



AUTOMATIC POWER FACTOR CONTROLLER

MODEL VAR-6A VAR-12A

User's Manual





• Before use, you should read this user's manual carefully to properly operate this device.

Be sure to forward the manual to the end user.

Introduction

Thank you for purchasing Automatic Power Factor Controller.

This instruction manual explains how to install and use Automatic Power Factor Controller VAR series (hereinafter referred to as "device").

Before use, you should read this user's manual carefully to properly operate this device. We recommend that you keep this manual in a safe place for future reference and read it whenever necessary.

Be sure to forward the manual to the end user.

The following marks are used in this manual.

Mark	Explanation
	This symbol indicates matters that may lead to death or serious injury if ignored or incorrectly handled.
	This symbol indicates matters that may lead to injury or physical damage if ignored or incorrectly handled.
	This symbol indicates precautions to avoid any device failure or to operate this device properly.

Even items described under [\triangle WARNING], [\triangle CAUTION], or [\checkmark NOTE] may cause serious results.

In any case, important information that must be observed is explained.

Check on your delivery

Besides the main unit, the following accessories are packaged.

Parts name	Quantity	Specifications
User's Manual (this document)	1	A5 size (148 mm × 210 mm)
Embedded Mounting Fittings	2	
Embedded Fixing Screw	2	(M3 mm × 14 mm)

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Safety Precautions

Working Environment and Working Condition

Avoid using this device in the following places. Use in the following places will negatively affect the device lifetime and operations.

Do not;

- Place where the ambient temperature exceeds the temperature range (-5 $^{\circ}$ C to +50 $^{\circ}$ C).
- Place where the daily average temperature exceeds 35 $^{\circ}$ C.
- Place where the ambient humidity exceeds the humidity range (30 % to 85 %).
- Place with a lot of dust, corrosive gas, salt or oily smoke.
- Place with a lot of vibrations or impacts.
- Place where the device may be exposed to rain or drops of water.
- Place exposed to the sun.
- Place where metal pieces and inductive substances are laying around.
- Place with strong electromagnetic field or much outside noise.
- Place higher than 1000 m above sea level.
- If you consider using this device for a special purpose, such as nuclear power plants, electric power aerospace, medical care, passenger vehicles, or systems, consult with our sales representative.

Cautionary Instructions for Installation and Connection

Read this User's Manual before using.

▲ CAUTION	 To secure safety, the connecting work should be done by a person qualified in performing electric wiring work. Do not perform hot line work. It can cause electrification, device failure or fire. At the time of tightening screws and wiring, be careful about the invasions of parings or the electric wire into the device. Perform connection after you fully check with the connection diagram. Inappropriate connection can cause electrification, device failure or fire. Use electric wires which can comply with the rated current. Using inappropriate wire can cause fire due to heat generation. At the time of the resisting pressure examination of the high voltage apparatus, carry out grounding to avoid any negative influence. The device can break down if more than 2000 V is impressed for 1 minute. Always earth the terminal to the protective earth conductor. Earth the terminal with less than 100 ohm of earth resistance. Otherwise there will be a false accuration.
	terminal with less than 100 ohm of earth resistance. Otherwise there will be a false operation.

	• Use solderless terminal that comply with th	e size of the electric wire. (Refer	
	to page 44) Using inappropriate terminals can cause malfunction, device		
	failure / burnout or fire.		
	• After tightening all the screws, be sure to	confirm that all the screws are	
	tightened enough. Leaving any screws loose can cause malfunction, fire or		
	electrification.		
	• Tighten the screws to the appropriate torque. Tightening to the excessive		
	torque can cause terminal damage. (Refer to page 44)		
	• In order to prevent the invasion of noise, do not place power line and high		
	voltage line near the input and output signal line or put them together. Make		
	the following distance showed below when power line and high voltage		
—	line are parallel to the input signal line.		
	Condition	Distance	
	The power line is less than 600 V	More than 300 mm	
	Other power lines	More than 600 mm	
	• Do not drop this device from high places.		
	When the device is dropped, and a LCD is	cracked, do not touch and drink	
	the liquid. If you touch the liquid, wash it away with soapy water promptly.		
	• Do not strongly pull the wire.		
	If terminal wire is pulled strongly, there is a possibility that an input-and-		
	output terminal can break away.		

Cautionary Instructions before Use

- Follow the environment and an operating condition in setting place.
- Make settings before use of this device. Read the User's Manual in order to set it correctly. Inappropriate settings can cause incorrect operation.
- After checking the power supply rating of this device, impress appropriate voltage. (Refer to page 49)

Cautionary Instructions for Using

- We cannot take responsibility for the loss, lost profits, and the damage caused in special circumstances. Moreover, we will not take responsibility to the second damage, accident compensation, and the damage to any places other than our product.
- When blackout occurs during setting, it will not be set correctly. After the return of electricity, set it again.

Safety Precautions



- Install series reactor to the capacitor, which is to be automatically controlled by this device.
- This device has a constant excitation system that outputs no voltage 1a contact that continuously keeps on when capacitor control signal is closed, while the contact becomes off when capacitor control signal is opened for each bank. One side of the output signal of from C1 to C6 is COM1 and the other side of the output signal of from C7 to C12 is COM2. When connecting with the vacuum electromagnetic contactor for disconnection and connection of capacitor, be sure to use auxiliary relay such as DC operated type (Model : SRD-T5) or AC operated type (Model : SR-T5) manufactured by Mitsubishi Electric.

• The maximum current must be under 1.5 A on a common terminals.

- In case of using by balanced load, connect at the diagram.
- Circuits set as "Manual ON" or "Manual OFF" will not connect/disconnect capacitor.
- When electric discharge coil is instituted, set Delay Time for 5 minutes.

• Set up the applicable delay time to the discharge device of the capacitor (Discharge resistance: over 5 minutes, Discharge coil: over 1 minute), when the connection/disconnection test with the high voltage circuit is carried out. Carry out the test with the delay time set to be shorter than it should can cause capacitor failure accidents.

	• Do not dismantle or remodel this device.	
	It can cause malfunction, electrification or fire.	

Safety Precautions

- Cautionary Instructions for Maintenance and Inspection
 - Wipe off surface with a soft cloth.
 - Do not allow chemical cloth to contact for a long time or wipe with benzene, thinner or alcohol.
 - For correct use of the device, perform the following inspection.

Enforce (4) as a periodic inspection (every half year to 1 year), and (1) to (3) as an everyday inspection. Check to see:

- ①Any damage in the device?
- ②Any Error in the LCD?
- 3 Any unusual sound or smell or fever?
- ④Any looseness in the installation or terminal block connection?
 - (Be sure to perform the inspection with the power off.)

Storage Precautions

When storing the device, turn off auxiliary power and the power supply of input circuit, remove wiring, and store it in a plastic bag etc. (Please take care of the removed wirings to prevent any accidents.) Do not store the device for long time in places mentioned below. There is a risk of failure or deterioration in service life.

Do not;

- Place where the ambient temperature exceeds the temperature range (-20 $^{\circ}$ C to +60 $^{\circ}$ C).
- \bullet Place where the daily average temperature exceeds 35 °C.
- Place where the ambient humidity exceeds the humidity range (30 % to 85 %).
- Place with a lot of dust, corrosive gas, salt or oily smoke.
- Place with a lot of vibrations or impacts.
- Place where the device may be exposed to rain or drops of water.
- Place exposed to the sun.
- Place where metal pieces and inductive substances are laying around.

Disposal

- Dispose of this device according to "The law about abandonment and cleaning".
- Batteries are not used in this device.

About the Packing material and the User's Manual

For environmental load reduction,

- Corrugated paper is used on packing material.
- Regenerated paper is used on User's Manual.

Term of Guarantee

The period of guarantee is for one year from the purchase date.

Repair is onerous in case you break the device intentionally or by mistake even if it is during the guaranteed period.

Recommended renewal time

Exchange cycle will depend on status of use, however update should be carried out in every 10 years.

Operation

1. Features

This device controls input of capacitor automatically with primary voltage and measured primary current.

List of Model

Madal	Output Function	Input Function
Model	Capacitor Control Signal	Forced Disconnection Signal
VAR-6A	6 circuits	1 circuit
VAR-12A	12 circuits	1 circuit

2. Functions in each mode

There are following modes in this device.

Operation Mode

Measurement value is indicated with digital number.

The measurement values and capacity (of capacitors) are displayed on this Mode.

Measure Set-up Mode

Set-up of phase/wire type, primary voltage, and primary current are possible. Set necessary items for operation.

In addition, it can carry out operation tests for connecting/disconnecting.

Control Set-up Mode

Set-up of target power factor, control method, and capacity are possible.

Set necessary items for operation.



3. Names and Function of Each Part

Name and Function of LCD / LED / Operation Key





VAR-12A

3. Names and Function of Each Part

Functions of LCD



*Since this LCD display is only for the explanation here, the acutual displays are different from the above.

A Name and the Work of Terminal.



Terminal

Voltage Input

Control Signal

Output Terminal

P0, P1, P2, P3

C1 to C6, COM1

C7 to C12, COM2



VAR-12A



Terminal Name	Terminal Number	Detailed Explanation
Auxiliary Power Terminal	Ма, Мв	Terminals for inputting auxiliary power for this device.
Earthing Terminal	÷	Terminal for earthing.
Non-connection	NC	They are not in use.
Terminal		Please do not connect.
Current Input Terminal	1S, 1L, 2S, 2L, 3S, 3L	Terminals for inputting the current (CT secondary signal) to the measurement circuit.
Connection	CS+, TS+, TA/S-	Connection disable input terminal: CS+
Disable /		Disconnection disable input terminal: TS+
Disconnection		Disable signal: TA/S -
Disable Input		Terminals for inputting the connection disable signal to disable
Terminal		the connection operation.
		Terminals for disconnection disable signal to disable the
		disconnection operation.
Forced	TA/S-, TB	Terminals for inputting the signal for forced disconnection of
Disconnection		capacitor circuits that are closed by automatic control.
Signal Input		* •
Terminal		
Connecting	CE+, TE+, E-	Connecting completion output terminal: CE+
Completion /		Disconnecting completion output terminal: TE+
Disconnecting		Completion signal common: E-
Completion Output		Terminals for outputting connecting completion signal when
Terminal		all the capacitors are connected and disconnecting completion
		signal when all the capacitors are disconnected.

the case of 220 V and 110 V circuit.

Terminals for inputting the voltage (VT secondary signal) to

the measurement circuit. Direct connections can be made in

In $3\phi 3W$, do not connect to P2 terminal for $3\phi 4W$.

Terminals for connecting the signal circuit for capacitor

Connection/Disconnection.

4.1 Details of Display of Power Factor Status and Auto/Manual Control Changeover

Details of Display of Power Factor Status and Auto/Manual Control Changeover is shown below.



4.2 Status of Power Factor

Status Indication of Power Factor

LEAD OUT△: This LED will light up on when Power Factor enters a Lead Out Area.

PROPER : This LED will light up on when Power Factor enters a Proper Area.

LAG OUT : This LED will light up on when Power Factor enters a Lag Out Area (Power Factor is less than Target Power Factor).

LIGHT LOAD \triangleleft : This LED will light up on when Power Factor enters a Light Load Disconnection Area. EXPORT \diamond : This LED will light up on when Power Factor enters a EXPORT Area (power transmission). FORCED DISCONNECTION \diamond :

This LED will light up on when the forced disconnection signal is inputted.



* The display changes based on the moving average deviations within 16 seconds.

·The Connection Level is the target power factor value.

·The Disconnection Level is defined as:

(Connection Level) - (capacity to be disconnected) \times 1.2

•The light load disconnection level is a value calculated as:

 $\alpha \times (\text{primary voltage setting value}) \times (\text{primary current setting value}) \times (\text{Light Load Power Ratio})$

$$3 \phi 3W: \alpha = \sqrt{3}$$
$$3 \phi 4W: \alpha = 3$$

4.3 Auto / Manual Control Changeover

A control set-up is possible among "Manual ON", "Manual OFF", and "Auto" on each capacitor bank.

Refer to "5.11 Set-up of Auto/Manual Control" (page 37) for the setting method.

(a) "Manual ON" set-up

"Manual ON" set-up (LED for "Manual ON" control lights up) is done by pressing "AUTO / MANUAL" Key, and the control signal for each capacitor will close after the Delay Time passes, regardless of the input conditions.

(b) "AUTO" set-up

"AUTO" set-up (LED for "AUTO" control lights up) is done by pressing "AUTO / MANUAL" Key, and automatic control will start.

If reactive power increases, "LAG OUT" LED lights up, and the control signal of capacitor will close after the Delay Time passes.

If reactive power decreases, "LEAD OUT" LED lights up, and the control signal of capacitor will open after the Delay Time passes.

(c) "Manual OFF" set-up

"Manual OFF" set-up (LED for "Manual OFF" control lights up) is done by pressing "AUTO / MANUAL" Key, and the control signal of capacitor will close for each capacitor immediately, regardless of the input conditions.

- *1. The Auto / Manual changeover is effective from the instant it is operated; There is no necessary for restarting the device after setting.
- *2. The "Manual ON" and "Manual OFF" operation is effective even if the connection disable signal or the disconnection disable signal is inputted.
- *3. After changing the setting from "Manual OFF" to "Auto", the generation of the capacitor connection signal will not begin until the Delay Time passes.
- *4. Please set to "Manual OFF" for banks that are not connected to capacitors.

4.4 Features of each Control

The features of each control is shown below.

Control name	Feature
Cyclic control	The cyclic control is suitable for controlling capacitors with equivalent capacity. Since the number of the switching operation of the vacuum electromagnetic contactors are made equally, long lifetime can be expected. It is necessary to replace all the contactors at the same time.
Priority control	The priority control is suitable for controlling the different - capacity capacitor group in stable load circuit which use the large - capacity capacitor on base and adjusts changes of reactive power on the small - capacity capacitors. But since the switching of certain vacuum electromagnetic contactors will become more frequent than those of others, maintenance and inspections must be made frequently and each contactor must be replaced at the end of their respective lifetime.
Optimal control	The optimal control is suitable for controlling the different - capacity capacitor groups in the circuit where load fluctuation is frequent. But since the switching of vacuum electromagnetic contactors become frequent and not equal, the maintenance and inspections must be performed frequently and each contactor must be replaced at the end of their respective lifetime.

4.5 Cyclic Control Operation

- In the cyclic control, the number of the switching operation of each capacitor circuit are made equally.
- At the time of turning on the power supply, the connection begins with C1 and proceeds as follows:

 \rightarrow C1 \rightarrow C2 \rightarrow C3 \rightarrow C4 \rightarrow C5 \rightarrow C6 \neg

It operates as follows in the case of 12 circuits.

 \rightarrow C1 \rightarrow C2 \rightarrow ······ \rightarrow C11 \rightarrow C12-

■ The disconnection also begins with C1 at the time of turning on the power supply and proceeds in the same manner as the connection:

 \rightarrow C1 \rightarrow C2 \rightarrow C3 \rightarrow C4 \rightarrow C5 \rightarrow C6 -



It operates as follows at the time of 12 circuits.

 \rightarrow C1 \rightarrow C2 \rightarrow ······ \rightarrow C11 \rightarrow C12 \neg

- The cyclic control is suitable for controlling capacitors with equivalent capacity. Since the switching operation of the vacuum electromagnetic contactors are made equally, long lifetime can be expected. It is necessary to replace all the contactors at the same time.
- When "Combination ON/OFF" set-up is "ON", a control method serves as only cyclic control.

4.6 Priority Control Operation

In the priority control method, priorities are attached to the connection and disconnection of each capacitor.

Upon turning on the power supply, the connection sequence begins with C1 and proceeds as follows:

 $C1 {\rightarrow} C2 {\rightarrow} C3 {\rightarrow} C4 {\rightarrow} C5 {\rightarrow} C6$

It operates as follows at the time of 12 circuits.

 $C1 {\rightarrow} C2 {\rightarrow} \cdots \cdots {\rightarrow} C11 {\rightarrow} C12$

■ In the disconnection sequence, disconnection proceeds sequentially, starting from the last capacitor circuit that was closed. In other words, it proceeds in the reverse order of the connection sequence.

 $C1 \leftarrow C2 \leftarrow C3 \leftarrow C4 \leftarrow C5 \leftarrow C6$ It operates as follows at the time of 12 circuits.

C1←C2←·····←C11←C12

- The priority control is suitable for controlling the different - capacity capacitor group in stable load circuit which use the large - capacity capacitor on base and adjusts changes of reactive power on the small - capacity capacitors. But since the switching of certain vacuum electromagnetic contactors will become more frequent than those of others, maintenance and inspections must be made frequently and each contactor must be replaced at the end of their respective lifetime.
- Priority control cannot be performed when "Combination ON/OFF" set-up is "ON." Control method serves as only cyclic control.



4. Explanation of Control and Movement

4.7 Optimal Control Operation

- In the optimal control, connection and disconnection is selectively performed for one capacitor circuit with the most appropriate capacity that will keep the lagging reactive power within the target power factor.
- In the connection, capacitors are cut off sequentially in order to decrease capacity until the power factor becomes the closest to the target power factor and the lag is minimized at the same time.
- Capacitors are cut off sequentially in order to decrease capacity until the power factor becomes the closest to the target power factor but it is never below the target power factor.
- The optimal control is suitable for controlling the different - capacity capacitor groups in the circuit where load fluctuation is frequent. But since the switching of vacuum electromagnetic contactors become frequent and not equal, the maintenance and inspections must be performed frequently and each contactor must be replaced at the end of their respective lifetime.
- At the time of turning on the power supply, the device first operates in the cyclic control mode until all capacitors C1 to C6 (It is C1 to C12 at the time of 12 circuits.) are closed. The device then begins the optimal control operations.
- When "Capacity Auto/ Hold" set-up is on "Hold" set-up and each capacity is the same, it becomes cyclic operation.
- The optimal control is not possible when the "Combination ON/ OFF" set-up is "ON." Control method serves as only cyclic control.



4.8 Capacitor Changing Control at Optimal Control Operation

- Optimal control is suitable for circuits with sharp load fluctuation. However, in case the load decreases gradually when multiple capacitors are closed, capacitors will open from the smallest capacity, and the capacitor with the largest capacity will remain last.
- In the area where light load disconnection is not made, the disconnection level is determined by the capacity. Thus this last capacitor will not be cut off.
- When the power factor leads out further than 95 % (Changing Area) in this status, changing control takes place where large capacity capacitor opens and small capacity capacitor closes.





4.9 Light Load Disconnection Operation

- In order to prevent overloading under light load conditions, the closed capacitors are sequentially cut off when the load falls below the power value determined from the low load power ratio setting value. (Please refer to page 32 about the calculation formula of the light load power ratio.)
- When the active power decreases and the "LIGHT LOAD" LED lights up and this condition continues for the Delay Time, one capacitor circuit is cut off. Thereafter, one capacitor circuit is cut off each time the Delay Time passes as long as the "LIGHT LOAD" LED lights up.
- When "EXPORT" LED lights up, the same operation as the case when "LIGHT LOAD" LED lights up is carried out.
- The order of disconnecting capacitor is as follow:
 - ① In cyclic control, capacitor circuits are turned OFF. This starts from the first capacitor circuit where the connection signal is outputted. (Disconnection proceeds in the same order as connection.)
 - ② In priority control, capacitor circuits are turned OFF. This starts from the last capacitor circuit where the connection signal is outputted. (Disconnection proceeds in the reverse order of connection.)
 - ③ In optimal control, capacitor circuits are turned OFF in order of the output terminal number. This starts from the lowest terminal number.



4.10 Forced Disconnection Operation

Forced disconnect operation is used to open the capacitor circuits when the influence of harmonic interferences is expected, and during nighttime operations.

■ Forced disconnection input terminals, "TA/S-" and "TB", are provided to disconnect the capacitor circuits closed by automatic control.

When these input terminals are cut, all capacitors are cut offsimultaneously.

■ When the signal across the input terminals becomes OFF, the control begins. Please use the applicable for the switching of 5 V, 25 mA DC for shorting.

Example of Control by Time Switch

5.1 Flow of Set-up (Measure Set-up Mode)

In order to perform control and measurement, it is necessary to set-up Phase/Wire Type, Primary Voltage, Primary Current, etc. in Measure Set-up Mode.

It changes from Operation Mode to Measure Set-up Mode, and required items are set-up.

The items you do not set up become the initial contents. (Please refer to page 50 for the initial contents.) Please refer to after page 26 for the detailed setting.

If ENTER Key is pressed over 2 seconds, it changes from Operation Mode to The Set Value Confirmation Mode. A setting value cannot be changed in The Set Value Confirmation Mode.

The setting method

1) It changes to Measure Set-up Mode by pressing (ENTER) Key and (CAPACITY) Key for 2 seconds simultaneously.

- (2) It changes to each set-up menu by pressing \oplus Key or \bigcirc Key.
- ③ Set-up in each menu. (Please refer to page 26 to page 29)
- (4) Press (-) Key or (-) Key to set-up each setting value and complete set-up by pressing (ENTER) Key.
- (5) Press (ENTER) Key after selecting "Measure Set-up Menu END", after all the set-ups are completed.
- 6 Press ENTER Key after changes "yES" Display.

Measure Set-up Mode/The Set Value Confirmation Mode Motion Key operation TEST Menu It changes to the following item after deciding a set-up item. ENTER) press (Operation tests for the connecting/disconnecting) Menu change press ्याः Setting value moving down Menu change ŝ press Setting value moving up. Set-/ Measure It changes to a front item after deciding a setting value. (DISPLAY) press Press for ENTER (DISPLAY) Setting value moving down. (fast forward) (-)1 second Menu / Press for Setting value moving up. (fast forward) Set-up h Measure Set-up/The Set Value Confirmation 1 second Operation tests for the Press for (-)Setting value moving down. (fast forward) connecting/disconnecting Measure 3 seconds Press for Setting value moving up (fast forward) (+)3 seconds (ENTER) Press for (LOCK/RELEASE) It locks or releases an automatic /manual change 2 seconds Control ("Manual ON" / "AUTO" / "Manual OFF") of (AUTO/MANUAL) press each capacitor circuit is changed. "YES" Display: It changes to Operation Mode after memorizing the contents of a setting. "CANCEL" Display: It changes to Operation Mode after (ENTER) press canceling the contents of a setting. END A "YES" display and a "CANCEL" displays are switched. (+)Menu press *1: This set-up is skipped when a "Using VT/direct input" set-up is "yES". -an (-)A "YES" display and a "CANCEL" displays are switched press *2: This set-up is skipped when a "Using Set-VT/direct input" set-up is "no". Press Measure The restart of device *3: This set-up is skipped when a" (PHASE) + (DISPLAY simultaneously This Key is effective only on a "CANCEL" Display. for 1 second Phase/Wire Type" set-up is "3¢4W". *4: This set-up is skipped when a" Press for It locks or releases an automatic /manual change (LOCK/RELEASE) Phase/Wire Type" set-up is "3ø3W". 2 seconds *5: This set-up is skipped when a "Primary Control ("Manual ON" / "AUTO" / "Manual OFF" of each AUTO/MANUAL press Voltage" set-up is except "SP." capacitor circuit is changed. *6: This set-up is skipped when a "Primary Note 2. The example of Display of "Measure Set-up Mode" and Current" set-up is except "SP." *7: It changes to Measure Set-up Mode. 'The Set Value Confirmation Mode' *8: It changes to The Set Value Confirmation Mode UQ 3 96 (Measure Set-up Mode) (The Set Value Confirmation Mode) Note 1. () : Press Kev : Press Key for 2 seconds SET flickers in "The Set Value Confirmation Mode" • Please set up "Measure Set-up Menu 1", or check the contents of setting. If the set-up is wrong, the measurement is not appropriately carried out. Set-up other items if needed. When it is not set-up, it operates at the initial contents. (please refer to page 50)· Restart of device will stop measurement (a measurement display and a control output) for several seconds.

5.2 Flow of Set-up (Control Set-up Mode)

In order to perform the detailed control set-up, it is necessary to set-up Target Power Factor, Delay Time, Capacity, etc. in Control Set-up Mode.

It changes from Operation Mode to Control Set-up Mode, and a required item has to be set-up. The items you do not set up are the initial contents. (Please refer to the page 50 for the initial contents.) Please refer to after page 30 for the setting details.

• The setting method

① It changes to Control Set-up Mode by pressing SET CONT.) Key for 2 seconds.

- (2) It changes to each set-up menu by pressing (+) Key or (-) Key.
- $(\ensuremath{\textcircled{3}})$ Set-up in each menu. (Please refer to page 30 to page 35)
- (4) Press (+) Key or (-) Key to set-up each setting value and complete set-up by pressing (ENTER) Key.
- (5) Press (ENTER) Key after selecting "Control Set-up Menu END", after all the set-ups are completed.
- 6 Press ENTER Key after changing to "yES" Display.

C: Press Key for over 2 seconds.

5. Set-up

5.3 Measure Set-up Menu 1 (Set-up of Phase/Wire Type · Using VT/direct input · Primary Voltage · Primary Current)

How to set up measurement.

"Measure Set-up Menu END" is displayed by pressing (ENTER) Key and (CAPACITY) Key for 2 seconds simultaneously in Operation Mode.

Furthermore, "Measure Set-up Menu 1" is selected by pressing \oplus Key or \bigcirc Key.

Then, the following set-ups are possible.

Set up "Secondary Voltage of VT". SET % ENTER DISPLAY % 63.5 V min 100 V 110 V ⊕ — Key 115 V (5) Secondry Voltage 120 V 4 Note 1. A setting value is phase to neutral voltage Note 2. When "3P3" is selected in "Phase/Wire Type" and "no" is selected in "Using VT/direct input", skip this set-up Note 3. Secondary voltage on 3¢3W is fixed at 110 V (phase to phase voltage). ENTER DISPLAY Set up "Primary Voltage of VT". SET % % 220 V 11 kV 33 kV 220 kV min 440 V 13.2 kV 66 kV 275 kV 690 V 13.8 kV 77 kV 380 kV 1100 V 15 kV 110 kV 500 kV + Key ⁽⁶⁾ Primary Voltage 2.2 kV 16.5 kV 132 kV 550 kV 3.3 kV 22 kV 154 kV 750 kV 6.6 kV 24 kV 187 kV SP. Note 1. In the case of 3¢3W, a setting value shows phase to phase voltage and, in the case of 3¢4W, a setting value shows phase to neutral voltage. Note 2. When "no" is selected in "Using VT/direct input", skip this set-up. ENTER DISPLAY Set up "Primary Voltage of VT (special)". SET % % 220.0 V min ⊕ — Key 6 59 kV 7 Special Primary Voltage 6.60 kV 6.61 kV Note 1. When "no" is selected in "Using VT/direct input" or other settings except for "SP" are selected in "Primary Voltage", skip this set-up. Note 2. Skipping Set-up will have the third digit to one variable. Note 3. In the case of 3ϕ 3W, a setting value expresses phase to phase voltage and, 1 in the case of 3¢4W, a setting value expresses phase to neutral voltage. 750 kV ENTER DISPLAY Set up "Primary Current of CT". SET % % 5 A 50 A 500 A 4 kA min 6 A 60 A 600 A 5 kA ₹Æ 7.5 A 750 A 75 A 6 kA 8 A 80 A 800 A 7.5 kA + - Key 10 A 100 A 1000 A 8 kA (8) Primary Current 12 A 120 A 1200 A 10 kA 15 A 150 A 1500 A 12 kA 20 A 200 A 1600 A 20 kA

Continuation of Measure Set-up Menu 1

continues onto the next pages.

DISPLAY

ENTER

From the previous page.

25 A

30 A

40 A

250 A

300 A

400 A

t

2000 A

2.5 kA

3 kA

25 kA

30 kA

SP.

5. Set-up

When the "Measure Set-up" is changed, all the capacitors which is connecting are cut off and the control starts again.

5.4 Measure Set-up Menu 2 (Setup of Combination)

How to set up combination. (When the cyclic control with combination is not used, no this setting change is required.)

Combination setting is used to increase the number of controllable capacitor circuits by using two units of this device with the cyclic control. For details, refer to page 48.

"Measure Set-up Menu END" is displayed by pressing (ENTER) Key and (CAPACITY) Key for 2 seconds simultaneously in Operation Mode.

Furthermore, "Measure Set-up Menu 2" is selected by pressing \oplus Key or \bigcirc Key.

Then, the following set-ups are possible.

✓ NOTE	 When "Combination ON/OFF" set-up is "ON", control method serves as only cyclic control. When this Set-up is changed, all the connecting capacitors are cut off and the control starts again.
--------	---

5. Set-up

5.5 Control Set-up Menu 1 (set-up of Target Power Factor)

How to set up target power factor.

"Control Set-up Menu End" is displayed by pressing (<u>SET CONT</u>) Key for 2 seconds in Operation Mode.

Furthermore, "Control Set-up Menu 1" is selected by pressing \oplus Key or \bigcirc Key.

Then, the following set-ups are possible.

5.6 Control Set-up Menu 2 (Set-up of Light Load Power Ratio)

How to set up light load power ratio.

"Control Set-up Menu END" is displayed by pressing (SET CONT.) Key for 2 seconds in Operation Mode.

Furthermore, "Control Set-up Menu 2" is selected by pressing \oplus Key or \bigcirc Key.

Then, the following set-ups are possible.

* Please refer to the following page for the determination method of the setting value of "Light Load Power Ratio".

5. Set-up

Continuation of Control Set-up Menu 2

"Light Load Power Ratio" is a setting value for "Light Load Disconnection" of a capacitor.

"Light Load Disconnection" is a function that forces the disconnection of all capacitors when the light load active power falls below the power required by the light load power ratio to prevent power factor from leading out too much.

Please decide the setting value of "Light Load Power Ratio" from power at nighttime based on the daily load curve.

(a) Calculate "Light Load Disconnection Level" based on the daily load curve."Light Load Disconnection Level" is a value about 20 % to 40 % higher than the power at nighttime.Please decide the margin, taking into account load charge during night time.

(b) Calculate "Light Load Power Ratio".

Calculate the following formula based on primary voltage and primary current.

Light Load Disconnetion level
$$\frac{1}{\alpha \times \text{Primary Voltage} \times \text{Primary Current}} \times 100(\%)$$
 $3 \neq 3W : \alpha = \sqrt{3}$
 $3 \neq 4W : \alpha = 3$

Example

When "Phase/Wire Type" is $3 \phi 3W$ and primary voltage is 6600 V and "Primary Current" is 100 A and Light Load Disconnection Level is 115 kW, "Light Load Power Ratio" becomes as follows.

Light Load Power Ratio = $\frac{115 \text{ kW}}{\sqrt{3} \times 6.6 \text{ kV} \times 100 \text{ A}} \times 100 \% = 10 \%$

Therefore "Light Load Power Ratio" is set at 10 %.

5.7 Control Set-up Menu 3 (Set-up of Delay Time)

How to set up delay time.

"Control Set-up Menu END" is displayed by pressing (SET CONT.) Key for 2 seconds in Operation Mode.

Furthermore, "Control Set-up Menu 3" is selected by pressing \oplus Key or \bigcirc Key.

Then, the following set-ups are possible.

5. Set-up

5.8 Control Set-up Menu 4 (Set-up of Control Method)

How to set up control method.

"Control Set-up Menu END" is displayed by pressing (SET CONT.) Key for 2 seconds in Operation Mode.

Furthermore, "Control Set-up Menu 4" is selected by pressing \oplus Key or \bigcirc Key.

Then, the following set-ups are possible.

	• When this Set-up is changed, all the connecting capacitor are cut off and
VNOTE	control starts again.
	• Please refer to pages 16 to 19 about the operations of each control.

5.9 Control Set-up Menu 5 (Set-up of Capacity)

How to set up Capacity.

✓ NOTE

A set-up for automatic recognition and manual input of capacity are possible by this set-up.

After the automatic recognition, by setting "HoLd", automatic recognition is stopped and the capacity recognized automatically is fixed. You can also manually input.

"Control Set-up Menu END" is displayed by pressing (SET CONT.) Key for 2 seconds in Operation Mode. Furthermore, "Control Set-up Menu 5" is selected by pressing \oplus Key or \bigcirc Key. Then, the following set-ups are possible.

The capacity is stored in non-volatile memory and will not be cleared even in the event of power failure.

5. Set-up

5.10 TEST Menu (Operation Tests for the Connecting/Disconnecting)

How to set up operation tests for the connecting/disconnecting.

"Measure Set-up Menu END" is displayed by pressing (ENTER) Key, and (CAPACITY) Key for 2 seconds simultaneously in Operation Mode.

Furthermore, "TEST Menu" is selected by pressing \oplus Key or \bigcirc Key.

Then, the following set-ups are possible.

	 During "Operation Tests for the Connection/ Disconnection" with the high voltage circuit live, set the "Delay Time" conforming to the capacitor discharge device. Carrying out the test with "Delay Time" set to be shortter than it should be may cause capacitor breakage accidents.
--	---

5.11 Set-up of Auto/Manual Control

Change of "MANUAL ON" / "AUTO" / "MANUAL OFF" is performed by pressing the (AUTO/MANUAL) Key of the applicable circuits after status of lock is released.

A status of lock is released by pressing (LOCK/RELEASE) Key for 2 seconds. (LED flickers) A status of release is locked by pressing (LOCK/RELEASE) Key for 2 seconds again. (LED lights up) The contents of change are reflected by changing into the Lock status.

<status lock="" of=""></status>					
MANUAL ON AUTO MANUAL OFF	MANUAL ON AUTO MANUAL OFF				
Press (LOCK/RELEASE) Key for over 2 seconds.	Press (LOCK/RELEASE) Key for over 2 seconds.				
MANUAL ON Press AUTO AUTO AUTO AUTO AUTO AUTO AUTO AUTO AUTO AUTO AUTO AUTO MANUAL OFF Key MANUAL OFF Note 1. A status of release continues, unless a status of Lock is changed.	Press AUTO AUTO Key MANUAL OFF				
Note 2. In a status of release, the device is controlling by the previous setting. Note 3. The (LOCK/RELEASE) Key lock and release circuit 1 to 6 or circuit 7 to 12 by package.					

5.12 Priority Order of Control

The priority order of control is as follows.

6.1 Changing of the Display

The display element switches by pressing $\textcircled{\mbox{DISPLAY}}$ Key.

6.2 Changing of the Phase

The display element of current phase or voltage phase switches by pressing (PHASE) Key.

<Example of display change (current)>

<Example of display change (voltage)>

*1.In 3¢4W, display of phase is "1-n" or "2-n" or "3-n".

6.3 Display of Capacity

In the Measurement display, the memorized capacity is displayed by pressing \bigcirc **CAPACITY**) Key for 1 second. Furthermore, The capacity display of each circuit is displayed by pressing \bigcirc Key or \bigcirc Key. Then, the following set-ups are possible.

6.4 Reset of Capacity

When "Capacity Auto/HoLd" set-up is "Auto", capacity set as "Auto" can be reset by pressing CAPACITY Key and (PHASE) Key for 2 seconds simultaneously in Display of Capacity.

However, capacitor circuits set as "Manual ON" or "Manual OFF" can not be reset.

In addition, when "Capacity Auto/ HoLd" set-up is "HoLd", capacity set as "Auto" can not be reset.

7.1 Operation

Operation of device other than "Operation Mode"

		Display		The sector is the formula of form	
Status	Measurement	Measurement	Power Factor	The output point of contact for	
		(LCD)	Status (LED)	capacitor control	
For several seconds	A measurement	No display.		All the circuits are "open" .	
after the auxiliary power	is not possible.				
supply injection					
Set-up Mode	A measurement	No display.	The same operation	The same operation as Operation	
	is possible		as Operation Mode	Mode	
During a blackout	A measurement	No display.		All the circuits are "open" .	
	is not possible.				
Second blackouts more	A measurement	No display.		All the circuits are "open" .	
than 3 cycles	is not possible.				

When a blackout occurs, the operation of this device will stop, and all displays on this device will disappear, all the output point of contact for capacitor control become "open". When the power supply revives, the new start of the capacitor control action is carried out from C1.

Device operation by the input power supply status

Measurement display			
Power Factor	The display of power factor becomes 100 %,		
	when the display of voltage is "0 V", or when	_	
	the display of current is "0 A" .		
Current	The display of current becomes "0 A", when		
	Input current is less than 0.4 % of rated current.		
Voltage	The display of voltage becomes "0 V", when		
	input voltage" is less than "6 V" .		
Active Power	The display of active power becomes "0 W",		
	when the display of voltage is "0 V", or when		
	the display of current is "0 A" .		
Reactive Power	The display of reactive power becomes	More than 9999 shows 9999.	
	"0 var" , when the display of voltage is		
	"0 V" , or when the display of current is		
	"0 A" .		
Apparent Power	The display of apparent power becomes		
	"0 VA" , when the display of voltage is		
	"0 V" , or when the display of current is		
	"0 A" .		

Notes in case of combination

- (1) In the following case, please set "Combination ON/ OFF" to "OFF" by the side of a master.
 ①When the slave side breaks down, or the auxiliary power supply by the side of a slave is OFF.
 - ⁽²⁾When the capacitor control by the side of a slave is set as all the circuit manual operation.
- (2) When forced disconnection signal is used, please connect with both a master and a slave.

7.2 Troubleshooting

If unusual sound, smell, emitting smoke, or fever occur from the device, turn off the power immediately. If there is a problem, confirm the following points before taking out to repair.

Phenomenon		Possible causes	Countermeasure	
	Setting value in Measure Set-up	Mode is "The Set Value	Please return to Operation Mode and change	
ation	can not be changed.	Confirmation Mode".	the setting value on Measure Set-up Mode.	
	Capacity cannot be cleared.	"AUTO/MANUAL" set-up is	Reset capacity after setting	
ben		"Manual ON" or "Manual OFF".	"AUTO/MANUAL" to "Auto".	
0		"Capacity Auto/HoLd" set-up is	Reset capacity after setting	
		"HoLd".	"Capacity Auto/HoLd" to "HoLd".	
	Display does not light up.	Auxiliary power is not impressed	Impress auxiliary power between MA	
		between MA and MB.	and MB.	
		Inside power supply is out of order.	It cannot be repaired by the	
			customer.	
			Contact to the service network.	
	Display does not light up	It is normal.	Keep using.	
ау	immediately.	Initialization of an internal circuit is		
spla		performed after the auxiliary power		
ō		supply injection.		
	LCD display becomes black.	It may become black under the	After a while, it will disappear.	
		influence of static electricity.		
	"END" display is kept on the display.	Setting has not been completed.	Press the ENTER Key.	
	"E**" is kept on the display.	An error is occurring in this device.	Turn on the auxiliary power again.	
	(** IS 01 to 05.)		If the display is not changed even after	
			reinjection, contact to the service network.	
	Capacitor Connection Signal is	1. The polarity of VT connection is wrong.	Check the wiring.	
	output, although load becomes	2. The polarity of CT connection is wrong.		
	leading power.	3. The wrong phase is inserted to the		
	Capacitor Disconnection Signal	detection VT.		
	is output, although load	4. The wrong phase is inserted to the		
	becomes leading power.	detection CT.		
ct	Capacitor is not disconnected although	The terminals for the disconnection	Check the wiring.	
nta	"LEAD OUT" LED lights up.	disable signal (TS+ and S-) are shorted.		
fo	Capacitor is not connected	1. Connection disable signal (CS+		
nto	although "LAG OUT" LED	and S-) are shorted.		
poi	lights up.	2. Forced disconnection signal		
put		(TA/S- and TB) are shorted.		
Out	"LAG OUT" LED does not	Light Load Disconnection Area	Check "Light Load Power Ratio".	
-	light up and capacitor is not			
	connected, although power	Export Area	Check the wiring.	
	factor lags target power factor.			
	Capacitor repeats connection	"Capacity Auto / HoLd" is "HoLd"	Check the set-up.	
	and disconnection.	and The setting value of all the capacity		
		manual input become "0 kvar".		
		Or the wrong value is set-up.		

After-sale service

When there is an unclear point or when the device breaks down, please contact to the service network. (See the back cover of this User's Manual.)

Installation 1. Dimensions

VAR-6A

[mm]

VAR-12A

[mm]

1 Panel Cutout

Cut out the panel like the below.

Panel Cutout (It is possible to attach the device on a board from 1.6 mm to 4 mm.)

2 Attachment Location

Contrast of LCD changes if looked at different angles.

The optimal angle is as follows. Attach the device to the panel with the optimal angle.

3 Attachment Method

Put the device onto the panel surface from the front side and fix it by using embedded mounting fittings and fixing screws (2 places)

Tighten the fitting screw to the torque from 0.61 to 0.82 N \cdot m.

At the time of attaching this device at the edge of the board, decide attachment location in consideration for the wiring space.

Installation 3. Wiring

1 Solderless Terminal

Use solderless terminal that comply with the size of the electric line.

Connecting Completion Output terminal Disconnecting Completion Output terminal Connection Disable Input terminal Disconnection Disable Input terminal Forced Disconnection Signal terminal Current Input terminal Voltage Input terminal Auxiliary Power terminal		Control Signal Output terminal	
Screw Specification	M4 screw	M3.5 screw	
Solderless Terminal	For M4 screw of outer diameter below 8.5	For M3.5 screw of outer diameter below 7.1	
Tighting Torque	0.98 N ⋅ m to 1.47 N ⋅ m	0.61 N ⋅ m to 0.82 N ⋅ m	

2 Terminal Cover

① Insert the terminal cover for power supply into the terminal stand as shown in the right figure.

② Since the terminal cover for input and output has structure to open, close it.

3 Wire connections

Tighten a terminal screw on the terminal stand.

Do not connect three or more electric wires to one terminal. It can generate heat and cause a fire.

4 Checking

Check that there is no mistake in wire connections after completing wire connetion.

5 Terminal cover attachment

After checking, close the terminal cover till it makes clicking sound.

,					
	Do not perform hot-line jobs.				
	Do not perform hot-line work. It can cause on electrification electric burn, fire and damage by fire on apparatus. Installation of protection fuse etc. is recommended to VT and auxiliary power.				
	Do not open the secondary side of CT circuit.				
	Correctly connect the secondary side signal of CT to the CT connection terminal. Incorrect connection of CT or disconnection of the secondary side of CT induces high voltage on the secondary side. It can cause insulation breakdown of the secondary winding which can result in burnout accidents.				
	Do not short circuit the secondary side of VT.				
	Correctly connect secondary side signal of VT to the VT connection terminal. Incorrect connection of VT or short circuiting in the secondary side of VT causes excessive current to pass in the VT secondary side. It can cause burnout of the secondary winding which can result in insulation breakdown of the primary winding and inter phase short-circuiting in the end.				
	Connect electric wire certainly to a terminal.				
	If the connection to a terminal is not as tight as it should be and result in a measurement mistake.				
A	Do not forget wiring of "1L", "2L" and "3L" for pass.				
	When the L side of CT circuit is common wire in " $3\phi 4W$ ", it is necessary to short-circuit "1L", "2L" and "3L" terminal of this device. In the case of $3\phi 3W$, "1L" and "3L" should be short circuited.				
	Do not use unsuitable electric wire.				
	Electric wire size should be suitable for rated current and rated voltage. Use of unsuitable electric wire can cause a fire.				
	Do not strongly pull the wire.				
	If terminal wire is pulled strongly, there is a possibility that an input-and-output terminal can break away. Tensile load is less than 39.2 N.				
	Attach a terminal cover.				
	Attach a terminal cover. If it is not attached, it can cause electrification.				
	Do not impress unusual voltage.				
	At the time of the resisting pressure examination of the high voltage apparatus, carry out grounding to avoid any negative influence. The device can break down if more than 2000 V is impressed for 1 minute .				
	Do not connect to Non-connection terminal.				
	Do not connect to Non-connection terminal for the purpose of relay etc.				

Auxiliary Power			
	Impress the appropriate voltage to auxiliary power. Impress the right voltage to auxiliary power. If inappropriate voltage is impressed, it can cause a fire or breakdown of the device.		

To secure safety, the connecting work should be done by a qualified person in electric wiring work. (electrician)

1 Connection with vacuum electromagnetic contactor for capacitor switching.

This device has a constant excitation system that outputs no-voltage 1a contact at each bank that keeps continuously ON at connection and continuously OFF at disconnection as a cap acitor control signal. Upon connecting with the vacuum electromagnetic contactor for capacitor switching, be sure to use auxiliary relay. (Refer to the connection with auxiliary relay C1 to C6 in page 47.) Use the counter electromotive force absorption diode built-in relay as the auxiliary relay for DC (100 V DC).

2 Reversed Phase

This device operates on reversed phase without changing the wire connections.

3 Forced Disconnection Signal

- When ON signal is input on the forced disconnection signal terminal TB and terminal TA/S, all the connecting capacitors in automatic control are disconnected.
- · When OFF signal is input on terminal TB and TA/S, the control operation restarts.
- Use input contacts suited for the switching of 5 V, 25 mA DC.
- *This signal can be used for the following applications.

①To disconnect the capacitor by an external time switch for purpose

of avoiding leading-out of power factor during night time.

Our recommended type:

skip-day-type	TSE-2SB Series
weeky-type	TSE-2WB Series

②To disconnect the capacitor for purpose of protecting the capacitor and the reactor, when content rate of harmonics is rising by use of a harmonic meter, etc.

Our recommended type: ME110SSR-HAH

4 Closing Prohibition Signal · Opening Prohibition Signal

• When an ON signal is inputted across the closing prohibition signal terminal CS+ and terminal TA/S-, the closing control of capacitors is stopped. Also, when an ON signal is inputted across the opening prohibition signal terminal TS+ and terminal TA/S-, the opening control of capacitors is stopped. Control operations are restarted when the input signal becomes OFF. Please use input contacts adapted for the switching of 5 V, 15 mA DC.

- At the time of 2 set combination use, do use connecting completion terminal (CE+), disconnecting completion terminal (TE+), completion terminal (E-), connection disable terminal (CS+) and disconnection disable terminal (TS+).
- When "Combination ON/OFF" set-up is "ON", the cyclic control operates.

6 Exemplary Overall Connections Diagram

Connection diagram examples for the capacitor control circuit (The following diagrams are for reference only, and consider according to customer's use.)

Example of a non-latching type vacuum electromagnetic contactor

 Note1. In VAR-6A, C□X in the figure shows C1X to C6X.

 Note2. In VAR-12A, C□X in the figure shows C1X to C12X.

 Note3. This diagrams are schematic diagrams. Prepare protected circuits, etc. if needed.

Installation 4. Wiring Diagram

9 Combination

10 Without VT

Specifications

Туре		VAR-6A, VAR-12A			
, ,	Power Factor	±2.0 %			
	Current	±1.0 %			
	Guireni	*1. In case of $3 \neq 3W$ and $3 \neq 4W$, current on neutral phase is not measured.			
Measurement	Voltage	*2. 3ϕ 3W measures phase to phase voltage, while 3ϕ 4W measures phase to neutral voltage			
Element	Active Power		2.5φ 5 w measures phase to phase voltage, while 5 φ 4 w measures phase to heather voltage.		
	Reactive Power	+1.0 %			
	Annarent Power	110 /0	110 /0		
Bespon	se Time	2 seconds (Note1)			
Automatic Power Fa	ctor Control Method	Beactive power detection method			
7 atomator ower ra	Voltage	$3 \pm 3W$ 110 V/220 V AC / $3 \pm 4W$ Max 254 V AC			
Input Bating	Current	5 A AC			
input nating	Frequency	50 Hz/60 Hz			
Phase S	equence	3 4 3W / 3 4 4W			
1 11000 0	cquenee	Phase/Wire Type (3 d 3W 3 d 4W) Using VT/direct input ()	(ES NO) Direct Voltage (3 & 3W: Phase to Phase		
	Measure Set-up	Voltage110 V/220 V, 3d/W/Phase to Neutral Voltage 63.5 V to	254 V/ Secondary Voltage (Phase to Neutral Voltage		
	modouro oot up	63.5 V to 120 V) Primary Voltage (220 V to 750 kV) Primary	Current (5 A to 30 kA) Combination Master/Slave		
Set-up Items		Target Power Factor (LAG85 % to 100 % to LEAD	95 %) Delay Time (1 to 10 minutes) Light		
	Control Set-up	Load Power Patie (0 to 25 %). Control method (1)	Cyclic 2: Priority 2:Optimal) Capacity		
	Control Get-up	Load Fowel Hallo (0 to 55 %), Control method (1.	r)		
	Display for Indigation		1)		
	Maximum Number	LOD, LED			
	of Display Digita	Digital display 4 figures			
	Conspilay Digits	Digital display 4 figures			
	Capacity Davias Esistes Otation				
Display	Conditions of Connection /	LEAD OUT, PROPER, LAG OUT, LIGHT LOAD,	EXPORT, FORCED DISCONNECTION		
	Disconnection for Conceitor	VAR-6A. output conditions of connecting/disconne	ecting signals for capacitor C1 to C6.		
	Disconnection for Capacitor	VAR-12A. Output conditions of connecting/discont	necting signals for capacitor CT to CT2.		
	Conditions of Auto / Manual	VAR-6A: conditions of auto/manual for capacitor (
	Control for Capacitor	VAH-12A: conditions of auto/manual for capacitor C1 to C12.			
	Updating Cycle				
Control Method	Automatic	Cyclic / Priority / Optimal			
	Manual Oine vit Total Number	Manual ON / Manual OFF			
Capacitor Control	Circuit Total Number	VAR-6A: 6 circuit VAR-12A: 12 circuit			
Output	Output Contact	Latching output form a			
Osassatisa	Contact Capacity	250 V T A AC, TTU V U.T A DC			
Connection	Conditions	"LAG OUT LED stays lit past Delay Time.			
Disconnectio	n Conditions	"LEAD OUT" LED stays lit past Delay Time.			
Operation	Connecting Completion	OFF across terminals CE+ and E-			
Completion Output	Disconnecting Completion	OFF across terminals 1E+ and E-			
	Output Contact	Porm A, contact capacity: 24 V, 0.1 A DC			
	Disconnection Disable	ON across terminals CS+ and TA/S-			
Operation Disable	Disconnection Disable	ON across terminals TS+ and TA/S-			
Input	Forced Disconnection	Connection Disable - Disconnection Disable - For	m A contrast conspirity EV/ 15 mA DC		
	Input Contact	Connection Disable • Disconnection Disable : For	m A, contact capacity : 5 V, 15 mA DC		
Davian Failura	O	Forced Disconnection : Form A, contact capacity : 5 V, 25 mA DC			
Power Failure	Compensation	Non-volatile memory (Items: setting value, Capacity)			
Apparent Dower	Voltage Circuit	Each Phase 0.1 VA (110 V), 0.2 VA (220 V)			
Apparent Power	Current Circuit				
Consumption	Auxiliary Power Circuit	VAR-6A 11 VA (110 V AC) 13 VA (220 V A	AC) 8 W (110 V DC)		
Auxilians De	war Cupplu	VAR-12A 15 VA (110 VAC) 19 VA (220 VA			
Auxiliary FU		100 V to 240 V AC (-15 %, +10 %) 50 H2/00 H2	100 V DC (-25 %, +40 %)		
		Across electric circuit group and frame	2000 V AC (50 H2/60 H2) 1 IIIIIIule		
		Across surrent sireuit / voltage sireuit group			
		and auxilian nowor			
Dielectric Strength		Arreas surrent sizevit (voltage sizevit group			
		and canaditar control output circuit / completion	2000 V/ AC (50 Hz/60 Hz) 1 minuto		
		autout / disable input circuit group	2000 V AC (50 H2/00 H2) T Minute		
		Auxilian / newer / consciter central output circuit			
		and completion output / disable input circuit group			
		Acress voltage airouit group and surrent airouit group	2000 V AC (E0 Hz/60 Hz) 1 minuto		
		Across voltage clicult group and current clicult group	2000 V AC (50 H2/60 H2) 1 IIIIIIule		
		combination of two circuit (capacitor control output	2000 V AC (50 Hz/60 Hz) 1 minute		
		Apropa electrical circuit and appoint 0 MO at 500 V			
Ambiont Temperature		-5° C to $\pm 50^{\circ}$ C (day average upped to magnitude	: 35 °C or below)		
Ambient Liumidity		30 % to 85 % BH or below: without condensation			
Amplent Humidity		0.0 % to 00 % HH or below; without condensation			
Dimo	nsion	0.3 ky			
Attachment Method		Embedding attachment			

Specifications

Set-up Table

Set-up Menu No.		enu No.	Set-up Item	Initial Content	VAR-6A	VAR-12A	Notes
	1.1	1.1.1	Phase/Wire Type	3P3 (3ø3W)	0	0	
		1.1.2	Using VT/direct input	YES (Using VT)	0	0	
		1.1.3	Direct Voltage(3¢3W)	110 V	0	0	
		1.1.4	Direct Voltage(3¢4W)	254 V	0	0	
		1.1.5	Secondary Voltage	63.5 V	0	0	
		1.1.6	Primary Voltage	6.6 kV	0	0	
1		1.1.7	Special Primary Voltage	6.60 kV	0	0	
		1.1.8	Primary Current	100 A	0	0	
		1.1.9	Special Primary Current	100.0 A	0	0	
	1.2	1.2.1	Combination ON/OFF	OFF (single operation)	0	0	
		1.2.2	Master/Slave	Master	0	0	
	1.3	1.3.1	Operation Tests for the	No (Test per everytion)	0	0	
			Connecting/Disconnecting	No (Test non-execution)	0	0	
	2.1	2.1.1	Target Power Factor	LAG99.5 %	0	0	
	2.2	2.2.1	Light Load Power Ratio	10 %	0	0	
	2.3	2.3.1	Delay Time	5 min	0	0	
	2.4	2.4.1	Control Method	1 (Cyclic)	0	0	
	2.5	2.5.1	Capacity Auto/HoLd	Auto (automatic recognition)	0	0	
		2.5.2	Capacity Manual Input of C1	0	0	0	
		2.5.3	Capacity Manual Input of C2	0	0	0	
		2.5.4	Capacity Manual Input of C3	0	0	0	
2		2.5.5	Capacity Manual Input of C4	0	0	0	
		2.5.6	Capacity Manual Input of C5	0	0	0	
		2.5.7	Capacity Manual Input of C6	0	0	0	
		2.5.8	Capacity Manual Input of C7	0	—	0	
		2.5.9	Capacity Manual Input of C8	0	—	0	
		2.5.10	Capacity Manual Input of C9	0	—	0	
		2.5.11	Capacity Manual Input of C10	0	_	Ó	
		2.5.12	Capacity Manual Input of C11	0	_	Ó	
		2.5.13	Capacity Manual Input of C12	0	-	Ó	

MEMO

AUTOMATIC POWER FACTOR CONTROLLER

Service network

MITSUBISHI ELECTRIC CORPORATION

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