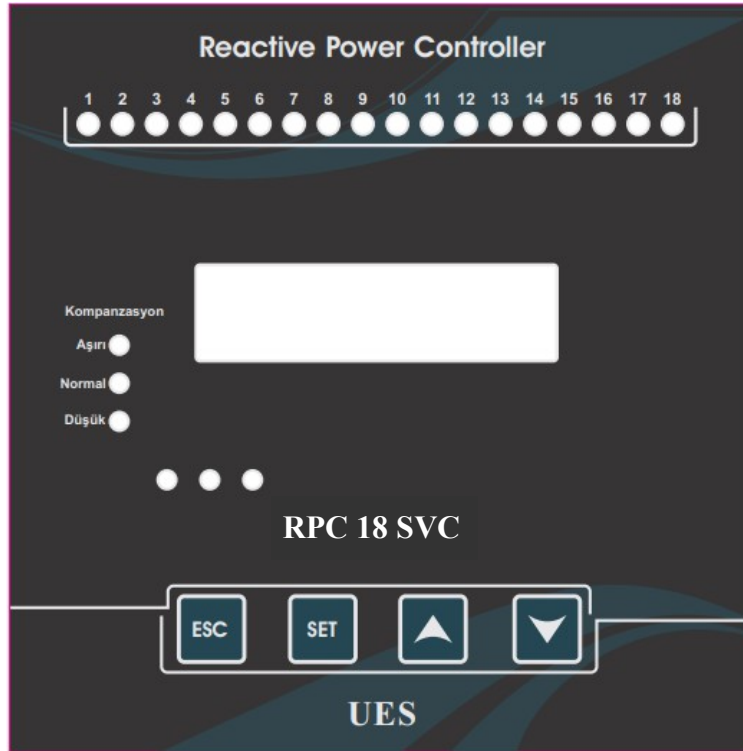


POWER-RPC 12/15/18 SVC

3-PHASE NEW GENERATION THYRISTOR CONTROLLED REACTOR / STATIC VAR COMPENSATOR (TCR/SVC) REACTIVE POWER CONTROL RELAY USER MANUAL



Note: The device photographs, the LCD screen images and the wiring/flow drawings in this manual are shown in their original (Turkish) form because they are images and cannot be translated. Menu and screen names are given in the text in translation, with the Turkish names in parentheses in the main menu list.

1. Getting Started with POWER RPC 18-SVC

Introduction:

The Power RPC 18-SVC series of reactive power control relays has been developed to provide a solution for every kind of compensation requirement: three-phase or single-phase, medium voltage or low voltage, balanced or unbalanced loads, normally varying or rapidly varying loads, wherever SVC is needed, and the like. The Power RPC 18-SVC is the new-generation SVC relay of this family, developed for the most complex systems. In addition to its 12-15-18 contact outputs, it has 3 reactor trigger outputs. With the Power thyristor driver modules connected to the reactor trigger outputs, it divides the 3 reactors into thousands of slices and provides compensation with excellent accuracy. All operations are performed with fast 20 ms measurements.

The Power RPC 18-SVC and the Power driver modules work together in perfect harmony. The user is offered 5 different SVC modes. For example, the SVC system can be activated only on a capacitive load or only when a daily penalty applies. It can work synchronously or asynchronously with the normal steps. Synchronous operation means compensating together with the normal steps. Asynchronous operation means clearing what remains after the normal steps. It is explained in more detail in the settings section.

While the Power RPC 18-SVC family was being developed, every feature users might need was considered; the whole family is equipped with superior features and privileges offered as standard. Optionally, every model has a fully functional communication port. In models with communication, all kinds of information can be read, written and controlled in full.

Foremost among the features offered as standard are the rich intelligent algorithm features. Parameters such as sensitive measurement starting from 15 mA, measurement with 0.5% accuracy, current and voltage harmonics measurement up to the 21st harmonic, instantaneous and monthly energy ratios, monthly ratios and per-phase energy ratios, import-inductive-capacitive-apparent energies, phase currents-voltages-powers, and also $\cos\Phi$ values are measured accurately and presented to the user with practical measurement screens.

Another standard feature is the connection test. The connection test is performed quickly and safely by connecting a three-phase capacitor to the first step. It detects not only polarity errors but also phase crossovers and corrects them automatically internally. If there is no error in the connections, it gives a confirmation. In cases where physical correction is required, such as current transformer terminals being crossed, it helps the user by giving a warning. If there is no voltage or no current, it warns by indicating on which phase or phases it is missing; so the relay does not merely say "connections wrong" or "connections correct": it corrects correctable errors automatically and also reports errors that must be corrected physically.

Another standard feature is the step test. With the fast and reliable step test, the relay learns the capacitors and reactors connected to its steps. The step test is faster with no load. When learning steps under load, so as not to be affected by changes in the load, the step test may take a few minutes depending on the load. The relay has smart algorithms for reliable step learning even under load. It learns the capacitors and reactors connected to its steps according to their phases. It is not affected by voltage fluctuations.

Event logging is among the other prominent standard features. The most important recent events are recorded.

Many features, such as the compensation target and the ability to enter the compensation target in three different ways, are available as standard in the Power RPC 18-SVC family.

All Power RPC 18-SVC series have intelligent intervention and intelligent timing algorithms. By recognizing the steps, they are switched in and out immediately or with a slight delay, depending on the needs of the system. This delay is determined according to many criteria and protects the life of the contactors and capacitors.

Equal aging is achieved by switching equal-sized steps an equal number of times. Timings can also be selected as fixed values. For reactors, timing and switching are handled differently from capacitors.

The menus of the Power RPC 18-SVC family are designed, with its 2x16 display, so that users can use them comfortably. Menus, alarms, settings and errors are written clearly in the selected language.

The Power RPC 18-SVC family has been designed with years of experience, keeping in the foreground what users directly want, and updates will continue according to new needs that may arise over time. The basic aim is to produce adequate and practical solutions to all compensation problems with a single family.

Selection Table:

In the RPC series of reactive power control relays, there is always a solution for every need.

Model	Standard Measurements: 3-phase currents I_{L1}, I_{L2}, I_{L3} 3-phase voltages U_{L1}, U_{L2}, U_{L3} 3-phase Active Powers PL1, PL2, PL3 3-phase Reactive Powers QL1, QL2, QL3 3-phase Apparent Powers SL1, SL2, SL3 3-phase $\cos\phi$ values $\cos\phi_{L1-L2-L3}$ Minimum and maximum values (of current, voltage and power) 0.5% accuracy	Energies Import kWh Σ Export kWh Σ Reactive kVarh L1-L2-L3- Inductive kVarh L1-L2-L3- Apparent kVAh L1-L2-L3 Harmonics Current harmonics L1-L2-L3 Voltage harmonics L1-L2-L3 THD, 3-21 odd harmonics, Ratio display screen Energy Ratios Instantaneous ratios, percentage $\tan\phi$	Display	Harmonics 2-21 of current and voltages	15 mA minimum measuring current	Connection correction	Polarity correction	Step learning and monitoring	Capacitor and reactor recognition	Step equal-aging	Intelligent switching	SVC	Target entry in 3 different ways	20 ms measuring speed	Password protection	Alarm	RTC and event log
BLF 12	✓	✓	2x16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BLF 15	✓	✓	2x16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BLF 18	✓	✓	2x16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BLF 12 SVC	✓	✓	2x16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BLF 15 SVC	✓	✓	2x16	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
BLF 18 SVC	✓	✓	2x16	M	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Areas of Use:

Compensation is specific to the installation. Although different installations have different needs, all installations can be solved with a few generalizations. The relay solutions needed according to installation type are as follows:

1. Compensation relay with contactors.
2. Compensation relay with contactor and SVC outputs (thyristor angle-controlled reactor).

As seen in the selection table above, relay models are offered in the Power RPC 18-SVC series for all of these solutions. The subject of this manual is the RPC 18-SVC NEW GENERATION three-phase reactive power control relay model.

The RPC 18 SVC relay achieves excellent results even in complex installations where the loads are unbalanced, sometimes small and sometimes large, and fast-fluctuating. It compensates the installation power precisely, as if there were thousands of capacitors and reactors.

The SVC relay can be used in every type of installation; we recommend it as the definitive solution for every kind of installation, not only for problematic ones but also to avoid problems in the future:

All industrial 3-phase installations

Factories

Petrol stations

Supermarkets

Banks

Schools

Buildings

Housing complexes

Government offices

Hotels

Press machines

Elevators

Cranes

Balanced-unbalanced, large and small loads

Measured Network Parameters:

In the RPC relay series, all the network parameters that users may need are measured accurately, saving valued users time, space and cost. These measurements are presented with practical and carefully prepared screens for easy analysis.

The parameters measured and displayed with the RPC family are as follows:

MEASURED NETWORK PARAMETERS

Voltages

Phase-to-phase voltages

Phase currents

Active powers

Reactive powers

Apparent powers

Cosphi values

Energy ratios

Current Harmonics

Voltage Harmonics

RPC 18 SVC Technical Specifications;

Auxiliary Supply	230V (+-20%) Optional: 57VAC,100 VAC For other special supply types please contact our company.
Supply circuit power consumption:	<6 VA
Voltage Measuring Inputs	30-600VAC
Current Measuring Inputs	.../5A (5/5...10000/5)
Frequency:	50 Hz
Measuring inputs power consumption:	< 0.5VA
L-N in:	344 VAC 50 Hz.
L-L in:	600 VAC 50 Hz.
Overcurrent Withstand	50A 0.5 s, 5 A continuous (Relay Measuring Inputs)
Current Measurement Secondary	15mA...6A
Current Measurement Primary	Up to 12000A (with suitable current transformer)
Current Measurement Accuracy	%0,5
Voltage Measurement Accuracy	%0,5
Apparent Power Accuracy	%1
Active Power Measurement Accuracy	%1
Reactive Power Measurement Accuracy	%1
Current Harmonic Measurement	1,3,5,..21 and THD
Voltage Harmonic Measurement	1,3,5,...,21 and THD
RTC battery life:	5 years
Connection type:	3P4W
Contacts	5A
Operating temperature:	-5...+55°C
Dimensions	144x144x80 mm
Panel Cut-out Width	136x136 mm
Display	2x16 character LCD

Commissioning

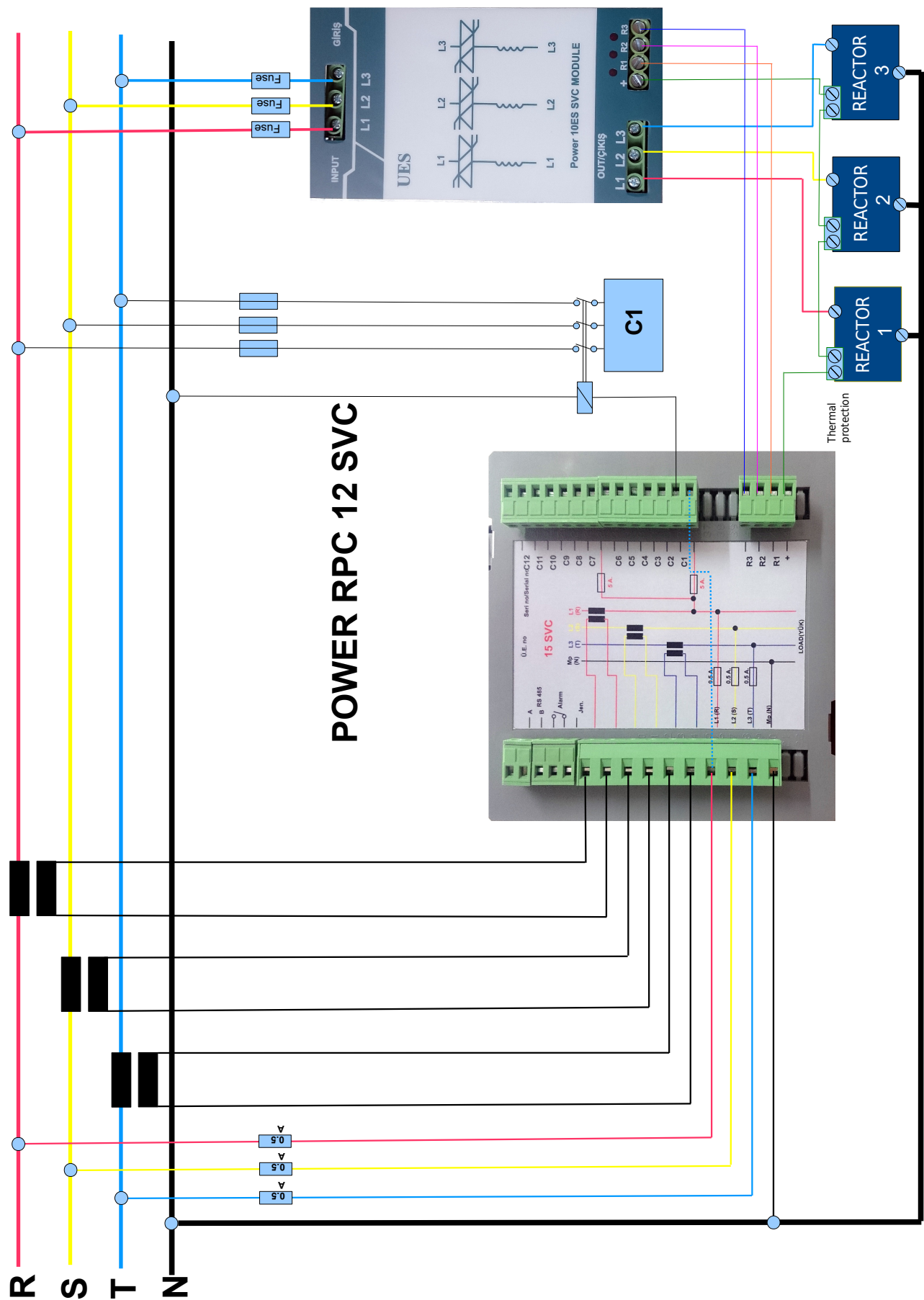
- ❖ The phase order and direction are not important in voltage and current connections. When the connection test is performed, the relay automatically corrects the connections by itself. Even so, we recommend connecting the phases in the right places and getting into the habit of doing so.
- ❖ The neutral (Mp) connection must be made correctly and must not be confused with the phase voltages.
- ❖ Even if the current transformer terminals are connected to the wrong phase, the relay corrects these errors along with polarity errors in the connection test. However, if the cables coming from separate current transformers are crossed with each other, correcting this is only possible physically.
- ❖ The current transformer terminals must be tightened especially firmly. A loose contact causes unwanted damage.
- ❖ Connections must not be disconnected while energized.
- ❖ The first step must be a three-phase capacitor; a large-value three-phase capacitor will make the connection test easier.

WARNINGS:

WARNINGS !!! 1. The current transformer terminals must never be left open-circuit! 2. Connections must not be removed while energized! 3. Always check the connections before energizing the device! If there is a loose connection at the terminals, fix it! 4. Always cut off the power while making corrections!

There are no user-serviceable parts in the device. If you experience a technical problem, please contact us.

A. Connection Diagram



Measurement Screens:**Measurement Screens Map:**

In the Power RPC 18-SVC relay series, the measured network parameters are displayed in the following order with the “up” and “down” keys.

A y l i k o r a n Q / P
L = % 2 6 . 7 C = % 7 . 7

P 1 = + 8 7 2 W Q / P
Q 1 = + 1 6 V A r % 1 . 9

T a r i h = 2 8 / 0 9 / 2 0 2 2
S a a t = 1 2 : 5 0

P 2 = + 1 2 2 4 W Q / P
Q 2 = + 7 6 V A r % 6 . 2

R 1 R 2 R 3
1 . 2 4 2 . 1 1 0 . 0 0

P 3 = + 1 2 1 8 W Q / P
Q 3 = + 7 1 V A r % 5 . 9

A k i m l a r
3 . 1 6 4 . 3 0 3 . 2 5

T H D U L 1 L 2 L 3
5 . 1 5 . 2 4 . 4

F a z f a z g e r i l i m
3 9 3 3 9 1 3 9 4

A k t i f g u c k W h
i m p = 0 0 0 0 0 0 0 . 0 0 0

C o s f i l e r
8 7 3 7 2 7 9 6 7

R e a k . g u c k W a r h
0 0 0 0 0 0 0 . 3 1 3

G o r u n u r g u c k V A
0 . 5 2 0 . 4 1 0 . 6 7

K p s t f . g u c k W a r h
i m p = 0 0 0 0 0 0 0 . 0 0 0

A k i m l a r
3 . 1 6 4 . 3 0 3 . 2 5

G e r i l i m l e r
2 2 3 2 2 6 2 2 5

Main Screen:

The home screen shows the most needed information: the percentage reactive ratios. The monthly ratio is the ratio of the energy counters recorded since the last billing cut-off date. It is reset when the end of the month arrives and is then seen as the old monthly ratio. The previous monthly ratio is the old monthly ratio recorded from the start of the previous month to its end. The billing cut-off date can be changed from the menu.

All of these measurements are displayed with an automatic floating point and with the kilo-mega unit also set automatically, in a form and at a speed that the user can read comfortably.

A y l i k o r a n Q / P
L = % 2 6 . 7 C = % 7 . 7

Currents:

This screen shows the currents per phase. It is also possible to follow the maximum values at a glance.

A k i m l a r
3 . 1 6 4 . 3 0 3 . 2 5

Voltages:

This screen shows the phase-to-neutral voltages. It is also possible to follow the maximum values at a glance.

G e r i l i m l e r
2 2 3 2 2 6 2 2 5

Phase-to-Phase Voltages:

This screen shows the phase-to-phase voltages.

F a z f a z g e r i l i m
3 9 3 3 9 1 3 9 4

Active Powers/Reactive Powers/Instantaneous ratios:

This screen shows the active powers per phase. Active power measurement is directional. A (-) sign appears in systems that export energy. If the system does not export energy and a (-) active power is shown, the current transformer directions of the phases with a minus sign are connected in reverse. This needs to be corrected. See the menu to use the automatic correction feature by performing a connection test.

P 1 = + 8 7 2 W Q / P
Q 1 = + 1 6 V A r % 1 . 9

P 2 = + 1 2 2 4 W Q / P
Q 2 = + 7 6 V A r % 6 . 2

P 3 = + 1 2 1 8 W Q / P
Q 3 = + 7 1 V A r % 5 . 9

Apparent Powers:

This screen shows the apparent powers per phase and the total apparent power.

G o r u n u r g u c k V A
0 . 5 2 0 . 4 1 0 . 6 7

Cosφ values:

This screen shows the cosφ values. Those with a minus (-) sign are capacitive, and those without are inductive.

C o s f i l e r
8 7 3 7 2 7 9 6 7

Energies:

This screen records the active energy drawn from the system / inductive reactive energy / capacitive reactive energy.

A k t i f g u c k W h
i m p = 0 0 0 0 0 0 . 0 0 0

R e a k . g u c k W a r h
0 0 0 0 0 0 . 3 1 3

K p s t f . g u c k W a r h
i m p = 0 0 0 0 0 0 . 0 0 0

Voltage and Current Harmonics:

This is the page that presents the harmonics of current and voltage for 3 phases at the same time, as percentage values. Current harmonics can be selected with the "set" key.

T H D	U	L 1	L 2	L 3
5 . 1		5 . 2		4 . 4

Step Monitor:

On this screen, the steps can be viewed by pressing the down key. You can see what is connected at which step.

K #	1	k V A r	K o n d .
0 . 0 0		0 . 0 0	0 . 0 0

Menu:

The settings of the RPC 18 SVC reactive relay are made with its clear and easy menu. Step test, connection test, energy, factory reset and zeroing operations are also performed with the help of the menu. Entry to the menu is password protected.

To enter the menu, press and hold the "set" key while on any measurement page. After the relay's 4-digit password is entered correctly, the main menu appears on the screen. To enter the password digits, the "up-down" keys are used. When the current digit is on the screen, the "set" key moves to the next digit. When the last digit is also entered, if the password is correct the main menu opens. If it is wrong, password entry returns to the first digit.

Default password: "0000".

The Main Menu has the following headings:

- 1.Quick Setup (Pratik Ayar)
- 2.Step Settings (Kademe Ayarı)
- 3.Connection Settings (Bağlantı Ayarı)
4. Compensation Target (Kompanzasyon hedefi)
- 5.Alarm Settings (Alarmlar ayarları)
- 6.Other Settings (Diğer Ayarlar)
- 7.Learn Steps (Kademe öğren)
- 8.Reset Menu (Sıfırlama Menü)
9. Manual Test (Manuel Test)
10. Event Log (Olay Kaydı)

When you are in any menu, press the “esc” key to return to the upper menu. To return to the measurement pages and exit the menu completely, press the “esc” key; or exit in two or three presses by pressing the “esc” key one at a time.

Entering the Menu:

When you are on any measurement page, it is enough to press and hold the “set” key. The Power RPC 18-SVC will ask for the password:

S i f r e g i r i n i z . . .
0 * * *

The first digit of the password is selected with the “up” and “down” keys. After selecting, move to the next digit with the “set” key, and after entering all four digits, enter the menu with the “set” key. If the password is entered wrongly, the menu is not entered; the four-digit password is requested again, starting from the first digit. The digit currently requested is shown as the selected item, while the other digits are hidden with the “*” character.

When the password is entered correctly, the main menu appears on the screen.

Main Menu:

When you first enter the menu, “Quick Setup” appears; the other options are reached by pressing the down/up key.

P r a t i k a y a r <
K a d e m e a y a r |

As in the picture in the example, the “Quick Setup” menu is shown as the selected item on first entry. The other menus are brought to the selected item with the “up” and “down” keys. When the menu you want to enter is selected, move to the submenu with the “set” key.

Pressing the “set” key while in the selected-item view opens the selected menu.

Quick Setup :

The following options appear in the Quick Setup menu. The current transformer ratio and, if there is one, the voltage transformer ratio are entered.

A k i m t r . o r a n
1

G e r i l i m t r . o r a n
1 . 0

K a d e m e s a y i s i
1

When you select it from the main menu and enter this menu with the “set” key, the menu content opens. The settings most needed when first commissioning the relay – the current transformer ratio, the voltage transformer ratio and the number of steps – are made in order as three steps. In the fourth step, the relay learns the panel. First the relay switches the first step in and out, automatically recognizes the polarity and the L1-L2-L3 phase order, and corrects any wrong connection. If there is a physical mistake during this time that the user needs to correct, it gives a warning by giving an address. When the connection test is complete, the relay moves on to learning the steps. By switching the steps in and out in turn, the step connections, types and powers are learned. For the relay's compensation intervention

algorithms to work properly, it must know the steps correctly. Therefore, instead of manual setting, we recommend running the automatic test from this menu or from the step test menu.

1. Select the Current Transformer Ratio with the “up-down” keys and press the “set” key. For example, if you have a 600/5 current transformer, 120 is selected. It is essential to enter the current transformer value correctly in order to see the primary values of the step powers, the measured parameters and the energy indexes correctly. A mistake does not harm the compensation, but the values appear as secondary values and cause errors in manual settings.
2. Select the Voltage Transformer ratio with the “up-down” keys and press the “set” key. This menu is also used in MV compensation. If compensation is made from LV, the multiplier must be left as 1. For example, if compensation is made from MV, the ratio is found by dividing the primary input voltage by the secondary output voltage. The input voltage must be entered as $34500/400=86.2$.
3. Select the number of steps with the “up-down” keys and press the “set” key. If you will not use all 18 steps and have connected the steps in order, you can enter a number smaller than 18. If you have connected the steps scattered, such that only the first step is a three-phase capacitor, leaving the number of steps at 18 does not affect the operation of the relay, even if there are only 3 steps. Apart from the step learning process finishing as quickly as possible, entering a large number of steps has no effect. However, if a small number is entered, the relay will not switch in or out the steps numbered above the number of steps. Therefore either 18 must be entered, or if a smaller number is entered, it must be entered correctly.
4. By learning the connections and steps, the relay will recognize the panel. After selecting the current transformer ratio and pressing the set key, the text “Start step learning” will appear as the selected item. If the “set” key is pressed in this state, the relay moves to the connection learning phase:

B a g l a n t ı l a r
K o n t r o l e d i l i y o r

The connections are learned by switching the first step in and out. If an error occurs during the connections, a warning is given. If the connections are correct, the relay moves on to learning the steps.

If the connections have been corrected:

B a g l a n t ı l a r
D u z e l t i l d i

After the connections are learned, these messages are kept on the screen for a few seconds; then the relay moves on to learning the steps. Learning the steps takes between 18 seconds and 5 minutes, depending on the state of the load. If, when 5 minutes are up, there are still steps that could not be learned because of load fluctuation, the steps can be learned manually from the learn steps menu, or a step-learning scan can be run again from the learn steps menu. In most load conditions 5 minutes will be sufficient.

After the steps have also been learned following the connections, the relay will perform its measurement and compensation duties correctly.

After completing the four steps in the Quick Setup menu, advanced settings can be made from the other menus if desired. For example, if settings such as step switch-in/switch-out times or the billing cut-off day are needed, they can be changed from the relevant menus.

Step Settings:

The submenus of this menu are as follows;

K o n d a n s a t o r 1
A l m a z a m a n i s n

K o n d a n s a t o r 1
C i k m a z a m a n i s n

K o n d a n s a t o r 3 0
D e s a r j z a m a n i s n

R e a k t o r 1 0 0
A l m a z a m a n i s n

R e a k t o r 1 0 0
C i k m a z a m a n i s n

K a d e m e 1
S a y i s i k a d e m e

M a n u e l K a d e m e
G i r i s i

When you select it from the main menu and enter this menu with the “set” key, the step settings appear on the screen. There are seven step settings.

With the “up/down” key you move to the next line/setting. With the “up-down” keys, the setting value of the line/selected item at that moment is changed. After 7 settings have been made, the “SAVE” option is chosen as yes/no. If the “esc” key is pressed, you return to the previous line/setting.

1.Number of Steps: So that no useless operations are made on unused steps, for example if 11 steps are used, by selecting this setting as 11 and connecting the 11 steps to the first 11 contactor outputs, the relay is made to disregard the last seven steps. Even if 3 steps are used, there is no harm in leaving this setting at 18.

2.Capacitor switch-in time: For the steps that are capacitors, this is the time between the intervention decision and the application decision. It can be set between 1 s and 999 s. Its default value is 1 s.

3.Capacitor switch-out time: For the steps that are capacitors, this is the time between the intervention decision and the switch-out decision. It can be set between 1 s and 999 s. Its default value is 1 s.

4.Discharge Time: For capacitors to be switched in again after being switched out, the energy that may remain on them must have been discharged. For this, the recommendation of the capacitor manufacturers must be applied. The capacitor discharge time is important for system life, so where no discharge coil is used, it must be set to the time recommended by the capacitor manufacturer.

The discharge time can be set between 1 s and 999 s in 1 s steps.

5.Reactor switch-in time: For reactors, the switch-in/switch-out times are kept different from the times for capacitors. Frequent switching of reactors degrades the power quality in the system. For this reason, even if a fixed time is entered manually, the relay keeps the reactor timing separate from the capacitor timing. It can be set between 1 s and 999 s in 1 s steps. Its default value is 100 s.

6.Reactor switch-out time: For reactors, the switch-in/switch-out times are kept different from the times for capacitors. Frequent switching of reactors degrades the power quality in the system. For this reason, even if a fixed time is entered manually, the relay keeps the reactor timing separate from the capacitor timing. It can be set between 1 s and 999 s in 1 s steps. Its default value is 100 s.

WARNING! If there is no sufficient discharge coil or resistor, enter the discharge time as specified by the capacitor manufacturer.

If the steps are to be entered manually:

Select manual step entry and press the “set” key. The relay then opens the settings page required for manual entry:

**K # 1 k V A r = K o n d .
0 . 0 0 0 . 0 0 0 . 0 0 0**

From the screen that opens first, the 18 step values can be viewed one by one with the “up-down” keys. While the step you want to change is selected, press the “set” key to set it manually.

Instead of entering the steps manually, we recommend using the relay's advanced step learning feature. In particular, there is a risk of wrongly entering the phases of single-phase capacitors manually. There is no such risk with automatic learning.

Connection Settings:

**A k i m t r . o r a n <
G e r i l i m t r . o r a n**

**G e r i l i m t r . o r a n <
K a d e m e s a y i s i**

**K a d e m e s a y i s i <
B a g l a n t i t e s t**

B a g l a n t i t e s t i <

Select “Connection Settings” from the main menu and enter this menu with the “set” key. In this menu the current transformer ratio / voltage transformer ratio and the number of steps are set. If desired, only the connection test can also be performed.

For the current transformer ratio, for example for 600/5, 120 is entered. If it is desired to use a voltage transformer ratio, it is set in "0.1" steps. Voltage Transformer Ratio = primary voltage / secondary voltage. In 230V LV installations, "1.0" must be entered.

Connection Test: Press the “set” key at step 4. The relay starts testing the connections. The connection test and the step test are separate tests. Both are performed one after the other only in “Quick Setup”. Only the connection test is performed in the connection test menu.

The connections are learned by switching the first step in and out. If an error occurs during the connections, a warning is given. If the connections are correct or have been corrected automatically, the message “connections corrected” appears.

Compensation Target:

Y o n t e m = O r a n h d f
% 3 i n d

T r f . k a y i p 1 8 . k d m
P a s i f

Y o n t e m = C o s f i h d f
0 . 0 0

"Compensation Target" is selected from the main menu and this menu is entered with the "set" key.

The normal operating target is set from this menu. In the RPC series, 3 targets can be set in two different directions. In this way the system is kept in the desired reactive region and at the desired reactive percentage. The relay makes all of its interventions to achieve the entered target.

1) Ratio target: The default target is a reactive ratio of "3% ind.". If you need to operate your system in the capacitive or inductive region, it is enough to set the target; the RPC relay does the rest. The setting range can be set from 50% ind. to 50% cap. in 1% steps.

2) Transformer loss: This method can be used when there is no fixed capacitor on your MV transformer, or to eliminate capacitance coming from the line. If there is no fixed group on your transformer, you can connect a capacitor that meets your need and have the relay switch it in. If you connect a shunt reactor to eliminate the capacitive effect over long distances between the MV power transformer and your meter, the relay switches in this shunt. In this case the relay does not include the capacitor or shunt you have connected in its calculations.

3) Method=Cosphi: If you select this option, you can set the operation of the relay between 0.8 ind. and 0.8 cap. in steps of 0.01.

Alarm Settings:

"Alarm Settings" is selected from the main menu and this menu is entered with the "set" key. Press the "esc" key to exit.

A l a r m 0
C i k i s i o f f

A k i m 1 5
H a r m o n i k %

G e r i l i m 1 5
H a r m o n i k %

A s i r i 6
A k i m a m p e r

D u s u k 1 7 5
G e r i l i m v o l t

A s i r i 2 5 5
G e r i l i m v o l t

I n d u k t i f 2 0
C e z a o r a n i %

K a p a s i t i f 1 5
C e z a o r a n i %

All alarm settings are seen and made from this menu. The alarm settings are completed by making 8 alarm settings. "esc" can be used to return to the previous line. On leaving each alarm setting, you are asked whether to save.

1.Alarm output: Turns the backlight of the relay screen on and off in case of an alarm.

2.Capacitive Penalty Alarm: If, for any reason, the relay has not been able to bring the capacitive values below this set percentage value, a capacitive penalty alarm is given. This value is 15% by default. It can be set in steps of 1%. This alarm is given if the last daily percentage is excessively capacitive and the new daily percentage is also excessively capacitive. If you get this alarm often, your panel needs reactors.

3.Inductive Penalty Alarm: If the inductive ratio percentage value runs high, an alarm is given above this setting. If you get this alarm often, your system needs capacitor steps, or your loads are very fast; you need an SVC or a thyristor relay.

4.Overvoltage Alarm: This is the value at which the device gives an alarm when the network voltage rises. When this alarm occurs, the steps are put into protection. All steps in service are switched out. Therefore it should not be set unnecessarily low. Its default value is 255V.

5.Undervoltage Alarm: This alarm is given when the network voltage falls below a certain voltage. The default setting is 175V.

6.Overcurrent Alarm: This alarm is given when excessive current is drawn. Its default value is 6 A. If current flows through the relay terminals for a long time, the relay is damaged.

8.Voltage Harmonic Alarm: When the total harmonic distortion in any phase voltage exceeds the limit value set here for 1 s, the "Excess THD-U" alarm is given. The default alarm value is 15%.

9.Current Harmonic Alarm: When the total harmonic distortion in any phase current exceeds the limit value set here for 1 s, the "Excess THD-I" alarm is given. The default alarm value is 400%.

When the overvoltage alarm occurs, the relay protects the steps by deactivating all of them. Therefore these alarm limits must not be entered unnecessarily low or high.

Other Settings:

When the "Other Settings" menu is selected from the main menu and the "set" key is pressed, the device moves to the other settings screen:

Baud rate 57600
bit / sn

Parite 0
off

Adres 1
(0 - 255)

Sifre Degistir <
* * * *

Tarih ve saat <
Ayarlar

Fatura 31
Kesim gunu

TCR Func .
Senkron aktif

The relay's rarely needed settings, which are separate from the other categories, are gathered in this menu.

Baud: This is the communication speed setting in models with communication. It can be set to 4800, 9600, 19200, 38400, 57600, 115200, 128000.

Parity: For communication; none, odd or even can be selected.

Address: 255 different devices can be connected to a Modbus RTU RS-485 line. The Modbus ID that distinguishes these devices from one another can be assigned between 1 and 255 with this address setting.

Change Password: If the "set" key is pressed, it asks you to enter the new password. Please do not forget the password you enter, otherwise you will not be able to enter the relay settings.

The factory default password of the device is "0000".

Date/Time: To change the date and time settings, press the set key and enter the date as day/month/year. Each time you press the set key the cursor moves, allowing you to adjust. After the last second is entered, continue by pressing the set key at the question of whether to save.

```
> 3 0      : 1 2      : 2 0 2 2
  1 4      : 1 5      : 2 3
```

Billing cut-off: Selects the day of the month on which monthly energy ratios are calculated.

SVC function: 5 different SVC/TCR modes are selected from this menu. These settings are explained in detail in the SVC section.

Manual Test:

Select the "Manual Test" menu from the main menu; when the "set" key is pressed, the device switches to manual test mode. In this mode the relay does not intervene in the steps. Only the user intervenes in the steps by turning the steps "on" and "off" one by one. Manual test mode is for testing by switching steps in and out by hand. Even if the relay is forgotten in this menu, it returns to normal mode by itself after 5 minutes. Since compensation stops during the time spent in this menu, the reactive meters register.

```
K #   1   c e k t i r
D e s a r j   b e k l e   0 s n
```

While in the manual test menu, the step currently selected is engaged by pressing the set key. To release it, the set key must be pressed again. The same step is not switched in again before the discharge time has elapsed.

The same operation is applied to the step you want to engage by pressing the up key.

Step #19 is used to trigger the driver. While on it, if the set key is pressed the driver is activated; if the set key is pressed again the driver is deactivated.

Event Log:

"Event Log" is selected from the menu and this screen opens by pressing the "set" key:

The Power RPC relay makes it possible to see important past events and the alarms that have occurred. If an alarm occurs, the screen light flashes, and which alarm was given can be seen by entering the event log menu.

G e r i l i m h a r m o n i k
O r a n a s i l d i

Reset Menu:

While in the main menu, the "Reset menu" item is selected and this menu is entered by pressing the "set" key.

F a b r i k a A y a r i <
E n e r j i s i f i r l a

There are three items in this menu. The desired command is selected with the "up-down" keys and applied with the "set" key. The relay asks for confirmation. Pressing the "set" key again gives confirmation and the operation is applied. After returning to factory settings, do not forget to make the new settings. For analysis of past data, it is good practice not to delete these values, only to delete them at the beginning.

Learn Steps:

While in the main menu, select the "Learn steps" item and enter this menu by pressing the "set" key.

K # 1 k V A r K o n d .
0 . 0 0 0 . 0 0 0 . 0 0

In this menu you can check the capacitor values. By pressing the up and down keys you can see the steps in order. You can also test the steps again in this menu. If you change one of the steps, when you move onto that step in this menu and press the test key, the relay tests that step and records its value.

Practical information:

Power RPC 18 SVC relays are designed so that their users can manage compensation in the fastest and easiest way.

At first commissioning, the connections are made and checked and the relay is energized. To set up the relay, if the device has just come from the factory, it is easily commissioned in 4 steps with the "quick setup wizard" menu. If it is a relay that has been used elsewhere, first return to factory settings from the "reset menu", then commission it easily in 4 steps with the "quick setup wizard" menu.

Although the use of the menu is explained in detail in the menu section, it is easily done with four keys.

The "set" key is used to enter menus, confirm, advance and save. To enter the menu, the "set" key must be pressed for a long time. A long press means pressing for 3-5 seconds without releasing.

The "esc" key is used to return to the previous menu or setting, to go back, to exit, or to cancel without confirming.

The "up-down" keys are used to increase and decrease, to move between values in list values, and to move between screens on the measurement screens.

In summary, menu use: enter with "set", select with "up-down", confirm with "set" and move to the next item; do the same in the next one and save with "set".

After the number of steps and the current transformer ratio have been entered into the relay from the "quick setup" menu, the relay automatically corrects connection mistakes and reports the ones it cannot correct. Then it learns all the steps by switching them in and out in turn. Under load this can take a few minutes, and if there are steps it could not learn within 5 minutes, these steps are completed manually. The "Manual step entry" menu is used to enter steps manually.

If special discharge resistors or discharge coils are not used, the values given by the capacitor manufacturer must be entered for the discharge time.

After introducing the connections and steps and reviewing the step settings, other settings can be made. For example, if there are special preferences for alarms, the desired settings are made from the "Alarm Settings" menu. Operations such as date-time setting, changing the password and setting the billing cut-off day (if known) are done from the "Other Settings" menu.

From the "Event Log" menu, you can look at important past events and follow what happened while you were away.

When the connections of the Power RPC 18 SVC relay are first made or changed, a "connection test" must be performed. The connection test is indispensable for the measurements, and therefore for the compensation, to work properly. To perform the connection test on its own, the "Connection Settings" menu is

The installation being compensated may be required to operate in the capacitive or inductive region. The default target value of the relay as it leaves the factory is a reactive ratio of 3% ind. If the compensation target setting is not changed, the relay tries to bring the reactive ratios to zero, and therefore the power factor and cosphi values to 1.000. It switches the steps accordingly. If the setting is changed, the relay works to achieve the entered reactive percentage or power factor. The targets entered can be capacitive or inductive. For example, if the system is near the end of the month and is in penalty on the inductive side, and the capacitive ratios are far from penalty, penalty can be avoided by selecting the target value as capacitive. The following may cause this situation: the relay has just been connected, or the steps are insufficient, or there has been a failure in the steps. In the end such unfavorable situations are encountered, and in the Power relay the target setting can be applied as a solution for these situations.

Target settings can also be used for different purposes. For example, if bringing the reactive powers to zero causes resonance and harmonics between some loads, the target values can be set to ratios such as 3%, 5%.

After the relay is commissioned, it must not be left without performing the connection test. Then the step test must be performed. To be safe, the phase active powers can be checked on the active powers page. No phase active power value should have a minus sign in front of it. The correct operation of the system depends on the relay knowing the connections and steps correctly. In addition, the overvoltage alarm and compensation target settings in particular must be entered correctly. In overvoltage alarms the relay also switches out the steps to protect them.

The connection test and step test can be performed together from the “Quick Setup” menu. For the connection test only, the “Connection settings” menu is used. For the step test only, the “Learn steps” menu is used. The steps can also be entered manually. It is not recommended to enter all steps manually. In summary:

1. Make the relay connections according to the rules and energize the relay.
2. Make sure the first step is a three-phase capacitor, and if the relay has been used elsewhere before, give the “return to factory settings” command from the “Reset menu”.
3. After seeing that currents and voltages are present on all 3 phases, enter the “Quick Setup” menu. If there is no load, switch the three-phase capacitor in by hand and see that current flows in all three phase currents.
4. In the “Quick Setup” menu select the number of steps and the current transformer ratio, then give the command to learn the connections and steps.
5. When it says the connections are correct or corrected, continue with the step test with the “set” key, or after a few seconds the relay will start learning the steps by itself.
6. While the steps are being learned and after they are learned, the necessary information will appear on the screen. When finished, exit with the “esc” key. The relay will start compensating.
7. If there are special settings you want to change, enter the relevant settings page from the main menu and change them.

If anything goes wrong during these steps, the relay will give the necessary warning. Then make the correction and start again from the beginning.

Using the SVC:

The Power RPC 18 SVC relay can also be used simply as a classic contactor relay. For SVC it has 3 trigger outputs. The reactor driver module is connected to these trigger outputs. 3 reactors are connected to the reactor driver module.

The Power RPC 18 SVC relay and the Power thyristor reactor driver modules work together compatibly and extremely stably. Their service life is incomparably longer than that of contactor steps.

What is the Power RPC 18 SVC?

It is the compensation relay, called an SVC or TCR system, that the Power relay family has developed for the most complex and fast installations. Compared with other SVC relays it has far superior usage, analyzer and intervention features. For the SVC function it offers a unique experience with not 1 but 5 different modes.

By dividing the reactors into approximately thousands of steps, it compensates effectively as if there were thousands of capacitors and reactors in the system. It has up to 18 steps of contact outputs and 3 semiconductor trigger outputs, to which one reactor is connected per phase. It can be used only as a classic relay, or as an SVC relay with 1 reactor driver and 3 reactors.

What are the benefits of the Power RPC 18 SVC?

It provides economical, long-life and smart intervention modes even in a mixture of every situation: balanced-unbalanced, fast load-slow load, low power-high power.

1. It ensures definite compensation success even in the most troublesome facilities.
2. With only 3 reactors, it meets the needs of thousands of single-phase capacitors and reactors. It reduces cost.

3. Semiconductors are fast, silent and long-lived. They also reduce long-term maintenance costs.
4. It handles unbalanced loads perfectly and precisely.
5. It compensates fast loads quickly at system frequency (up to 50 times per second - 20 ms speed).
6. At the same time, it achieves flawless results with both very low-power loads and high-power loads.
7. Both capacitors and reactors can be connected to the normal steps.
8. It provides solutions to various problems with 5 different TCR modes.
9. The home screen has a percentage display showing to what extent the TCR steps are in service.
10. The SVC steps are also learned automatically by the relay.

What are the TCR/SVC function modes of the Power RPC 18 SVC relay?

They allow you to set how and when the SVC intervention will be performed.

The SVC system has 2 disadvantages. These are that it consumes a small amount of active power and that it causes harmonic currents. In the Power relay, to protect against these disadvantages, there are measures and settings that ensure SVC intervention is taken only when necessary. With these features, found only in the Power relay, you use the solution most suitable for your system in the way that affects the power quality of your system least.

In brief, these modes are:

1. off: The SVC function never comes into operation. It is used to turn off the SVC function. For example, if the SVC relay was chosen with the future in mind and only the classic outputs are used, off can be selected.

2. synchronous active: The SVC function is continuously in operation. There is no relay within the relay in this mode. Intervention on the normal steps and intervention on the SVC steps are carried out synchronously to achieve the desired compensation target.

In this mode the relay adjusts both capacitors and reactors together.

3. Asynchronous active: The SVC function is continuously in operation. In this mode, the SVC steps compensate the reactive power left over from the intervention on the normal steps. It works differently from the synchronous mode. In asynchronous mode the reactors come into operation less than in synchronous mode.

4. Only on capacitive load: In this mode the SVC function does not work while a capacitor is in service. When no capacitor is in service, if the load is capacitive the SVC function works. The aim in this mode is only to compensate capacitive loads with the SVC. It compensates the other loads with the normal steps.

5. Active when near penalty: In this mode the SVC function does not always engage. The moment the daily ratios approach the penalty limits, only in the hours and minutes when the penalty is approached or exceeded, the SVC engages and prevents the accumulation of reactive energies. In this way, by being engaged only when necessary, protection is obtained from the harmonics it produces and the small amount of active power it consumes.

Power RPC 18 SVC

Commissioning the Relay

!!! Before starting the connections, always cut the power; never make connection changes while electrical power is on. !!!

1) Relay Voltage Connections

- 1a) Connect the 3 phases of the network one by one to the L1-L2-L3 voltage inputs of the relay. Even if the phase direction and order are connected wrongly, the relay will correct it.
- 1b) Connect the neutral to the neutral input of the relay; never connect a phase instead of the neutral. Connecting a phase to the neutral causes damage in the system.
- 1c) When making the voltage connections, take the utmost care that the terminals are not loose and do not short-circuit with other terminals. Otherwise serious damage will occur in the system.

2) SVC Driver Module Voltage Connections

- 2a) Connect the 3 phases of the network to the L1-L2-L3 voltage inputs of the SVC driver module in the same order as you connected them to the voltage inputs of the relay. Whichever phase you connected to the relay's L1 voltage input, connect the same phase to the driver module's L1 voltage input. Whichever phase you connected to the relay's L2 voltage input, connect the same phase to the driver module's L2 voltage input. Whichever phase you connected to the relay's L3 voltage input, connect the same phase to the driver module's L3 voltage input.
- 2b) When all connections are finished and you energize the system for the first time, you can check that the phases are not different by measuring the relay voltage inputs and the driver module voltage inputs one by one with the help of a multimeter/voltmeter.
- 2c) The voltage between the relay's L1 voltage input and the driver module's L1 input must be zero; if connected wrongly, there will be a phase-to-phase voltage between them because they are different phases. For example, if a voltage between 380-400V is seen on 230VAC systems, this means the driver module is connected wrongly. In the same way there must be no voltage difference between the relay's L2 and the driver module's L2 inputs, and between the relay's L3 and the driver module's L3 inputs. If there is a phase-to-phase voltage it is wrong and must be corrected manually.
- 2d) If the voltage inputs of the driver module and the relay are accidentally connected to different phases, at the stage of introducing the steps to the relay the relay will see the reactor values as considerably lower than they are. For example, it may see a 5 kVAr reactor as 2 kVAr. It also runs making a clicking sound and causes quite high harmonics.
- 2e) When making the voltage connections, take the utmost care that the terminals are not loose and do not short-circuit with other terminals. Otherwise serious damage will occur in the system.

Relay current connections;

- 1) Connect the pairs coming from the current transformer in turn to the L1-L2-L3 current input pairs of the relay. As long as the k-l ends of the pairs are not crossed with each other, the relay will automatically correct the other connection errors. For example, if you connect the “k” end coming from L1 and the “l” end coming from L2 to the relay's L1 current input pair, the relay cannot correct this crossing. As long as you do not make these crossings, the relay will automatically correct other phase crossings and polarity errors.
- 2) When making the relay current connections, take the utmost care that the terminals are tightly connected and not loose. Leaving current terminals open-circuit causes vital damage in the system.

Reactor connections of the SVC driver module;

- 1) Connect one end of each reactor to the L1-L2-L3 outputs of the driver module. Join the other ends of the reactors and connect them to the neutral.
- 2) When making the connections, take the utmost care that the terminals are tightly connected and that there is no open/short circuit.

R1-R2-R3 trigger connections of the SVC driver module;

- 1) Make the connections correctly in order and without crossing: from the relay's R1 port to the driver module's R1 port, from the relay's R2 port to the driver module's R2 port, from the relay's R3 port to the driver module's R3 port. The voltage at these ports is 5 VDC.
- 2) Make a connection from the relay's “+” port to the driver module's “+” port.

Connecting the steps to the relay's contact outputs;

- 1) Connect the classic contactor steps, between 3 and 12, as many as you need.
- 2) Connect a three-phase capacitor to the first step and, if possible, the step with the largest power. This is necessary for the connection test to be performed reliably.
- 3) To the classic steps you can connect either reactors or capacitors, regardless of three-phase or single-phase.
- 4) In the TCR relay, reactors are generally not used in the classic steps for small reactor needs. Each of the reactors connected to the R1-R2-R3 outputs is already divided and behaves like thousands of reactors. However, in some installations a high-power reactor may be needed in addition. By connecting reactors to the classic steps, a solution can be produced for these installations.

Energizing the relay, driver module and system;

- 1) After making sure you have made the connections properly and firmly, apply power.
- 2) Check the relay L1-L2-L3 voltage inputs and the driver module L1-L2-L3 voltage inputs with the help of a voltmeter, as described in 1.b.
- 3) Check on the relay's home screen that the voltage of all 3 phases is correct. If there are phases without voltage, find and fix them.

4) If there is no load in the circuit, it is useful to switch any three-phase load or step in by hand and see that current flows in all 3 phases on the home screen. If you cannot do this, the relay will give a warning if there is no current in the automatic connection test. If there is, find and fix the phase(s) with no current and continue.

5) If the connections are complete and voltages and currents are present, perform the following tests with the relay's menu, in the following steps.

Performing the connection test with the relay's "Quick Setup" menu;

- 1) Hold the relay's "set" key pressed for 3-5 s. The password screen will appear.
- 2) Enter the password. The default is "0000".
- 3) The main menu will appear on the screen. Enter the "Quick Setup" menu.
- 4) Enter the current transformer ratio. For example, enter 20 for 100/5. Enter the number of steps.
- 5) Enter the voltage transformer ratio. It is "1" for LV.
- 6) Enter the number of classic steps, whatever it is.
- 7) Press the set key and wait for the relay to correct the connection errors. After the connection errors are corrected, the relay will move on to recognizing the steps.
- 8) The relay will switch the first step in and out and find and correct the polarity and phase-crossing errors on the current inputs. If there are loads operating in the system, the relay will keep trying until it is sure.
- 9) When the relay says "connection errors corrected" and "connections correct", it will move on to the step test. If there is a mistake in the connections, correct the errors according to the relay's message and try again.
- 10) After the connection test has passed successfully, the relay will learn all steps, including the SVC steps, by switching the steps in and out in turn. Check that the SVC steps are learned correctly by taking into account the reactor power you connected.
- 11) When the connections and steps are learned, the relay can start compensating.
- 12) If you will make special settings, you can examine the other menus.

BOX DIMENSIONS;

