e-Front runners

FUJI ELECTRIC

MEASURING INSTRUMENTS

TRANSDUCERS

ARRESTERS

POWER FACTOR CONTROLLERS

POWER MONITORING EQUIPMENT

Switchboard instruments

Instrument transformers

Panel instruments

Watthour meters

Digital panel meters

Automatic power factor regulators

Transducers

Power monitoring equipment
F-MPC

Arresters

LOW VOLTAGE EQUIPMENT
Up to 600 Volts

INDIVIDUAL CATALOG

from D&C CATALOG 19th Edition
Revised

09

D & C CATALOG DIGEST INDEX

09 Measuring Instruments, Transducers Arresters, Power Factor Controllers Power Monitoring Equipment

MINIMUM ORDERS

Orders amounting to **less than ¥10,000** net per order will be charged as ¥10,000 net per order plus freight and other charges.

WEIGHTS AND DIMENSIONS

Weights and dimensions appearing in this catalog are the best information available at the time of going to press. FUJI ELECTRIC FA has a policy of continuous product improvement, and design changes may make this information out of date.
Please confirm such details before planning actual construction.

INFORMATION IN THIS CATALOG IS SUBJECT TO CHANGE WITHOUT NOTICE.

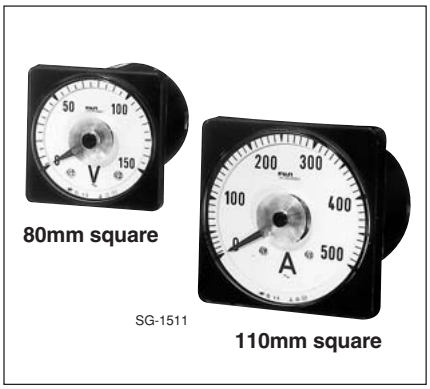
SW type wide-angle indicating switchboard instruments

■ Description

SW-type meters are used in many industrial applications such as switchboards, supervisory panels, metal-clad switchgear and control desks. These are compact in size and easy to read. Scales have equal intervals and indicate through a 240° angle, a feature which distinguishes them from the conventional meters. Meters can be read at a distance, since instrument surfaces are protected by a non-reflecting glass and are not affected by reflections from room lighting . Ammeters are provided with an overload scale in red. The moving parts such as the pointer and moving mechanism employ the span-band (taut-band) suspension system, so that there is complete freedom from sticking mechanisms, and meters are highly sensitive with resistance to vibration and shock. These instruments comply with the requirements of JIS C1102 and are highly reliable. They can withstand a great deal of abuse in use because of their rugged construction.

■ Features

- Span-band suspension system
  Freedom from pivots eliminates such troubles as pointer sticking, and gives the meters excellent vibration and shock resistance.
- High accuracy
  External magnetic fields cannot influence readings.
- Accuracy class: 1.5
- Easy-to-read long-scales and pointer-indications can easily be read from a distance.



- 110 × 110mm and 80 × 80mm front frame sizes.
- Easily secured by means of two stud bolts .
- Auxiliary equipment such as shunt, impedance box and series resistor is available.

Meter	Description			110mm square Type (Ordering code)	80mm square Type (Ordering code)
AC ammeter	For direct connection Measuring range 0 – 0.5A 0 – 1 0 – 3 0 – 5 0 – 7.5 0 – 10 0 – 15 0 – 20 0 – 30	Extended range type (0–X–3X) 0 – 0.5 – 1.5A 0 – 1 – 3 0 – 3 – 9 0 – 5 – 15 0 – 7.5 – 22.5 0 – 10 – 30 0 – 15 – 45 0 – 20 – 60 0 – 30 – 90	Operating principle: Rectifier type Power consumption: 1 VA	**SWR-3** (WM3013-□ ■) □: Measuring range 0.5A: M50, 1A: 001 to 30A: 030 ■: Range extension No extension: Blank 3X: 3	**SWR-6** (WM3016-□ ■)
	For connection to CT CT ratio / Measuring range / Extended type (0–X–3X) 10/5A / 0 – 10A / 0 – 10 – 30A 15/5 / 0 – 15 / 0 – 15 – 45 20/5 / 0 – 20 / 0 – 20 – 60 30/5 / 0 – 30 / 0 – 30 – 90 40/5 / 0 – 40 / 0 – 40 – 120 50/5 / 0 – 50 / 0 – 50 – 150 60/5 / 0 – 60 / 0 – 60 – 180 75/5 / 0 – 75 / 0 – 75 – 225 100/5 / 0 – 100 / 0 – 100 – 300 150/5 / 0 – 150 / 0 – 150 – 450 200/5 / 0 – 200 / 0 – 200 – 600 300/5 / 0 – 300 / 0 – 300 – 900 400/5 / 0 – 400 / 0 – 400 – 1200 500/5 / 0 – 500 / 0 – 500 – 1500 600/5 / 0 – 600 / 0 – 600 – 1800 750/5 / 0 – 750 / 0 – 750 – 2250 800/5 / 0 – 800 / 0 – 800 – 2400		Operating principle: Rectifier type Power consumption: 1 VA Extended types 0 – X – 5X Available on request CT with secondary current 1A is also available.	**SWR-3** (WM3013-□■○) 10: 010, 15: 010, 20: 020 □: Measuring range 30A: 030 to 800A: 800 ■: Range extension No extension: Blank 3X: 3, 5X: 5 ○: CT secondary current 5A: C 1A: C1	**SWR-6** (WM3016-□■○)

■ Ordering information

Specify the following:
1. Type number (Ordering code)
2. Measuring range
3. Supply voltage and frequency
4. Connection (When connecting to VT or CT, specify VT ratio or CT ratio)

Example

Ammeter
- AC ammeter, front frame 110 ×110 (mm)
- Measuring range: 0 – 60A
- Extended range: 60 – 180A
- For connection to CT: CT ratio 60/5

Type number: SWR-3-60A-X3-/C
(Ordering code: WM3013-0603C)

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Meter	Description		110mm square Type (Ordering code)	80mm square Type (Ordering code)
AC voltmeter	For direct connection Measuring range 0 – 50V 0 – 75 0 – 100 0 – 150 0 – 300 0 – 600	Operating principle: Rectifier type Power consumption: 0.5 VA	**SWR-3** (WM3023-☐) ☐: Measuring range 50V: 050 to 600V: 600	**SWR-6** (WM3026-☐)
	For connection to VT VT ratio / Measuring range 440/110V / 0 – 600V 3300/110 / 0 – 4.5kV 6600/110 / 0 – 9kV	Operating principle: Rectifier type VT ratio: Y/110 (Y: VT primary voltage) Measuring range: $0 - \frac{1.5}{1.1} \times Y$ Power consumption: 0.5VA	**SWR-3** (WM3023-☐P) ☐: Measuring range 400V: 400, 600V: 600, 9kV: 09K	**SWR-6** (WM3026-☐)
DC ammeter	For direct connection Measuring range 0 –1mA / 0 – 200mA / 0 – 10A 0 – 3 / 0 – 500 / 0 – 15 0 – 5 / 0 – 1A / 0 – 20 0 – 10 / 0 – 1.5 / 0 – 30 0 – 20 / 0 – 2 0 – 50 / 0 – 3 0 – 100 / 0 – 5	Operating principle: Moving coil type Internal resistance: 1mA: Approx. 220Ω 3mA: Approx. 33Ω 5mA: Approx. 10Ω 10mA: Approx. 5Ω 20mA and above: Approx. 60mV	**SWM-3** (WM3053-☐) ☐: Measuring range 1mA: 01M to 5mA: 05M 10mA: M01 to 500mA: M50 1A: 001 to 30A: 030	**SWM-6** (WM3056-☐)
	For connection to shunt Measuring range 0 – 50A / 0 – 600A / 0 – 3000A 0 – 75 / 0 – 750 / 0 – 4000 0 – 100 / 0 – 1000 / 0 – 5000 0 – 200 / 0 – 1200 / 0 – 7500 0 – 300 / 0 – 1500 0 – 500 / 0 – 2000	Operating principle: Moving coil type Shunt ratings: 60mV Shunt lead wire 1.5m is provided.	**SWM-3** (WM3053-☐S) ☐: Measuring range 50A: 010 to 500A: 500 1000A: 10X to 7500A: 75X	**SWM-6** (WM3056-☐S)
DC voltmeter	For direct connection Measuring range 0 – 10V / 0 – 150V 0 – 30 / 0 – 300 0 – 50 / 0 – 500 0 – 75 / 0 – 600 0 – 100	Operating principle: Moving coil type Power consumption:1mA	**SWM-3** (WM3063-☐) ☐: Measuring range 10A: 010 to 600A: 600	**SWM-6** (WM3066-☐)
	For connection to series resistor Measuring range 0 – 750V 0 – 1000 0 – 1500 0 – 2000	Operating principle: Moving coil type Power consumption:2mA	**SWM-3** (WM3063-☐B) ☐: Measuring range 750V: 750, 1000V: 10X to 2000V: 20X	**SWM-6** (WM3066-☐B)

■ Ordering information

Specify the following:
1. Type number (Ordering code)
2. Measuring range
3. Supply voltage and frequency
4. Connection (When connecting to VT or CT, specify VT ratio or CT ratio)

Example

Voltmeter

- DC voltmeter, front frame 80 × 80 (mm)
  Measuring range: 0 – 150V
  Type number: SWM-6-150V
  (Ordering code: WM3066-150)

- AC voltmeter, front frame 110 × 110(mm)
  Measuring range: 0 – 600V
  For connection to VT
  Type number: SWR-3-600V/P
  (Ordering code: WM3023-600P)

Meter	Description		110mm square Type (Ordering code)	80mm square Type (Ordering code)
Frequency meter	Measuring range 45 – 55Hz 110V 55 – 65Hz 110V 45 – 55Hz 220V 55 – 65Hz 220V	Operating principle: Frequency/DC transducing type Power consumption: 1.4VA at 110V 2.6VA at 220V	**SWP1-3** (WM3163-□ ■) □: Frequency 45-55Hz: 50, 55-65Hz: 60 ■: Voltage 110V: H, 220V: M	**SWP1-6** (WM3166-□ ■)
Single-phase 2-wire wattmeter	For connection to VT and CT Measuring range 0 – ZkW $Z = 0.5 \times \frac{X}{5} \times \frac{Y}{110}$ Z: kWatt X: CT primary current Y: VT primary voltage	Operating principle: Power/DC transducing type Power consumption Current coil: 0.2VA (at 5A) Voltage coil: 3VA (at 110V)	**SWC-3** (WM3103 -□KW■H●5) □: Measuring range, Z (kW) ■: Primary voltage 220V: 02, 440V: 04 3300V: 33, 6600V: 66 ●: Primary current 15A: 015 to 2000A (20X)	**SWC-6** (WM3106 -□KW■H●5)
3-phase 3-wire wattmeter	For connection to VT and CT Measuring range 0 – ZkW $Z = \frac{X}{5} \times \frac{Y}{110}$ Z: kWatt X: CT primary current Y: VT primary voltage	Operating principle: Power/DC transducing type Power consumption Current coil: 0.2VA per element (at 5A) Voltage coil: 3VA per element (at 110V)	**SWC2-3** (WM3113-□KW■H●5) □: Measuring range, Z (kW) ■: Primary voltage 220V: 02, 440V: 04 3300V: 33, 6600V: 66 ●: Primary current 15A: 015 to 2000A (20X)	**SWC2-6** (WM3116 -□KW■H●5)
3-phase 3-wire varmeter	For connection to VT and CT Measuring range 0 – Zkvar $Z = \frac{X}{5} \times \frac{Y}{110}$ Z: kvar X: CT primary current Y: VT primary voltage	Operating principle: Reactive power/DC transducing type Power consumption Current coil: 0.2VA per element (at 5A) Voltage coil: 3VA per element (at 110V)	**SWC2-3** (WM3113 -□KV■H●5) □: Measuring range, Z (kvar) ■: Primary voltage 220V: 02, 440V: 04 3300V: 33, 6600V: 66 ●: Primary current 15A: 015 to 2000A (20X)	**SWC2-6** (WM3116 -□KV■H●5)
3-phase 4-wire wattmeter, varmeter	For connection to VT and CT Measuring range 0 – ZkW 0 – Zkvar $Z = \frac{X}{5} \times \frac{Y}{110}$ Z: kWatt or kvar X: CT primary current Y: VT primary voltage	Operating principle: Reactive power/DC transducing type Power consumption Current coil: 0.2VA per element (at 5A) Voltage coil: 3VA per element (at 110V)	**SWC3-3** (WM3123-□KW■H●5) (WM3123-□KV■H●5) □: Measuring range, Z (kW or kvar) ■: Primary voltage 220V: 02, 440V: 04 3300V: 33, 6600V: 66 ●: Primary current 15A: 015 to 2000A (20X)	**SWC3-6** (WM3126 -□KW■H●5) (WM3126 -□KV■H●5)
3-phase 3-wire power factor meter (for balanced circuit)	For connection to VT and CT VT ratio: = $\frac{Y}{110}$ V CT ratio: = $\frac{X}{5}$ A	Operating principle: Phase angle/DC transducing type Power consumption Current coil: 0.3VA (at 5A) Voltage coil: 1.0VA per phase (at 110V)	**SWA1-3** (WM3133-H5) Class 5.0	**SWA1-6** (WM3136-H5)
3-phase 3-wire power factor meter (for unbalanced circuit)	For connection to VT and CT VT ratio: = $\frac{Y}{110}$ V CT ratio: = $\frac{X}{5}$ A	Operating principle: Phase angle/DC transducing type Power consumption Current coil: 0.2VA per phase (at 5A) Voltage coil: 3VA per phase (at 110V)	**SWA2-3** (WM3143-H5) Class 5.0	**SWA2-6** (WM3146-H5)
3-phase 4-wire power factor meter	For connection to VT and CT VT ratio: = $\frac{Y}{110}$ V CT ratio: = $\frac{X}{5}$ A	Operating principle: Phase angle/DC transducing type Power consumption Current coil: 0.2VA per phase (at 5A) Voltage coil: 3VA per phase (at 110V)	**SWA4-3** (WM3153-H5) Class 5.0	**SWA4-6** (WM3156-H5)

■ Ordering information

Specify the following:
1. Type number (Ordering code)
2. Measuring range
3. Supply voltage and frequency
4. Connection (When connecting to VTor CT, specify VT ratio or CT ratio)

Example

Frequency meter
- Front frame 110 × 110 (mm)
  Measuring range: 45 – 55Hz
- Supply voltage: 110V (When connecting to VT, specify VT ratio Y/110)
  Type number: SWP1-3-110V-45-55Hz)
  (Ordering code WM3163-50H)

3-phase wattmeter
- Front frame 110 × 110 (mm)
- Measuring range: 0 – 80kW
- For connection to VT and CT
- VT ratio: 440/110, CT ratio: 100/5
- Frequency: 50Hz
  Type number: SWC2-3-80kW-440/110V-100/5A
(Ordering code WM3113-80KW04H1005)

■ Type number nomenclature

SW M - 3

Front frame
3: 110mm square
6: 80mm square

Operating principle
M: Moving coil type
R: Rectifier type
P: Frequency/DC transducing type
C: Power (or reactive power)/DC transducing type
A: Phase angle/DC transducing type

Basic type

■ Accessories

Illustration		Ratings	Ordering code
 AFSG-1507	Shunt *	60mV 50A	WM9-60050
		60mV 75A	WM9-60075
		60mV 100A	WM9-60100
		60mV 150A	WM9-60150
		60mV 200A	WM9-60200
		60mV 250A	WM9-60250
		60mV 300A	WM9-60300
		60mV 400A	WM9-60400
		60mV 500A	WM9-60500

* Lead wire for shunt
Two lead wires (each 1.5m in length) are normally provided.
When lead wires of over 1.5m in length are required, refer to the following table.

Length (m)	2	3	5.5	9	12.5	22	35
Cross sectional area (mm^2)	1.25	2	3.5	5.5	8	14	22
Resistance (Ω)	0.06						

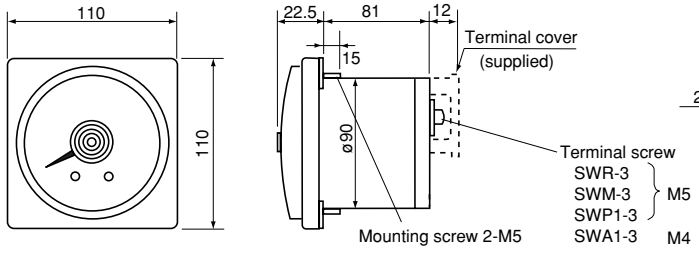
■ Ordering information

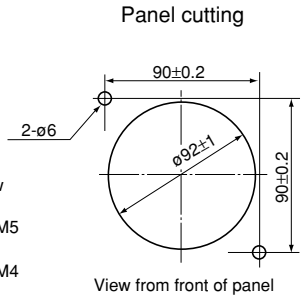
Specify the following:
1. Accessory designation
2. Ratings
   (in case of lead wire for shunt, length of lead wire)

Example
- Shunt for DC ammeter
- Ratings: 60mV, 200A
  (Ordering code WM9-60200)

■ Dimensions, mm

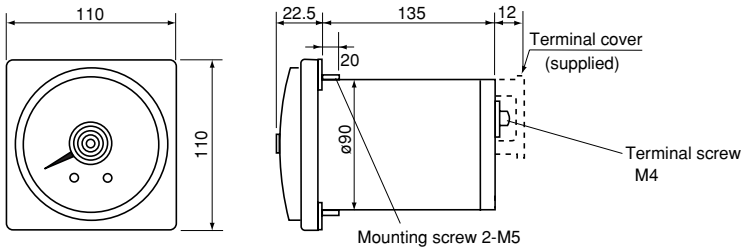
SWR-3, SWM-3, SWP1-3, SWA1-3





Type	Mass (g)
SWR-3	AC ammeter: 700 AC voltmeter: 700
SWM-3	DC ammeter: 500 DC voltmeter: 500
SWP1-3	530
SWA1-3	720

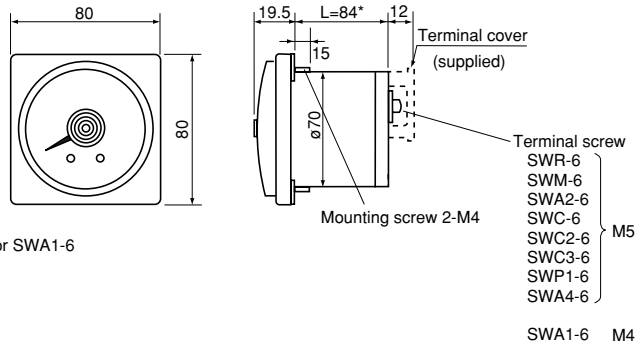
SWA2-3, SWA4-3, SWC-3, SWC2-3, SWC3-3



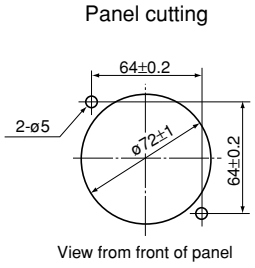
Type	Mass (g)
SWA2-3	750
SWA4-3	850
SWC-3	720
SWC2-3	720
SWC3-3	720

Panel cutting:
Same as above

SWR-6, SWM-6, SWP1-6, SWA1-6, SWA2-6, SWC2-6, SWC-6, SWC3-6, SWA4-6



* 132 for SWA1-6



Type	Mass (g)
SWR-6	AC ammeter: 600 AC voltmeter: 600
SWM-6	DC ammeter: 400 DC voltmeter: 400
SWP1-6	410
SWA1-6	590
SWA2-6	340
SWA4-6	340
SWC-6	340
SWC2-6	340
SWC3-6	340

DC converters for SWC-6, SWC2-6 and SWA2-6 are installed separately.

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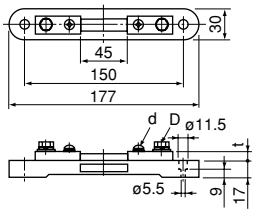
■ Dimensions, mm

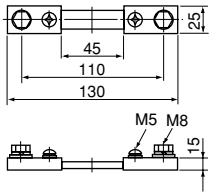
Shunt

With base 1 to 75A, 100A



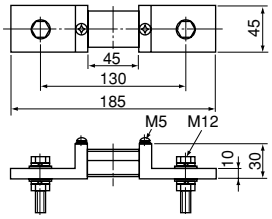
Ratings	D	d	t	Mass (g)
60mV 1–75A	M6	M5	8	270
60mV 100A	M8	M5	10	350

Without base 150, 200A



Ratings	Mass (g)
60mV 150A	370
60mV 200A	380

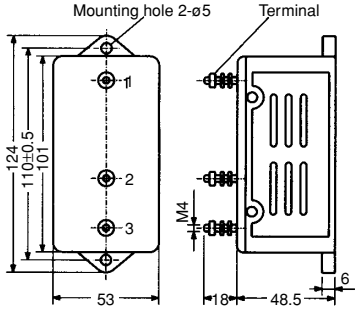
Without base 250 to 500A



Ratings	Mass (g)
60mV 250A	930
60mV 400A	945
60mV 500A	960

Series resistor (for SWM-3, 6)

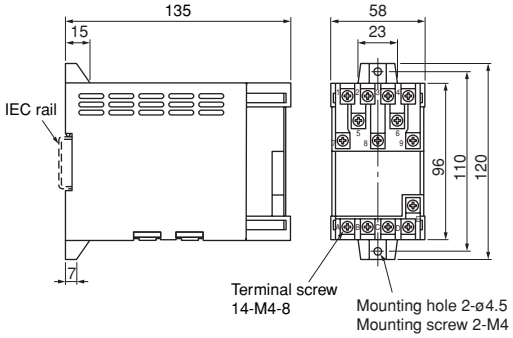
3-terminal, 750V to 2kV



Mass: 250g

DC converter for wattmeter, varmeter and power factor meter

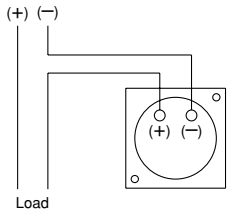
SWC-6, SWC2-6, SWC3-6, SWA2-6, SWA4-6



Used with	Mass (g)
SWC-6	580
SWC2-6 (wattmeter)	580
SWC2-6 (varmeter)	650
SWC3-6 (wattmeter)	580
SWC3-6 (varmeter)	650
SWA2-6	650
SWA4-6	750

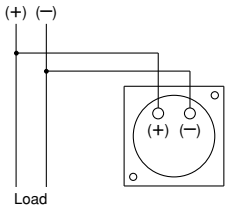
■ Wiring diagrams

DC ammeter SWM-3, -6
AC ammeter SWR-3, -6



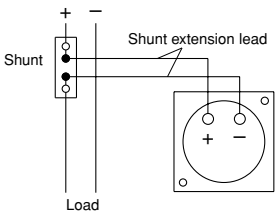
DC ammeter 30A
AC ammeter 30A
(+)(–): For DC voltmeter

DC voltmeter SWM-3, -6
AC voltmeter SWR-3, -6



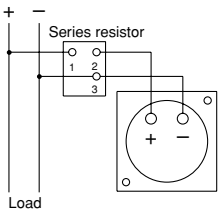
DC voltmeter 600V
AC voltmeter 600V
(+)(–): For DC voltmeter

DC ammeter SWM-3, -6

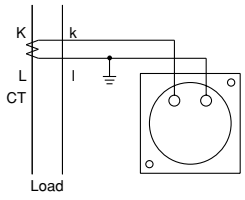


DC ammeter 30A
In case of 60mV shunt, the turn-round resistance of extension lead is 60 milliohms

DC voltmeter SWM-3, -6

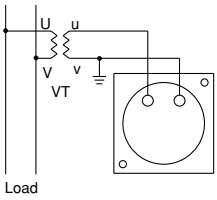


AC ammeter SWR-3, -6



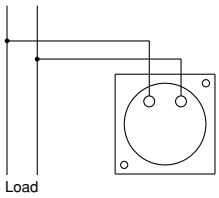
For connection to CT

AC voltmeter SWR-3, -6

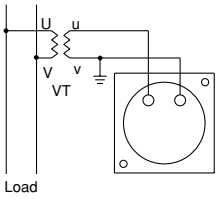


For connection to VT

Pointer type frequency meter SWP1-3, -6

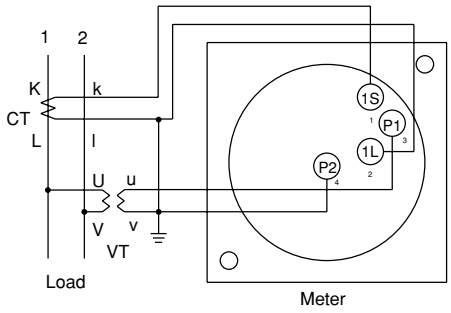


Direct connection

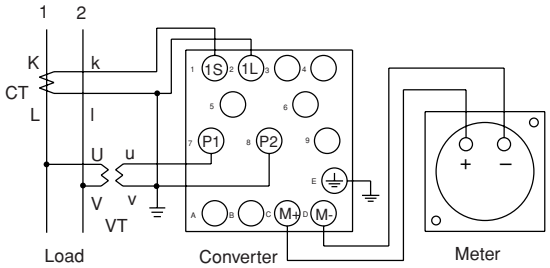


For connection to VT

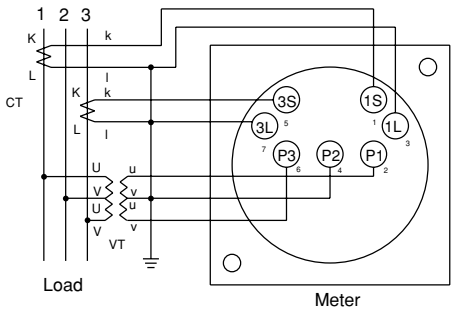
Single-phase wattmeter SWC-3



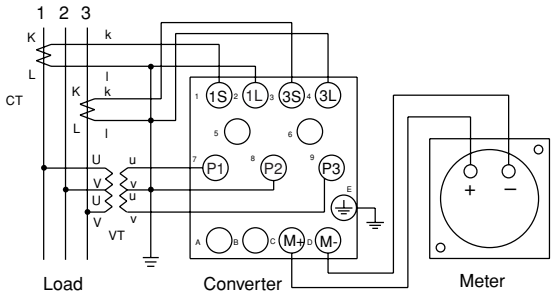
Single-phase wattmeter SWC-6



3-phase wattmeter (varmeter) SWC2-3

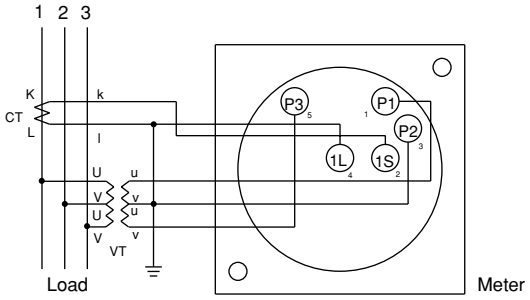


3-phase wattmeter (Varmeter) SWC2-6

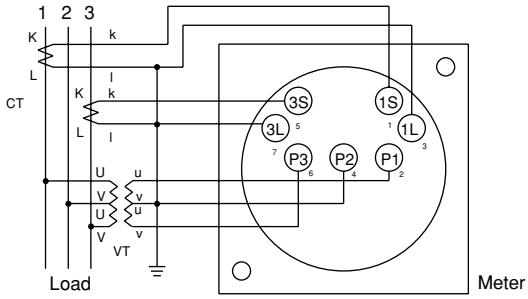


09

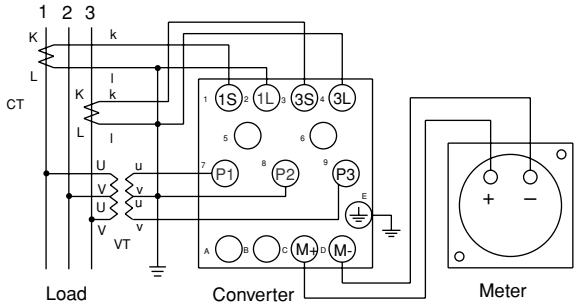
3-phase power factor meter SWA1-3, -6



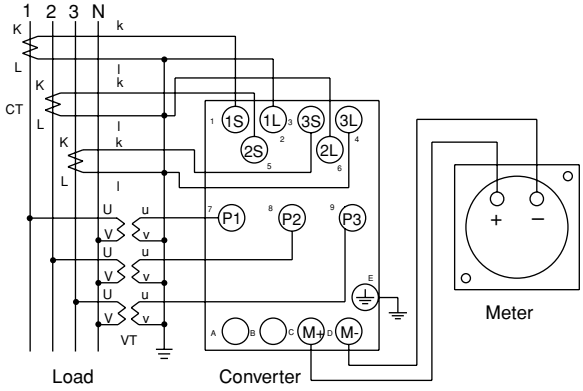
3-phase power factor meter (for unbalanced circuit) SWA2-3



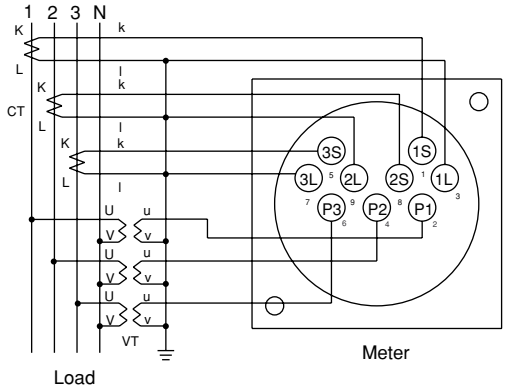
3-phase power factor meter (for unbalanced circuit) SWA2-6



3-phase 4-wire power factor meter and wattmeter SWA4-6, SWC3-6



SWC3-3, SWA4-3



WE12 power line multi-meters

■ Description

WE12 meter handles up to 12 measurements and outputs the results. Abundant functions support managing data for power distribution lines and facilities.

WE12 AF97-206

■ Features

- Handles up to 12 measurements: Three separate line voltage measurements, three separate phase current measurements, active power, reactive power, power factor, frequency, electric energy (watthour), and reactive electric energy (varhour). Also measures reactive power flow and lead and lag angles for the power factor.
- Digitally displays up to three measurements simultaneously and indicates the value of the measurement on the main monitor with a bar graph.
- Measurements can be switched by pressing a button on the front surface or by external signals.
- The upper limit for a current and the upper and lower limits for a voltage can be preset. Any measured value exceeding these limits will flicker on the display.
- The least significant digit of the digital display can be specified as a dead zone.
- Up to three measurements can be output (optical feature) for centralized monitoring of the system.
- Three types of output are provided: Analog, pulse, and RS-485.
- The standard terminal cover ensures safety by covering charged parts.
- Meters with backlight can also be manufactured.

■ Types and ratings

Measurement item	Input circuit	Rated input voltage	Rated input current	Control power supply	Type (Ordering code)*
Voltage, current Active power Reactive power Power factor Frequency Electric energy (watthour) Reactive electric energy (varhour)	3-phase 3-wire	110V AC	5A	85–253V AC/80–143V DC	**WE12-311□□0**
				20–56V DC	**WE12-312□□0**
			1A	85–253V AC/80–143V DC	**WE12-321□□0**
				20–56V DC	**WE12-322□□0**
		220V AC	5A	85–253V AC/80–143V DC	**WE12-331□□0**
				20–56V DC	**WE12-332□□0**
			1A	85–253V AC/80–143V DC	**WE12-341□□0**
				20–56V DC	**WE12-342□□0**
	3-phase 4-wire	110/$\sqrt{3}$ V AC	5A	85–253V AC/80–143V DC	**WE12-411□□0**
				20–56V DC	**WE12-412□□0**
			1A	85–253V AC/80–143V DC	**WE12-421□□0**
				20–56V DC	**WE12-422□□0**
		220/$\sqrt{3}$ V AC	5A	85–253V AC/80–143V DC	**WE12-431□□0**
				20–56V DC	**WE12-432□□0**
			1A	85–253V AC/80–143V DC	**WE12-441□□0**
				20–56V DC	**WE12-442□□0**
	Single-phase 2-wire	110V AC	5A	85–253V AC/80–143V DC	**WE12-111□□0**
				20–56V DC	**WE12-112□□0**
			1A	85–253V AC/80–143V DC	**WE12-121□□0**
				20–56V DC	**WE12-122□□0**
		220V AC	5A	85–253V AC/80–143V DC	**WE12-131□□0**
				20–56V DC	**WE12-132□□0**
			1A	85–253V AC/80–143V DC	**WE12-141□□0**
				20–56V DC	**WE12-142□□0**
	Single-phase 3-wire	100/200V AC	5A	85–253V AC/80–143V DC	**WE12-211□□0**
				20–56V DC	**WE12-212□□0**
			1A	85–253V AC/80–143V DC	**WE12-221□□0**
				20–56V DC	**WE12-222□□0**

Note: * See *page 09/12* for type number nomenclature.

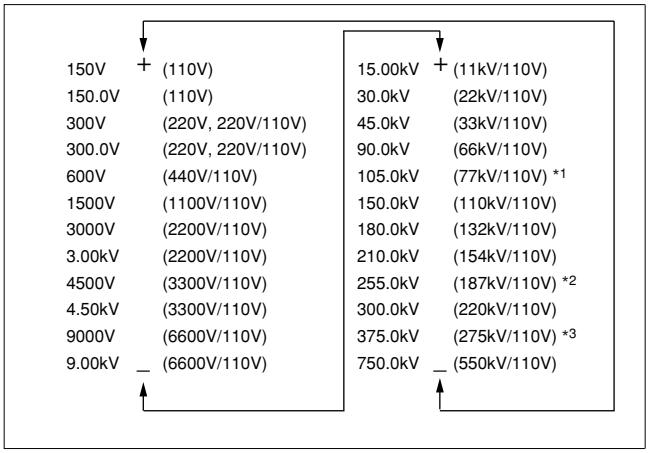
■ Measurement and performance

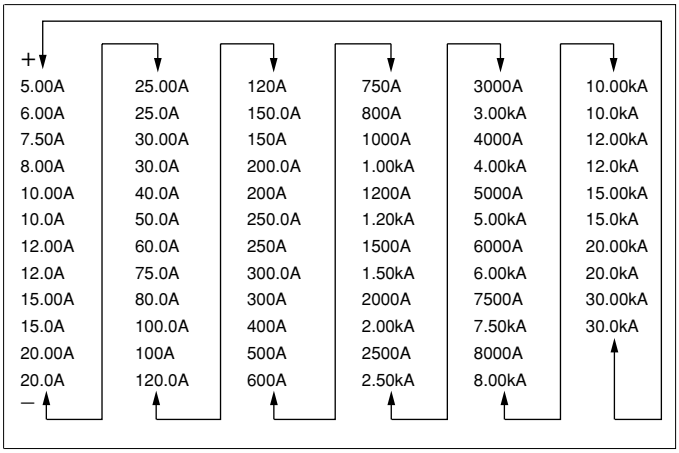
Measure-ment	Measurement ranges and display specifications	Accuracy *1		Remarks
		Digital display	Analog output *2 Pulse output *2 Transmission output *2	
Voltage	150V to 750kV (24 ranges)	±1.0%±1 digit	±0.5%	Selected by switching R-S, S-T, and T-R line voltages (or R-N, S-N, and T-N phase-voltages).
Current	5.00A to 30.0kA (70 ranges)	±1.0%±1 digit	±0.5%	Selected by switching R, S, and T (or N) phase currents.
Active power	480W to 1000MW (range is determined by voltage and current ranges)	±1.0%±1 digit	±0.5%	Measurement ranges for the analog output can be independently specified from the ranges for display of the measurement value.
Reactive power	Lead/lag 360var to 1000Mvar (range is determined by voltage and current ranges)	±1.0%±1 digit	±0.5%	Measurement ranges for the analog output can be independently specified from the ranges for display of the measurement value.
Power factor	Lead 0.5 to 1 to lag 0.5, or lead 0 to 1 to lag 0 (selection)	±3.0%±1 digit	±3.0%	If the input voltage is below 20% of the voltage range, or if the input current is below 2% of the current range, cosø is equal to 1.
Frequency	45 to 55Hz, 55 to 65Hz, or 45 to 65Hz (selection)	±0.5%±1 digit	±0.5%	If the input voltage is below 20% of the voltage range, the measurement output is 0.0Hz. (Lower limit.)
Electric energy (watthour)	Display: 5-digit integer Multiplication factor: 10^n (n: integer) Fractions can be partially displayed in decimal form to a maximum of three decimal places. Only electric energy flow is measured.	±2.0% (power factor = 1) ±2.5% (power factor = 0.5)	±2.0% (power factor = 1) ±2.5% (power factor = 0.5)	Conforms to the standard for ordinary watthour meters. See the optional parts specifications for the setting range of units of energy (kWh) per output pulse.
Reactive electric energy (varhour)	Display: 5-digit integer Multiplication factor: 10^n (n: integer) Fractions can be partially displayed in decimal form to a maximum of three decimal places. Only (lag) reactive energy flow is measured.	±2.5% (power factor = 0) ±2.5% (power factor = 0.87)	±2.5% (power factor = 0) ±2.5% (power factor = 0.87)	See the optional parts specifications for the setting range of units of reactive energy (kvarh) per output pulse.

Notes: *1 Due to the measurement system of the meter, the accuracy will decrease if the meter directly measures the output of cycle-control inverters or phase-angle-control SCR inverters.
*2 The analog, pulse and transmission output types are not standard.

■ Measurement ranges

Select current and voltage measurement ranges as required from the value below to specify the values for the meter.





Notes: *1 Full scale of the bar graph is 120.0kV.
*2 Full scale of the bar graph is 270.0kV.
*3 Full scale of the bar graph is 400.0kV.

■ Specifications

Accuracy of bar graph display		±5% (of displayed bar span)
Conforming standards		JIS C 1102 (IEC51), JIS C 1111, JIS C 1216, JIS C 1263
Display refresh time		Approx. 1s (approx. 0.25s for a bar graph)
Liquid crystal display	Main display	Height: 11mm, 5 digits
	Sub-display	Height: 6mm, 4 digits (Left and right)
	Bar graph	30 dots
Input power consumption		Voltage circuit: 0.25VA/110V max., 0.5VA/220V max., zero-phase voltage circuit: 0.5VA/190V max. Current circuit: 0.1VA max.
Overvoltage or overcurrent withstand		Voltage circuit: 2 × rated voltage for 10s, 1.2 × rated voltage continuously Current circuit: 40 × rated current for 1s, 20 × rated current for 4s, 10 × rated current for 16s, 1.2 × rated current continuously Control power supply: 1.5 × rated voltage for 10s, 1.2 × rated voltage continuously (100/110, 200/220V AC, 24/48V DC), 1.5 × rated voltage for 10s, 1.3 × rated voltage continuously (100/110V DC)
Insulation resistance		50MΩ (500V DC megger)
Dielectric strength		Except between analog output and pulse output circuits: 2000V AC, 50/60Hz, 1 minute Between analog output and pulse output circuits: 1500V AC, 50/60Hz, 1 minute
Impulse withstand		Between electrical circuits (excluding analog output) connected together and cabinet (ground): 6kV, 1.2/50μs Between analog output circuits and cabinet (ground): 5kV, 1.2/50μs
Noise immunity		(1) Oscillating surge voltage Damped oscillation noise wave of 1 to 1.5MHz, peak of 2.5 to 3kV: Measurement error < 10% (2) Rectangular impulse noise 1μs/100ns-wide rectangular-impulse 5 minutes: Measurement error < 10% Voltage and current circuits (normal mode/common mode): 1.5kV min. Power supply circuit (normal mode/common mode): 1.5kV min. Pulse output circuit (common mode): 1.0kV min. Relay output circuit (common mode): 1.0kV min. Control input circuit (common mode): 1.0kV min. Analog output circuit (induction noise): 1.0kV min. (3) Radio noise 150, 400, 900MHz, 5W radio noise 1m: Measurement error < 10% (4) Electrostatic noise (generated by capacitor discharging): 8kV Measurement error < 10%. No damage at 10kV-noise (not in operation)
Vibration and shock resistance		Vibration: 0.30mm double amplitude, 10 to 55Hz Shock: 490m/s², three times in each ±X, ±Y, and ±Z directions
Cabinet		Material: ABS (V-0) resin Color: Black (Munsell color code: N1.5) Mass: 600g
Data backup time		10 years (set values and accumulated values)
Operating temperature and humidity		-10 to +55˚C, 40 to 85% RH (no condensation)
Storage temperature		-25 to +70˚C

■ Optional pulse output specifications

Output	kWh (electric energy) or kvar (reactive electric energy)						
Details	Output system: Optical MOS-FET relay, 1 NO contact Contact rating: 125V AC/DC, 70mA (both resistive and inductive loads)						
	Pulse width: 250ms ±10% (100 to 130ms for some measurement ranges) The unit of output pulse can be specified within the following ranges. The unit of output pulse remains unchanged even if the measurement range is switched. Full load power (kW, kvar) = $\sqrt{3}$ × rated voltage (V) × rated current (A) × 10^{-3}						
	Full load power (kW, kvar)		Pulse	Output	kWh	(kvarh)	Multiplication factor
		less than 10	1	0.1	0.01	0.001	0.1
	10 or more	less than 100	10	1	0.1	0.01	1
	100 or more	less than 1,000	100	10	1	0.1	10
	1,000 or more	less than 10,000	1,000	100	10	1	100
	10,000 or more	less than 100,000	10,000	1,000	100	10	1,000
	100,000 or more	less than 1,000,000	100,000	10,000	1,000	100	10,000

■ Type number nomenclature (Ordering code)

WE12 - □ □ □ □ □ □ 0 □

Basic type

Input circuit
1: Single-phase 2-wire
2: Single-phase 3-wire
3: 3-phase 3-wire
4: 3-phase 4-wire

Rated input voltage and current
1: 110V AC 5A, 110/√3V AC for 3-phase 4-wire
2: 110V AC 1A, 110/√3V AC for 3-phase 4-wire
3: 220V AC 5A, 220/√3V AC for 3-phase 4-wire
4: 220V AC 1A, 220/√3V AC for 3-phase 4-wire

Control power supply
1: 85 to 253V AC/80 to 143V DC common use
2: 20 to 56V DC

External operation input
0: No backlight, no external operation input
1: No backlight, display switch input
A: Backlight, no external operation input
B: Backlight, display switch input

Analog output
0: None (no analog, no transmission output)
1: 4 to 20mA DC
2: 0 to 1mA DC
3: 1 to 5V DC
4: 0 to 5V DC
5: 0 to 10V DC
A: RS-485 (for transmission)

Note:
There are three analog output channels if the meter has no watthour pulse output, and two if the meter has one watthour pulse output.

Watthour pulse output
0: None
1: One output (NO contact)

Display pattern
Specify for all but standard pattern.

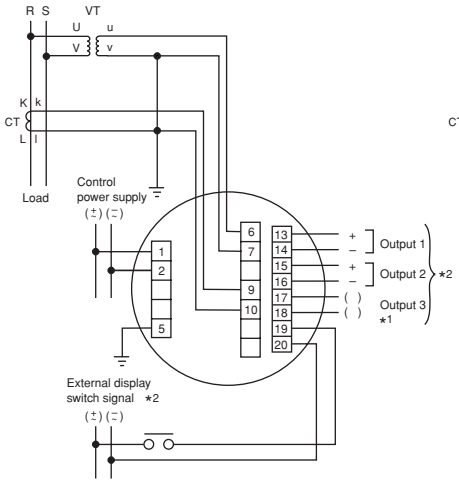
	Pattern	Main	Left	Right	Bar graph
None:	1(standard)	A(S)	V(RS)	W	A(S)
1:	2	W	V(RS)	A(S)	W
2:	3	Wh	V(RS)	A(S)	A(S)
3:	4	Wh	A(S)	W	A(S)
4:	5	Wh	A(S)	W	W
5:	6	A(S)	V(RS)	Hz	A(S)
6:	7	A(S)	V(RS)	–	A(S)
7:	8	V(RS)	V(ST)	V(TR)	V(RS)
8:	9	A(S)	A(R)	A(T)	A(S)
9:	A	V(RS)	–	Hz	V(RS)
A:	B	cosø	A(S)	W	W
B:	C	cosø	V(RS)	Hz	cosø
C:	D	cosø	–	Hz	cosø
D:	E	var	A(S)	W	W

■ Ordering information

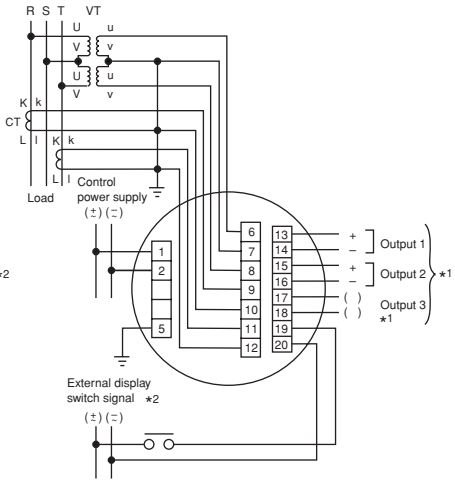
Specify the following:
1. Type number

■ Wiring diagrams

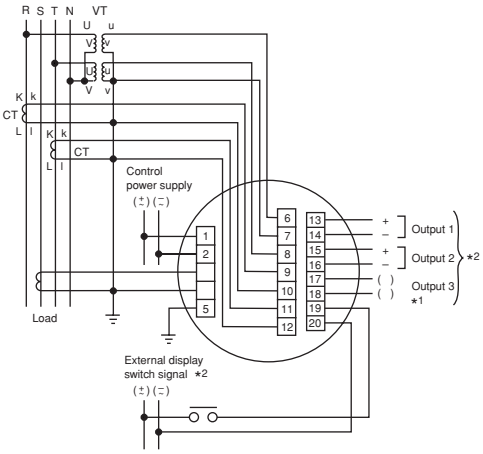
Single-phase 2-wire system



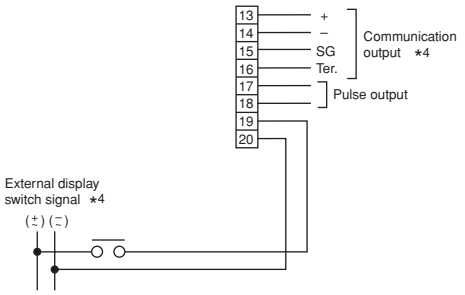
3-phase 3-wire system, Single-phase 3-wire system *3



3-phase 4-wire system



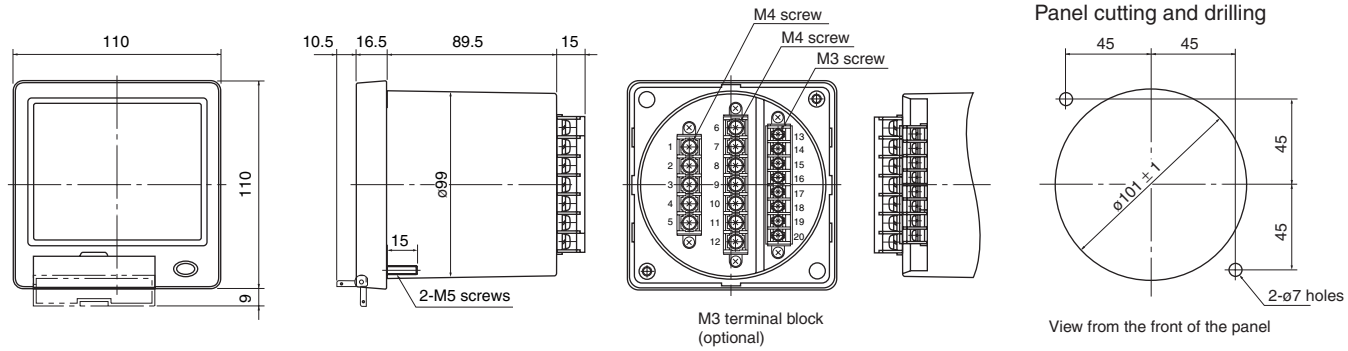
Terminal arrangement of meter with a communication output



Notes:
*1 Output 1 and output 2 are for analog output only. Output 3 is for analog or pulse output.
If output 3 is set for analog output, note the polarities: 17(+) and 18(-).
Output pulses of electric energy (kWh) and reactive electric energy (kvar) are obtained at output 3.
*2 Output 1, output 2, output 3, and display switch signal input are optional.
*3 In the single-phase 3-wire system, line S (7) is a neutral line.
*4 The internal terminal resistor is connected by shorting terminals 14 and 16.

Be sure to connect voltage circuit wires (except for any meter used to measure current only).

■ Dimensions, mm



Mass: 600g

F-type panel instruments 60mm and 80mm square

■ Description

The F-type is both small in size and budget-priced. Since they take a minimum of installation space they are best suited for motor starter, control center and distribution board applications. Meter cases are made of a highly attractive and durable plastic. Front frame sizes are either 60 × 60mm or 80 × 80mm. AC meters are a moving iron-type and DC meters moving coil-type.

■ Features

- Accuracy class: 2.5
- Meter scales are easy to read without error
- Compact design and budget-priced
- Meter accuracy is not affected by panel materials or adjacent current-carrying conductors
- Complies with requirements of JIS C1102 and C1103
- Dielectric test: 2000V AC, 1 min.

AF98-380

60mm square

80mm square

AF98-380

Meter	Description	60mm square Type (Ordering code)	80mm square Type (Ordering code)
AC ammeter	For direct connection (up to 500V) Measuring range / Extended range type 0 – 0.5A / 0 – 0.5 – 1.5A 0 – 1A / 0 – 1 – 3A 0 – 3A / 0 – 3 – 9A 0 – 5A / 0 – 5 – 15A 0 – 7.5A / 0 – 7.5 – 22.5A 0 – 10A / 0 – 10 – 30A 0 – 15A / 0 – 15 – 45A 0 – 20A / 0 – 20 – 60A 0 – 30A / 0 – 30 – 90A Operating principle: Moving iron type Power consumption: 1VA	**FS-60** (WM1SA2-□ ■) □: Measuring range 0.5A: 0P5, 1A: 001, 3A: 003, 5A: 005 7.5A: 7P5, 10A: 010 to 30A: 030 ■: Range extension No extension: Blank Extended range type: 3	**FS-80** (WM1SA3-□ ■)
	For connection to CT Measuring range / Extended range type 0 – X(A) / 0 – X – 3X CT ratio: $\frac{X}{5}$ (X: CT primary current) Operating principle: Moving iron type Power consumption: 1VA	**FS-60** (WM1SA2-□ ■C) □: Measuring range 10A: 010 to 800A: 800 ■: Range extension No extension: Blank Extended range type: 3	**FS-80** (WM1SA3-□ ■C)
AC voltmeter	For direct connection Measuring range 0 – 150V 0 – 300V 0 – 600V Series resistor to be mounted externally Operating principle: Moving iron type	**FS-60** (WM1SV2-□) □: Measuring range 150V: 150, 300V: 300, 600V:600	**FS-80** (WM1SV3-□)
	For connection to VT Measuring range 0 – 600V 0 – 4.5kV 0 – 9kV Operating principle: Moving iron type	**FS-60** (WM1SV2-□P) □: Measuring range 600V: 600, 4.5kV: 45K, 9kV:09K	**FS-80** (WM1SV3-□P)
	For direct connection Measuring range 0 – 30V, 0 – 75V 0 – 50V, 0 – 100V Operating principle: Rectifier type	**FR-60** (WM1RV2-□) □: Measuring range 30V: 030, 50V: 050, 75V:075, 100V: 100	**FR-80** (WM1RV3-□)
DC ammeter	For direct connection Measuring range 0 – 1mA / 0 – 100mA / 0 – 3A 0 – 3mA / 0 – 200mA / 0 – 5A 0 – 5mA / 0 – 500mA / 0 – 10A 0 – 10mA / 0 – 1A / 0 – 15A 0 – 20mA / 0 – 1.5A / 0 – 20A 0 – 50mA / 0 – 2A / 0 – 30A Operating principle: Moving coil type	**FM-60** (WM1MA2-□) □: Measuring range 1mA: 01M to 500mA: M50 1A: 001 to 30A: 030	**FM-80** (WM1MA3-□)
	For connection to shunt Measuring range 0 – 50A / 0 – 300A 0 – 75A / 0 – 500A 0 – 100A / 0 – X (A) 0 – 200A Shunt rating: 60mV Operating principle: Moving coil type	**FM-60** (WM1MA2-□S) □: Measuring range 50A: 050 to 500A: 500 0 – X: X (rated current of shunt)	**FM-80** (WM1MA3-□S)

Meter	Description	60mm square Type (Ordering code)	80mm square Type (Ordering code)
DC voltmeter	For direct connection Measuring range 0 –1V 0 – 50V 0 – 3V 0 – 75V 0 – 5V 0 – 100V 0 – 10V 0 – 150V 0 – 15V 0 – 300V 0 – 30V Operating principle: Moving coil type	**FM-60** (WM1MV2-☐) ☐: Measuring range 1V: 001 to 300V: 300	**FM-80** (WM1MV3-☐)
	For connection to series resistor Measuring range 0 – 500V 0 – 1kV 0 – 600V 0 – 1.5kV 0 – 750V 0 – 2kV Operating principle: Moving coil type Series resistor to be mounted separately	**FM-60** (WM1MV2-☐B) ☐: Measuring range 500V: 500 to 750V: 750 1kV: 10X to 2kV: 20X	**FM-80** (WM1MV3-☐B)
Single-phase 2-wire wattmeter	For connection to VT and CT Measuring range 0 – ZkW $Z = 0.5 \times \frac{X}{5} \times \frac{Y}{110}$ Z: kWatt X: CT primary current Y: VT primary voltage Operating principle: Power/DC transducing type (mounted separately) Power consumption Current coil: 0.2VA (at 5A) Voltage coil: 3VA	**FR-60W1** (WM1RV2W1-☐KW■H●5) ☐: Measuring range, Z (kW) ■: Primary voltage 220V: 02, 440V: 04 3300V: 33, 6600V: 66 ●: Primary current 15A: 015 to 2000A: 20X	**FR-80W1** (WM1RV3W1-☐KW■H●5)
3-phase 3-wire wattmeter	For connection to VT and CT Measuring range 0 – ZkW $Z = \frac{X}{5} \times \frac{Y}{110}$ Z: kWatt X: CT primary current Y: VT primary voltage Operating principle: Power/DC transducing type (mounted separately) Power consumption Current coil: 0.4VA (at 5A) Voltage coil: 3VA	**FR-60W3** (WM1RV2W3-☐KW■H●5) ☐: Measuring range, Z (kW) ■: Primary voltage 220V: 02, 440V: 04 3300V: 33, 6600V: 66 ●: Primary current 15A: 015 to 2000A: 20X	**FR-80W3** (WM1RV3W3-☐KW■H●5)
3-phase 3-wire varmeter	For connection to VT and CT Measuring range 0 – Zkvar $Z = \frac{X}{5} \times \frac{Y}{110}$ Z: kVar X: CT primary current Y: VT primary voltage Operating principle: Reactive power/DC transducing type (mounted separately) Power consumption Current coil: 0.4VA (at 5A) Voltage coil: 3VA	**FR-60V3** (WM1RV2V3-☐KV■H●5) ☐: Measuring range, Z (kvar) ■: Primary voltage 220V: 02, 440V: 04 3300V: 33, 6600V: 66 ●: Primary current 15A: 015 to 2000A: 20X	**FR-80V3** (WM1RV3V3-☐KV■H●5)
3-phase 3-wire power factor meter (for balanced circuit)	For connection to VT and CT Measuring range Lead 0.5 – 1 – 0.5 Lag VT ratio = $\frac{Y}{110}$ V CT ratio = $\frac{X}{5}$ A Operating principle: Power/DC transducing type (mounted separately) Power consumption Current coil: 0.55VA Voltage coil:1VA (at 110V) 2VA (at 220V)	**FR-60PF3** (WM1RV2F3-H5)	**FR-80PF3** (WM1RV3PF3-H5)
Frequency meter	Measuring range 45 – 55Hz 110 or 220V 55 – 65Hz 110 or 220V 45 – 65Hz 110 or 220V Operating principle: DC transducing type (built-in) Power consumption 1.1VA at 110V 1.8VA at 220V	**FR-60F** (WM1RV2FX-☐ ■) ☐: Secondary voltage code 110V: 1, 220V: 2 ■: Secondary current code 5A: 5	**FR-80F** (WM1RV3FX-☐ ■)

09

■ Type number nomenclature (Ordering code)

F □ - □

Basic type

Operating principle
S: Moving iron type
M: Moving coil type
R: Rectifier type

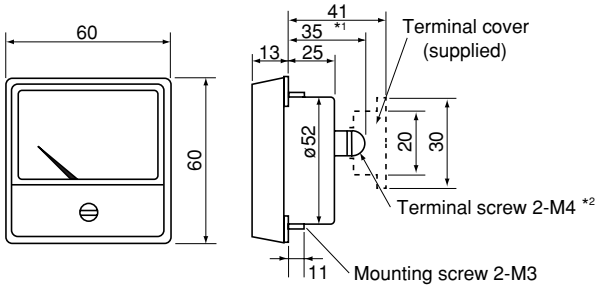
Front frame
60: 60mm square
80: 80mm square

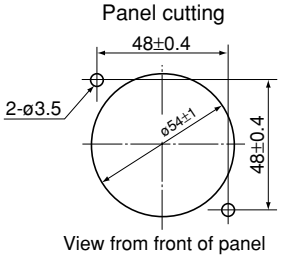
■ Ordering information

Specify the following:
1. Type number (Ordering code)
2. Measuring range
3. Supply voltage and frequency
4. Connection (When connecting to VT or CT, specify VT ratio or CT ratio)

■ Dimensions, mm

FS-60, FR-60, FM-60, FR-60W1, FR-60W3
FR-60V3, FR-60PF3, FR-60F

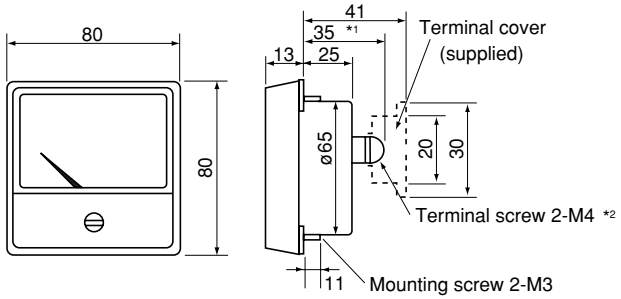


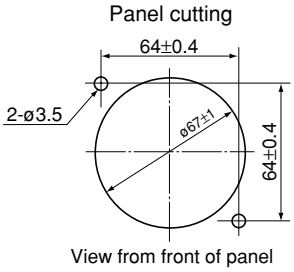


Note: AC ammeter and DC ammeter of 30A direct connection type
*1: 37mm
*2: M5

Mass: 130g

FS-80, FR-80, FM-80, FR-80W1, FR-80W3
FR-80V3, FR-80PF3, FR-80F



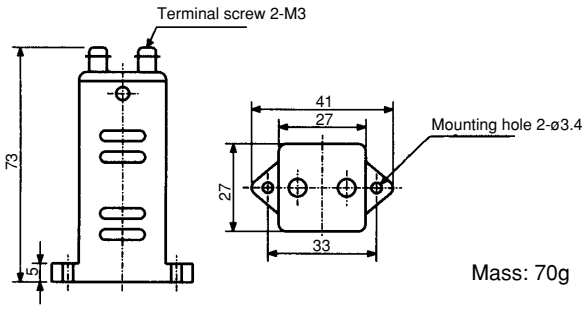


Note: AC ammeter and DC ammeter of 30A direct connection type
*1: 37mm
*2: M5

Mass: 170g

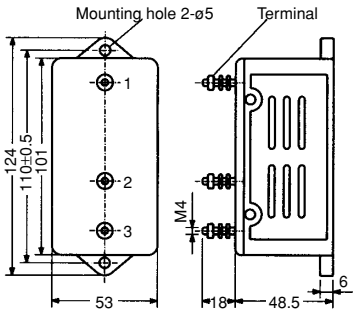
• Series resistor

For FM-60, 80, 100A
2-terminal, 500V to 1kV



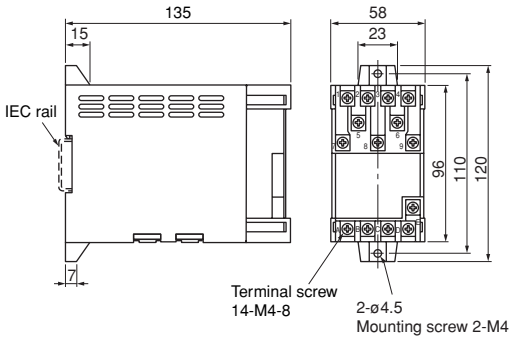
Mass: 70g

For FM-60, 80, 100A
3-terminal, 1.5 to 2.0kV



Mass: 250g

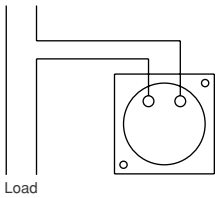
• DC converter



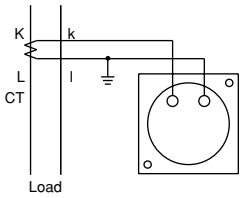
Used with	Mass (g)
FR-□W1, W3	580
FR-□V3, PF3	650

■ Wiring diagrams

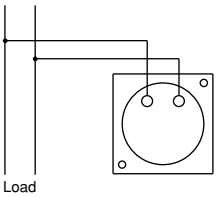
AC ammeter FS-60, 80
(For direct connection)



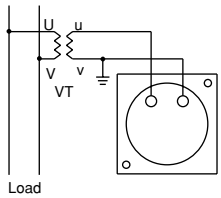
AC ammeter FS-60, 80
(For connection to CT)



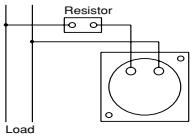
AC voltmeter FS-60, 80
FR-60, 80
(For direct connection)



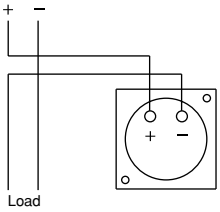
AC voltmeter FS-60, 80
FR-60, 80
(For connection to VT)



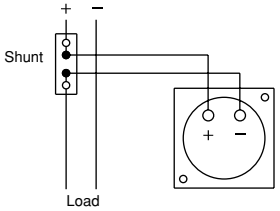
AC voltmeter FS-60, 80
(For connection to series resistor)



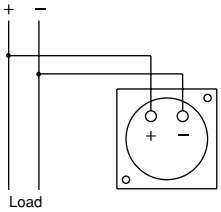
DC ammeter FM-60, 80
(For direct connection)



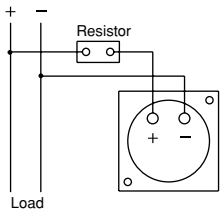
DC ammeter FM-60, 80
(For connection to shunt)



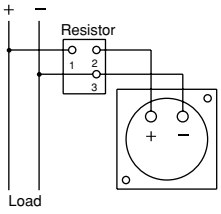
DC voltmeter FM-60, 80
(For direct connection)



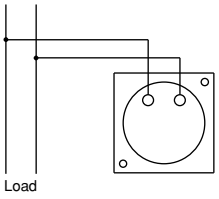
DC voltmeter FM-60, 80
(For connection to series resistor/
2-terminal)



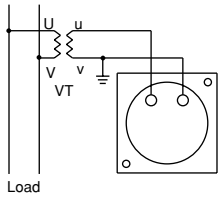
DC voltmeter FM-60, 80
(For connection to series resistor/
3-terminal)



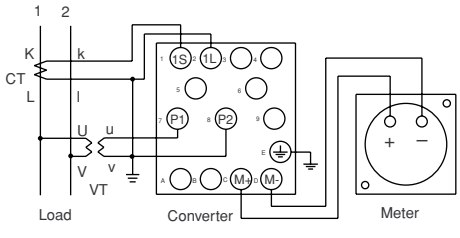
Frequency meter FR-60F, 80F
(For direct connection)



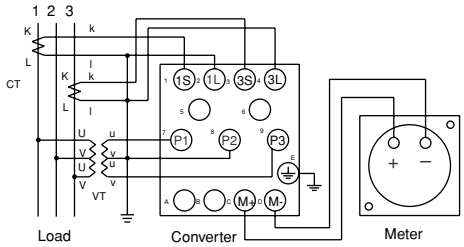
Frequency meter FR-60F, 80F
(For connection to VT)



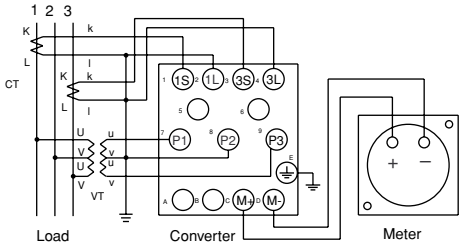
Wattmeter (Single-phase, 2-wire) **FR-□W1**



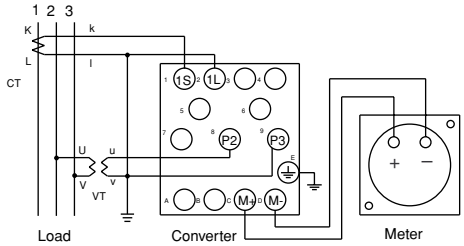
Wattmeter (3-phase, 3-wire) **FR-□W3**



Varmeter (3-phase, 3-wire) **FR-□V3**



Power factor meter (3-phase, 3-wire, for balanced circuit) **FR-□PF3**



F-type panel instruments, 100mm square

■ Description

The F-type has been designed to meet a wide range of applications such as switchboards, supervisory panels, distribution boards, motor starters and control centers. Their electrical performance complies with the requirements of JIS C1102 and they are robustly constructed and reliable.

FS-100A AF98-354

Meter	Description			100 × 100mm Class: 2.5 Type (ordering code)
AC ammeter	For direct connection (up to 500V) Measuring range / Extended range type 0 – 0.5A / 0 – 0.5 – 1.5A 0 – 1 / 0 – 1 – 3A 0 – 2 / 0 – 2 – 6 0 – 3 / 0 – 3 – 9 0 – 5 / 0 – 5 – 15 0 – 7.5 / 0 – 7.5 – 22.5 0 – 10 / 0 – 10 – 30 0 – 15 / 0 – 15 – 45 0 – 20 / 0 – 20 – 60 0 – 30 / 0 – 30 – 90			Operating principle: Moving iron type Power consumption: 1VA max.	**FS-100A** (WM1SA4-□■) □: Measuring range 0.5A: M50, 1A: 0.01, 7.5A:7P5, 10A: 010 15A: 015, 20A: 020, 30A: 030 ■: Range extension No extension: Blank Extended range type: 3
	For connection to CT CT ratio / Measuring range / Extended type 10/5A / 0 – 10A / 0 – 10 – 30A 15/5 / 0 – 15 / 0 – 15 – 45 20/5 / 0 – 20 / 0 – 20 – 60 30/5 / 0 – 30 / 0 – 30 – 90 40/5 / 0 – 40 / 0 – 40 – 120 50/5 / 0 – 50 / 0 – 50 – 150 60/5 / 0 – 60 / 0 – 60 – 180 75/5 / 0 – 75 / 0 – 75 – 225 100/5 / 0 – 100 / 0 – 100 – 300 150/5 / 0 – 150 / 0 – 150 – 450 200/5 / 0 – 200 / 0 – 200 – 600 300/5 / 0 – 300 / 0 – 300 – 900 400/5 / 0 – 400 / 0 – 400 – 1200 500/5 / 0 – 500 / 0 – 500 – 1500 600/5 / 0 – 600 / 0 – 600 – 1800 750/5 / 0 – 750 / 0 – 750 – 2250 800/5 / 0 – 800 / 0 – 800 – 2400			Operating principle: Moving iron type Power consumption: 1VA max.	**FS-100A** (WM1SA4-□■C) □: Measuring range 10A: 010 to 75A: 075, 100A: 100 to 600A: 600 ■: Range extension No extension: Blank Extended range type: 3
AC voltmeter	For direct connection Measuring range 0 – 150V 0 – 300 0 – 600 (with series resistor)		Operating principle: Moving iron type Power consumption: 4.5VA (at 150, 300V) 9VA (at 600V)	**FS-100A** (WM1SV4-□) □: Measuring range 150V: 150, 300V: 300, 600V: 600
	For connection to VT VT ratio / Measuring range 440/110 / 0 – 600V 3300/110 / 0 – 4.5kV 6600/110 / 0 – 9kV		Operating principle: Moving iron type Measuring range = $\frac{1.5}{1.1}$ Y (Y: VT primary voltage) Power consumption: 4.5VA	**FS-100A** (WM1SV4-□P) □: Measuring range 600V: 600, 4.5kV: 45K, 9kV: 09K
	For direct connection Measuring range 0 – 30V 0 – 50V 0 – 75V 0 – 100V		Operating principle: Rectifier type	**FS-100A** (WM1RV4-□) □: Measuring range 30V: 030, 100V: 100

Note: Replace □ and ■ marks in ordering codes by the measuring and extended range codes.

Meter	Description		100 × 100mm Class: 2.5 Type (Ordering code)
DC ammeter	For direct connection Measuring range 0 – 1mA 0 – 1A 0 – 3mA 0 – 1.5 0 – 10mA 0 – 2 0 – 20mA 0 – 5A 0 – 50mA 0 – 10A 0 – 100mA 0 – 15A 0 – 200mA 0 – 20A 0 – 500mA 0 – 30A	Operating principle: Moving coil type Built-in shunt except for 0 to 1mA range	**FM-100A** (WM1MA4-□) □: Measuring range 1mA: 01M, 10mA: M01 to 100mA: M10 1A: 001, 10A:010, 30A: 030
	For connection to shunt Measuring range 0 – XA X: 50 – 500A	Shunt: 60mV Operating principle: Moving coil type	**FM-100A** (WM1MA4-□S) □: Measuring range 50A: 050 to 500A: 500
DC voltmeter	For direct connection Measuring range 0 – 1V 0 – 50 0 – 3 0 – 75 0 – 5 0 – 100 0 – 10 0 – 150 0 – 15 0 – 300 0 – 30	Internal resistance: 1k /1V Operating principle: Moving coil type	**FM-100A** (WM1MV4-□) □: Measuring range 15V: 015, 300V: 300
	For connection to series resistor Measuring range 0 – 500V 0 – 600 0 – 750 0 – 1000 0 – 1500 0 – 2000	Operating principle: Moving coil type	**FM-100A** (WM1MV4-□B) □: Measuring range 500V: 500, 750V: 750, 1000V:10X, 1500V:15X
Single-phase 2-wire wattmeter	For connection to VT and CT Measuring range 0 – ZkW $Z = 0.5 \times \frac{X}{5} \times \frac{Y}{110}$	Operating principle: Transducing type Power consumption: 3VA (at 110V) X: CT primary current Y: VT primary voltage	**FR-100AW1** (WM1RV4W1-□KW■H●5) □: Z ■: Y 220V: 02, 440V: 04, 3300V: 33, 6600V: 66 ●: X 5A: 005 to 4000A: 40X
3-phase 3-wire wattmeter	For connection to VT and CT Measuring range 0 – ZkW $Z = \frac{X}{5} \times \frac{Y}{110}$	Operating principle: Transducing type Power consumption: 3VA (at 110V, 220V)	**FR-100AW3** (WM1RV4W3-□KW■H●5) □: Z ■: Y 220V: 02, 440V: 04, 3300V: 33, 6600V: 66 ●: X 5A: 005 to 4000A: 40X
3-phase 4-wire wattmeter	For connection to VT and CT Measuring range 0 – ZkW 0 – Zkvar $Z = \frac{X}{5} \times \frac{Y}{110}$ Z: kWatt or kvar X: CT primary current Y: VT primary voltage	Operating principle: Reactive power/DC transducing type Power consumption Current coil: 0.2VA per element (at 5A) Voltage coil: 3VA per element (at 110V)	**FR-100AW4** (WM1RV4W4-□KW■H●5) □: Z ■: Y 220V: 02, 440V: 04, 3300V: 33, 6600V: 66 ●: X 5A: 005 to 4000A: 40X
3-phase 3-wire varmeter	For connection to VT and CT Measuring range 0 – Zkvar $Z = \frac{X}{5} \times \frac{Y}{110}$	Operating principle: Transducing type Power consumption: 3VA (at 110V, 220V) X: CT primary current Y: VT primary voltage	**FR-100AV3** (WM1RV4V3-□KW■H●5) □: Z ■: Y 220V: 02, 440V: 04, 3300V: 33, 6600V: 66 ●: X 5A: 005 to 4000A: 40X

09

Meter	Description		100 × 100mm Type (Ordering code)
3-phase 3-wire power factor meter (for balanced circuit)	For connection to VT and CT Measuring range 0.5 – 1 – 0.5 cosø Input voltage 110V or 220V Class: 5.0	Operating principle: Transducing type CT ratio: $\frac{X}{5}$ VT ratio: $\frac{Y}{110}$ or $\frac{Y}{220}$ X: CT primary current Y: VT primary voltage	**FR-100APF3** (WM1RV4F3-□■) □: Y 110: H, 220: M ■: X 5A: 5
3-phase 3-wire power factor meter (for unbalanced curcuit)	For connection to VT and CT Measuring range 0.5 – 1 – 0.5 cosø Input voltage 110V or 220V Class: 5.0	Operating principle: Transducing type CT ratio: $\frac{X}{5}$ VT ratio: $\frac{Y}{110}$ or $\frac{Y}{220}$ X: CT primary current Y: VT primary voltage	**FR-100APFU** (WM1RV4FU-□■) □: Y 110: H, 220: M ■: X 5A: 5
Frequency meter	Input voltage 110V or 220V Class: 1.0 Measuring range 45 – 55Hz 55 – 65Hz 45 – 65Hz	Operating principle: Transducing type Consumption: 1.1VA (at 110V) 1.8VA (at 220V)	**FR-100AF** (WM1RV4FX-□■) □: 50Hz: 5, 60Hz: 6 ■: 110V: H, 220V: M

■ Type number nomenclature (Ordering code)

F □ - 100A □

Versions
W1: 1ø2W wattmeter
W3: 3ø3W wattmeter
W4: 3ø4W wattmeter
V3: 3ø3W varmeter
PF3: 3ø3W power factor meter (for balanced circuit)
PFU: 3ø3W power factor meter (for unbalanced circuit)
F: Frequency meter

Front frame
100: 100 × 100mm

Operating principle
S: Moving iron type
M: Moving coil type
R: Transducing type

Basic type

■ Ordering information

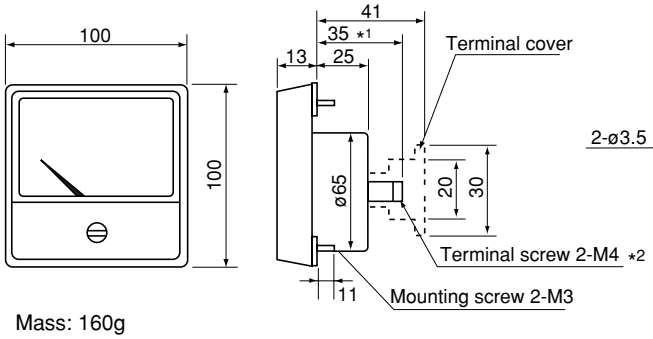
Specify the following:
1. Type number (Ordering code)
2. Measuring range
3. VT or CT ratio
4. Input voltage (for power factor meter and frequency meter)

Example

• 3-phase power factor meter
Front frame 100mm class 2.5 Type: FR-100APF3
Measuring range: 0.5 – 1 – 0.5 cosø
Input voltage: 110V
CT ratio: 50/5
VT ratio: 220/110 (Ordering code: WM1RV4F3-M5)

■ Dimensions, mm

FS-100A, FR-100A, FM-100A, FR-100AW1, FR-100AW3, FR-100AW4, FR-100AV3, FR-100APF3, FR-100APFU, FR-100AF

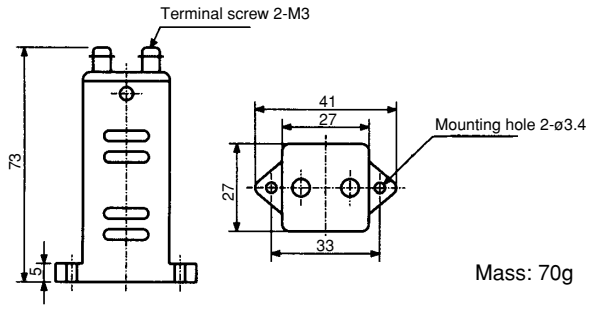


Note: AC ammeter and DC ammeter of 30A direct connection type
*1 37mm
*2 M5

Mass: 160g

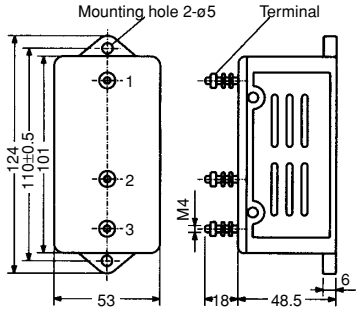
Series resistors

For FM-100A
2-terminal 500-1000V



Mass: 70g

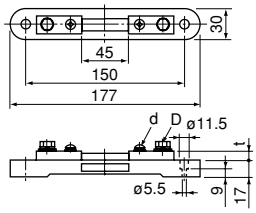
For FM-100A
3-terminal 1500-2000V



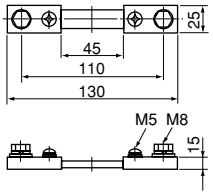
Mass: 250g

Shunts

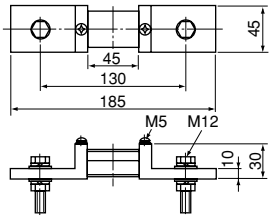
With base 1 to 75A, 100A



Without base 150A, 200A

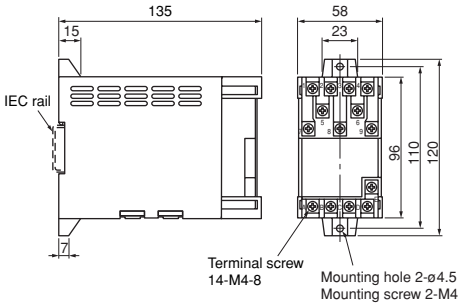


Without base 250 to 500A



	D	d	t
1 to 75A	M6	M5	8
100A	M8	M5	10

DC Converter



Used with	Mass (g)
FR-100AW1, W3, W4	580
FR-100AV3, PF3, PFU	680

Rating of shunts

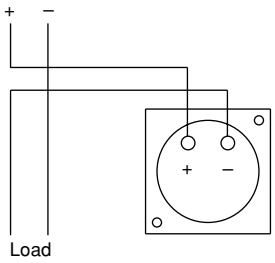
Ratings:	60mV 1A	60mV 7.5A	60mV 40A	60mV 150A	60mV 500A
	60mV 1.5A	60mV 10A	60mV 50A	60mV 200A	
	60mV 2A	60mV 15A	60mV 60A	60mV 250A	
	60mV 3A	60mV 20A	60mV 75A	60mV 300A	
	60mV 5A	60mV 30A	60mV 100A	60mV 400A	

Lead wire for shunt:
Two lead wires (each 1.5m in length) are normally provided.
When lead wires of over 1.5m in length are required, refer to the following table.

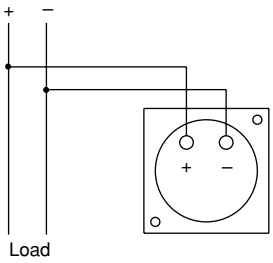
Length (m)	2	3	5.5	9	12.5	22	35
Cross sectional area (mm^2)	1.25	2	3.5	5.5	8	14	22
Resistance (Ω)	0.06						

■ Wiring diagrams

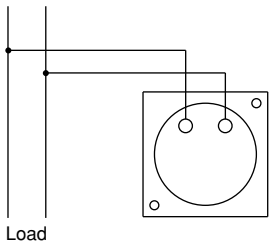
DC ammeter (Direct connection)
FM-100A



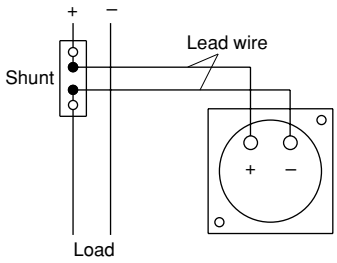
DC voltmeter (Direct connection)
FM-100A



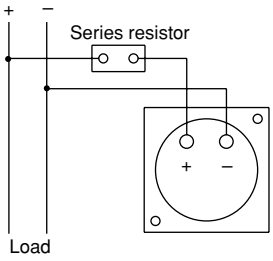
AC voltmeter (Direct connection)
FS-100A



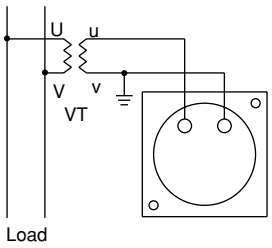
DC ammeter (Connection to shunt)
FM-100A



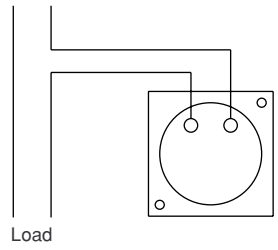
DC voltmeter
(Connection to 2-terminal series resistor)
FM-100A



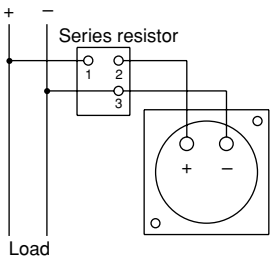
AC voltmeter (Connection to VT)
FS-100A



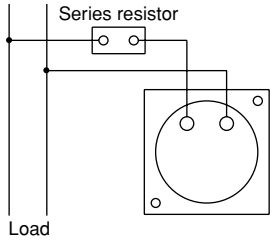
AC ammeter (Direct connection)
FS-100A



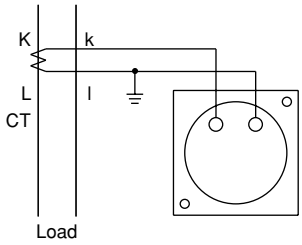
DC voltmeter
(Connection to 3-terminal series resistor)
FM-100A



AC voltmeter
(Connection to series resistor)
FS-100A

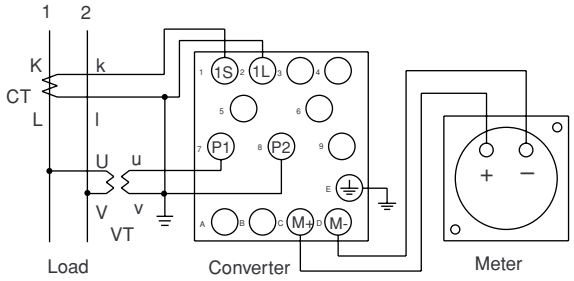


AC ammeter (Connection to CT)
FS-100A

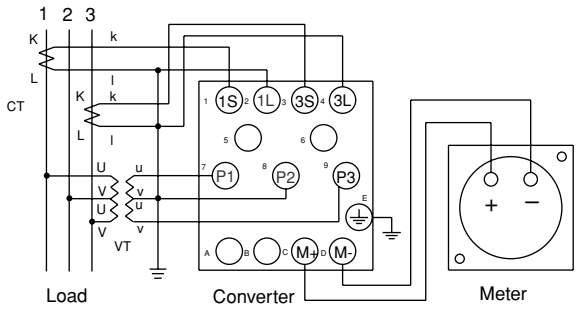


■ Wiring diagrams

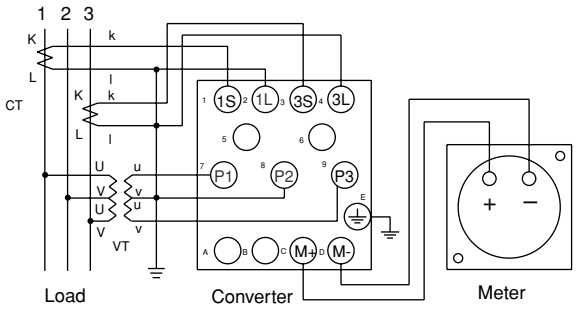
Single-phase, 2-wire wattmeter FR-100AW1



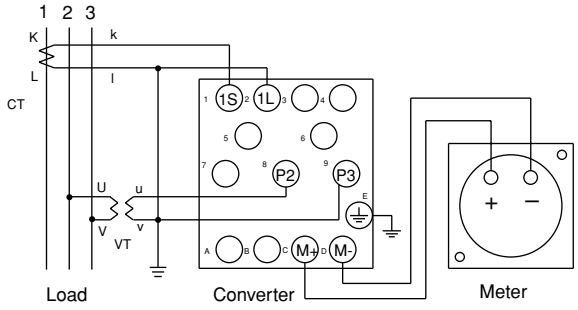
3-phase, 3-wire wattmeter FR-100AW3



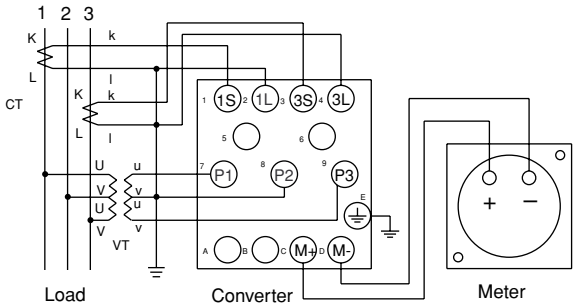
3-phase, 3-wire varmeter FR-100AV3



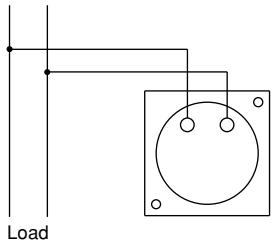
3-phase, 3-wire power factor meter (for balanced circuit) FR-100APF3



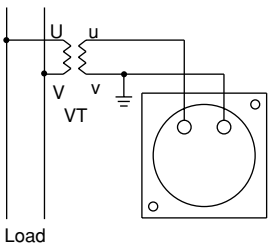
3-phase power factor meter (for unbalanced circuit) FR-100APFU



Frequency meter (Direct connection) FR-100AF



Frequency meter (Connection to VT) FR-100AF



09

FDS-203 process meters

■ Features

- Ultra-compact (24 × 48mm) DIN size of snap-on mounting
- Supports process control input
- Scaling function to convert and display input signals between 1 and 5V or 4 and 20mA into appropriate values.
- Offset value within a range of ±1000 settable on the front panel
- Full-scale range is adjustable between 100 and 1999 digits on the front panel

FDS-203

CP97-2604

■ Instrumentation input / DC voltage measurement

Type	Measurement range	Display	Accuracy	Input impedance	Max. input voltage
FDS-203-1V	1 to 5V	Offset: ±1000 Full scale: 100 to 1999	±0.1%rdg ±2 digits (23˚C ±5˚C)	Applox. 1MΩ	±250V

■ Instrumentation input / DC current measurement

Type	Measurement range	Display	Accuracy	Internal impedance	Max. input current
FDS-203-2A	4 to 20mA	Offset: ±1000 Full scale: 100 to 1999	±0.1%rdg ±2 digits (23˚C ±5˚C)	51Ω	±70mA

■ DC voltage measurement

Type	Measurement range	Display	Accuracy	Input impedance	Max. input voltage
FDS-203-11	±199.9mV	Offset: ±1000 Full scale: ±100 to ±1999	±0.1%rdg ±2 digits (23˚C ±5˚C)	100MΩ	±100V
FDS-203-12	±1.999V			100MΩ	±250V
FDS-203-13	±19.99V			10MΩ	±250V
FDS-203-14	±199.9V			10MΩ	±500V

■ DC current measurement

Type	Measurement range	Display	Accuracy	Internal impedance	Max. input current
FDS-203-21	±199.9μA	Offset: ±1000 Full scale: ±100 to ±1999	±0.2%rdg ±2 digits (23˚C±5˚C)	1kΩ	±10mA
FDS-203-22	±1.999mA			100Ω	±50mA
FDS-203-23	±19.99mA			10Ω	±150mA
FDS-203-24	±199.9mA			1Ω	±500mA

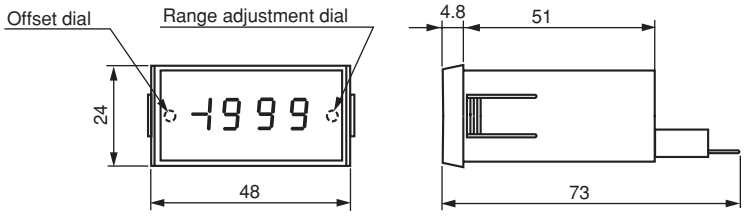
■ Basic specifications

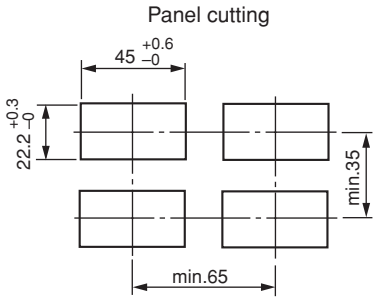
Measurement function	DC voltage or current measurement
Operation method	Double integral method
Sampling speed	2.5 times/s
Noise reduction ratio	NMR 40dB min. (50/60Hz)
Over-range alarm	Blinking 1999
Display	8mm-high, 7-segment red LED display
Max. display value	1999
Polarity display	Negative symbol (–) automatically displayed for negative operation values
External control	Hold, start, blanking, and decimal point
Standard	IEC 1010-1, EN 50082-2, EN-50081-2 Installation Class II, pollution degree 2 (IEC 1010-1)

■ General specifications

Operating condition	0 to 50˚C, 85%RH max. (no condensation)
Power supply	24V DC ±20%, 30mA max. 5V DC ±5%, 120mA max.
Power consumption	Approx. 480mW
Mass	Approx. 46g
Dielectric strength	1,500V AC 1 minute between input terminal and mounting panel 500V DC 1 minute between power supply and input terminals
Insulation resistance	100MΩ min. at 500V DC megger between the terminals described in above
Optional output	Connector

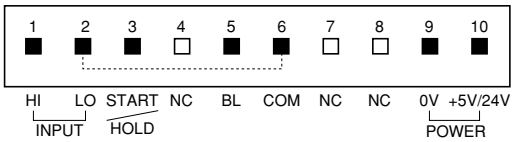
■ Dimensions, mm





Panel thickness:0.8 to 3.5mm

■ I/O connector terminal arrangement



Note: NC is unused, don't connect this terminal.

■ Type number nomenclature

FDS-203-□□-□

Power supply
3: 5V DC
4: 24V DC

Range

1V: 1 to 5V	21: ±199.9μA
2A: 4 to 20mA	22: ±1.999mA
11: ±199.9mV	23: ±19.99mA
12: ±1.999V	24: ±199.9mA
13: ±19.99V	
14: ±199.9V	

Basic type

■ Ordering information

Specify the following:
1. Type number

09

FDT-216 digital thermometers

■ Features

- Compact, 48(W) × 24(H) × 88(D) mm
- Conforms to NEMA4 and IEC (IP66) dustproof and waterproof requirements.
- Isolated analog output between 4 and 20mA with scaling
- Easily set comparison relay or photocoupler output
- Multi-range K, J, T, or R thermocouple input
- Pt100 RTD resistance thermometer is available.
- Detachable terminal block

FDT-216

■ Thermocouple input

Type	Temperature range code	Input sensor	Measurement range	Resolution	Accuracy 23˚C ±5˚C 35 to 85% RH
FDT-216-TC	A	K	-50.0 to 199.9˚C	0.1˚C	±0.5% FS
	B	K	-50 to 1200˚C	1˚C	±0.2% FS
	J	J	-50 to 1000˚C	1˚C	±0.2% FS
	T	T	-50 to 400˚C	1˚C	±0.6% FS
	R	R	-10 to 1700˚C	1˚C	±0.4% FS

Note: The accuracy of cold junction compensation is ±1˚C (10 to 40˚C).
Thermocouple input is calibrated with mV thermal electromotive force according to JIS C 1602.

■ RTD resistance thermometer input

Type	Temperature range code	Input sensor	Measurement range	Resolution	Accuracy 23˚C ±5˚C 35 to 85% RH
FDT-216-PT	PA	Pt-100Ω	-100.0 to 199.9˚C	0.1˚C	±0.15% FS
	PB	Pt-100Ω	-100 to 600˚C	1˚C	±0.3% FS

Note: Each model is calibrated according to JIS C 1604.

■ Basic specifications

Input circuit	Single-ended type
Operation method	Double integral method
Sampling speed	0.625 times/s (thermocouple type) or 1.25 times/s (resistance thermometer type)
Noise reduction ratio	NMR 40dB min.
Display	8mm-high, 7-segment red LED
Polarity display	Negative symbol (–) automatically displayed for negative operation values
Over-range alarm	If the input signal is not within the display range, "o. FL" or "– o. FL" is displayed.
Zero display	Reading zero suppress
Sensor correction	±99 digits

• Thermocouple (TC) type

Input sensor	K, J, T, R
Sensor internal resistance	50Ω max.
Linearization method	Digital linearizer
Burnout alarm	The display will blink "----".
Temperature drift	±200ppm/˚C of FS (at 0 to 50˚C)

• Resistance thermometer (PT)

Input sensor	Pt 100Ω
Resistance thermometer current	1mA (Typical)
External resistance	10Ω max. per lead wire
Linearization method	Digital linearizer
Burnout alarm	If input terminal A or B is burnout, the display "o. FL" will blink. If input terminal is burnout, "----" will blink.
Temperature drift	±200ppm/˚C of FS (at 0 to 50˚C)

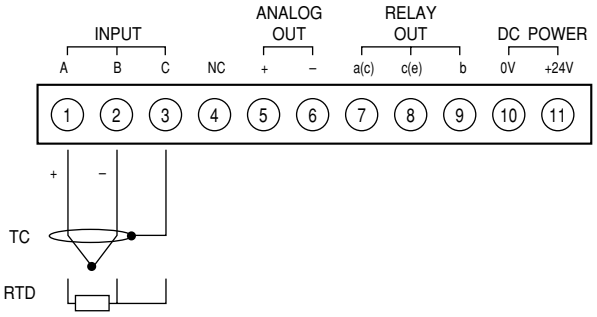
• Comparison section

Control method	Microcomputer operation
Setting range	Single-step setting between -1999 to +9999
Comparison operation	Depends on sampling speed
Comparison conditions	Present value > Set value: The alarm indicator (type A) will turn ON Present value < Set value: The alarm indicator (type B) will turn ON
Relay output	Contact rating of 0.5A at 125V AC or 1A at 30V DC (res. load)
Photocoupler output	NPN voltage output of 30V max. and current output of 50mA max. Output saturated voltage of 1.2V max. at 50mA
Hysteresis	1 to 199 digits for each comparison setting item

■ General specifications

Memory backup	EEPROM storing set data for 10 years (100,000 write operations)
Operating ambient temperature and humidity	0 to 50˚C 35% to 85% RH (no condensation)
Power supply	24V DC ±20%
Current consumption	40mA (Typical)
Mass	Approx. 100g
Dielectric strength	500V DC, 1 minute between input, comparison output and analog (–) output terminals 500V DC, 1 minute between power supply (0V), input, comparison output, analog (–) terminals and case 1,500V AC, 1 minute between input terminals and case
Insulation resistance	100MΩ min. at 500V DC megger between above terminals

■ External connection



■ Output specifications

• **Analog output** (isolated from input terminals)

Output	Load resistance	Accuracy (at 23˚C ±5˚C)	Ripple
4 to 20 mA	0 to 300Ω	±0.5% FS	25mV (p-p) max.

Note: The above accuracy is specified on condition that the humidity is between 35% to 85%RH. The maximum ripple is specified on condition that the load resistance is 250Ω with a current of 20mA.

■ Enclosure

The front panel is of dustproof and waterproof construction meeting IEC (IP66) and NEMA4 (IP66) for indoor use.

■ Type number nomenclature

FDT-216-□□ - □□

Basic type

Comparison output
1: Relay
2: Photocoupler (on request)

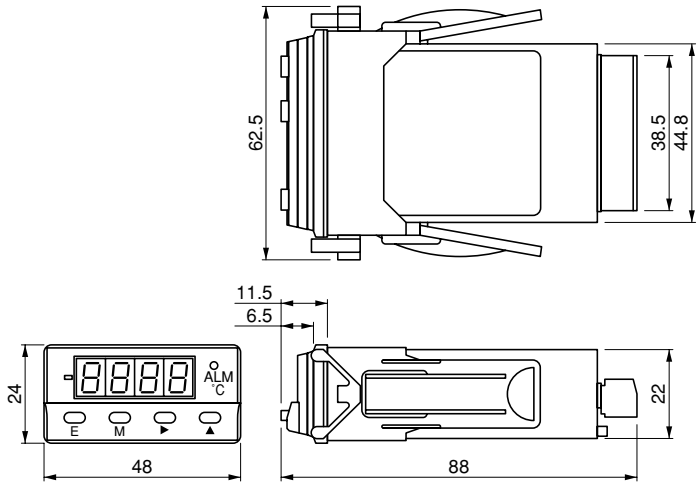
Analog output
1: None
6: 4 to 20mA (on request)

Input sensor
TC: Thermocouple
PT: Resistance thermometer

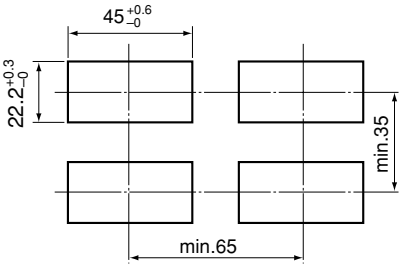
■ Ordering information

Specify the following:
1. Type number

■ Dimensions, mm



Panel cutting



Panel thickness 0.8 to 5.0mm

09

C series transducers

CAC

CW3

■ Description

FUJI C series transducers are designed to convert various electrical characteristics of circuits into DC signals. Input and output circuits are isolated from each other.
These transducers are ideal for handling the analog data input of microcomputer-incorporated control devices. Distorted waveforms from electronic power control devices can be accurately converted to DC signals with the innovative conversion methods used. (The r.m.s.-value method for voltage and current conversion, time-division multiplication for power conversion and differential method for frequency conversion.)

■ Features

- Superb-quality, high-reliability design
- Complete isolation between input and output
- Strong construction
- Provided with terminal protective covers

■ Specifications and types

• AC voltage and current transducers/CAC

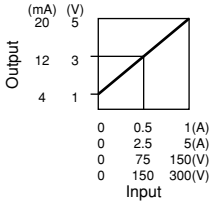
Accuracy: 0.5%
Response time: 1.3s or less
Insulation resistance: 100MΩ, 500V megger
Dielectric strength: 2000V AC, 1 min. between input and output circuits, between input circuit and power supply
2000V AC, 1 min. between output circuit and power supply, output circuit and case (earth terminals)
Ambient temperature and humidity: -10 to +50°C, 90% RH or less (no condensation)

Input (AC)			Output (DC) (Load resistance) (■)			Conversion method (▲)	Control (●) power supply	Type *
Voltage or current (□)		Power consumption						
AC voltage		0.45VA	1–5V	(1kΩ or more)	(A)	Effective value method (1)	100/110V AC	**CAC-□■●▲1**
0–150V	50/60Hz (150)		0–5V	(1kΩ or more)	(B)	Mean value method (2)	50/60Hz (1)	
0–300V	50/60Hz (300)		0–10V	(2kΩ or more)	(C)		or	
			4–20mA	(500Ω or less)	(H)		200/220V AC	
AC current	0–1A (010)	0.1VA	1–5V	(1kΩ or more)	(A)	Effective value method (1)	50/60Hz (2)	**CAC-□■●▲1**
			0–5V	(1kΩ or more)	(B)	Mean value method (2)		
	0–5A (050)		0–10V	(2kΩ or more)	(C)		Approx. power consumption 2VA	
			4–20mA	(500Ω or less)	(H)			

Note: * Replace the marks □ ■ ● ▲ in the type number by codes indicated in parenthesis.

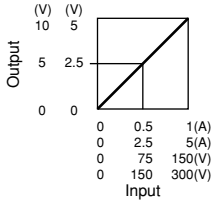
Input-output

Input	Output
0–1A	1–5V
0–5A	4–20mA
0–150V	
0–300V	



Input-output

Input	Output
0–1A	0–5V
0–5A	0–10V
0–150V	
0–300V	



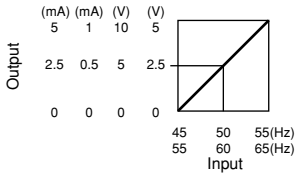
• Frequency transducers/CF1
Accuracy: 0.5%
Response time: 1s or less
Insulation resistance: 100MΩ or more, 500V megger
Dielectric strength: 2000V AC, 1 min. between input and output circuits, between input circuit and power supply
2000V AC, 1 min. between output circuit and power supply, output circuit and case (earth terminals)
Ambient temperature and humidity: -10 to +50°C, 90% RH or less (no condensation)

Input		Output (DC) (Load resistance) (■)	Control power supply (●)	Type *
Voltage and frequency (□)	Power consumption			
110V 45Hz–110V 55Hz(115) 110V 55Hz–110V 65Hz(116) 220V 45Hz–220V 55Hz(225) 220V 55Hz–220V 65Hz(226)	0.3VA	1–5V (1kΩ or more) (A) 0–5V (1kΩ or more) (B) 0–10V (2kΩ or more) (C) 4–20mA (600Ω or less) (H) 0–1mA (10kΩ or less) (J) 0–5mA (2kΩ or less) (K)	100/110V AC 50/60Hz (1) or 200/220V AC 50/60Hz (2) 24V DC ±10% (3) None (9) Approx. power consumption 2.1VA	**CF1-□■●**

Note: * Replace the marks □ ■ ● ▲ in the type number by codes indicated in parenthesis.

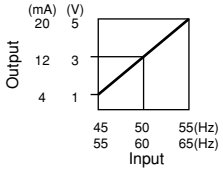
Input-output

Input	Output
45–55Hz	0–5V 0–10V
55–65Hz	0–1mA 0–5mA



Input-output

Input	Output
45–55Hz	1–5V 4–20mA
55–65Hz	



09

- **Active and reactive power transducers/CW, CR**

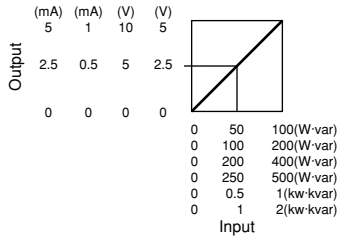
Accuracy: 0.5%
Response time: 0.5s or less
Insulation resistance: 100MΩ, 500V megger
Dielectric strength: 2000V AC, 1 min. between input and output circuits, between input circuit and power supply
2000V AC, 1 min. between output circuit and power supply, output circuit and case (earth terminals)
Ambient temperature and humidity: -10 to +50°C, 90% RH or less (no condensation)

Description		Input (AC)					Output (DC) (■) Load resistance	Control (▲) power supply	Type *
Active or reactive power	Circuit	Voltage	Current	Power (□)	Frequency (●)	Power consumption Voltage Current			
Active power	Single phase 2-wire	110V 110V 220V 220V	1A 5A 1A 5A	0–100W (11) 0–500W (15) 0–200W (21) 0–1kW (25)	50Hz (5) or 60Hz (6)	Approx. 0.35VA (110V) Approx. 0.2VA (5A)	1 – 5V (A) (1kΩ or more) 0 – 5V (B) (1kΩ or more) – 5 – 0– +5V (S) (1kΩ or more) 0 – 10V (C) (2kΩ or more) 4 – 20mA (H) (600Ω or less) 0 – 1mA (J) (10kΩ or less) 0 – 5mA (K) (2kΩ or less)	100/110V AC 50/60Hz (1) 200/ 220V AC 50/60Hz (2) 24V DC±10% (3) 110V DC±10% Except CW4 (4) None (9) Approx. power consumption CW1: 1.8VA CW3: 1.9VA CW4: 2VA	**CW1-□■●▲**
	3-phase 3-wire	110V 110V 220V 220V	1A 5A 1A 5A	0–200W (11) 0–1kW (15) 0–400W (21) 0–2kW (25)	50Hz (5) or 60Hz (6)	Approx. 2×0.35VA (110V) Approx. 2×0.2VA (5A)			**CW3-□■●▲**
	3-phase 4-wire	110V 110V 220V 220V	1A 5A 1A 5A	0–200W (11) 0–1kW (15) 0–400W (21) 0–2kW (25)	50Hz (5) or 60Hz (6)	Approx. 3×0.35VA (110V) Approx. 3×0.2VA (5A)			**CW4-□■●▲**
Reactive power	Single phase 2-wire	110V 110V 220V 220V	1A 5A 1A 5A	0–100var (11) 0–500var (15) 0–200var (21) 0–1kvar (25)	50Hz (5) or 60Hz (6)	Approx. 0.35VA (110V) Approx. 0.2VA (5A)	1 – 5V (A) (1kΩ or more) 0 – 5V (B) (1kΩ or more) – 5 – 0– +5V (S) (1kΩ or more) 0 – 10V (C) (2kΩ or more) 4 – 20mA (H) (600Ω or less) 0 – 1mA (J) (10kΩ or less) 0 – 5mA (K) (2kΩ or less)	100/110V AC 50/60Hz (1) 200/220V AC 50/60Hz (2) 24V DC±10% (3) None (9) Approx. power consumption CR1: 1.8VA CR3: 1.9VA CR4: 2.0VA	**CR1-□■●▲**
	3-phase 3-wire	110V 110V 220V 220V	1A 5A 1A 5A	0–200var (11) 0–1kvar (15) 0–400var (21) 0–2kvar (25)	50Hz (5) or 60Hz (6)	Approx. 2×0.35VA (110V) Approx. 2×0.2VA (5A)			**CR3-□■●▲**
	3-phase 4-wire	110V 110V 220V 220V	1A 5A 1A 5A	0–200var (11) 0–1kvar (15) 0–400var (21) 0–2kvar (25)	50Hz (5) or 60Hz (6)	Approx. 3×0.35VA (110V) Approx. 3×0.2VA (5A)			**CR4-□■●▲**

Note: * Replace the marks □ ■ ● ▲ in the type number by codes indicated in parenthesis.

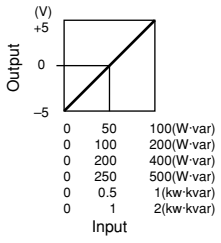
Input-output

Input	Output
0–100W·var	0–5V
0–200W·var	0–10V
0–400W·var	0–1mA
0–500W·var	0–5mA
0–1kW·kvar	
0–2kW·kvar	



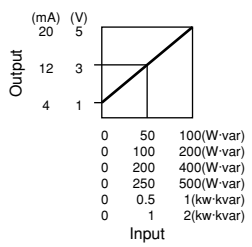
Input-output

Input	Output
0–100W·var	–5–0–+5V
0–200W·var	
0–400W·var	
0–500W·var	
0–1kW·kvar	
0–2kW·kvar	



Input-output

Input	Output
0–100W·var	1–5V
0–200W·var	4–20mA
0–400W·var	
0–500W·var	
0–1kW·kvar	
0–2kW·kvar	



• **Power factor transducers/CC**

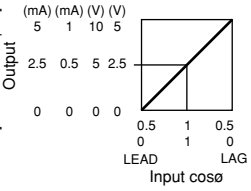
Accuracy: 3.0%
Response time: 0.7s or less
Insulation resistance: 100MΩ or more, 500V megger
Dielectric strength: 2000V AC, 1 min. between input and output circuits, between input circuit and power supply
2000V AC, 1 min. between output circuit and power supply, output circuit and case (earth terminals)
Ambient temperature and humidity: -10 to +50°C, 90% RH or less (no condensation)

Description		Input (AC)				Output (DC) (●) Load resistance	Control (▲) power supply	Type
Power factor	Circuit	Voltage Current (□)	Power factor (■)	Frequency	Power consumption Voltage Current			
	Single phase 2-wire	110V 1A (11) 110V 5A (15) 220V 1A (21) 220V 5A (25)	LEAD LAG 0.5 — 1 — 0.5 (5) 0 — 1 — 0 (0)	50/60Hz	Approx. 0.35VA (110V) Approx. 0.25VA (5A)	1 – 5V (A) (1kΩ or more) 0 – 5V (B) (1 kΩ or more) – 5 – 0– +5V (S) (1kΩ or more) 0 – 10V (C) (2kΩ or more) 4 – 20mA (H) (600Ω or less) 0 – 1mA (J) (10kΩ or less) 0 – 5mA (K) (2kΩ or less)	100/110V AC 50/60Hz (1) 200/220V AC 50/60Hz (2) 24V DC±10% (3) None (9)	**CC1-□■●▲**
	3-phase 3-wire	110V 1A (11) 110V 5A (15) 220V 1A (21) 220V 5A (25)			Approx. 2×0.35VA (110V) Approx. 2×0.25VA (5A)			**CC3-□■●▲**
	3-phase 4-wire	110V 1A (11) 110V 5A (15) 220V 1A (21) 220V 5A (25)			Approx. 3×0.35VA (110V) Approx. 3×0.25VA (5A)		Approx. power consumption 2.2VA	**CC4-□■●▲**

Note: * Replace the marks □ ■ ● ▲ in the type number by codes indicated in parenthesis.

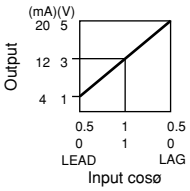
Input-output

Input		Output
LEAD	LAG	0–5V
0.5 –1– 0.5		0–10V
LEAD	LAG	0–1mA
0 –1– 0		0–5mA



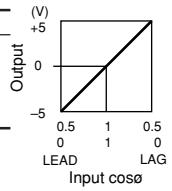
Input-output

Input		Output
LEAD	LAG	1–5V
0.5 –1– 0.5		4–20mA
LEAD	LAG	
0 –1– 0		



Input-output

Input		Output
LEAD	LAG	–5–0–
0.5 –1– 0.5		+5V
LEAD	LAG	
0 –1– 0		



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- **Phase angle transducers/CP**

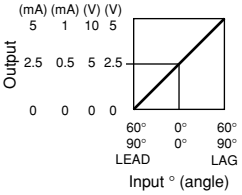
Accuracy: 3.0%
Response time: 0.7s or less
Insulation resistance: 100MΩ or more, 500V megger
Dielectric strength: 2000V AC, 1 min. between input and output circuits, between input circuit and power supply
2000V AC, 1 min. between output circuit and power supply, output circuit and case (earth terminals)
Ambient temperature and humidity: -10 to +50°C, 90% RH or less (no condensation)

Description		Input (AC)					Output (DC) (●) Load resistance	Control (▲) power supply	Type
Phase angle	Circuit	Voltage	Current (□)	Phase angle (■)	Frequency	Power consumption Voltage / Current			
	Single phase 2-wire	110V 110V 220V 220V	1A (11) 5A (15) 1A (21) 5A (25)	LEAD LAG 60° — 0 — 60° (6) 90° — 0 — 90° (9)	50/60Hz	Approx. 0.35VA (110V) / Approx. 0.25VA (5A)	1 – 5V (A) (1kΩ or more) 0 – 5V (B) (1kΩ or more) – 5 – 0– +5V (S) (1kΩ or more) 0 – 10V (C) (2kΩ or more) 4 – 20mA (H) (600Ω or less) 0 – 1mA (J) (10kΩ or less) 0 – 5mA (K) (2kΩ or less)	100/110V AC 50/60Hz (1) 200/220V AC 50/60Hz (2) 24V DC±10% (3) None (9) Approx. power consumption 2.2VA	**CP1-□■●▲**
	3-phase 3-wire	110V 110V 220V 220V	1A (11) 5A (15) 1A (21) 5A (25)			Approx. 2×0.35VA (110V) / Approx. 2×0.25VA (5A)			**CP3-□■●▲**
	3-phase 4-wire	110V 110V 220V 220V	1A (11) 5A (15) 1A (21) 5A (25)			Approx. 3×0.35VA (110V) / Approx. 3×0.25VA (5A)			**CP4-□■●▲**

Note: * Replace the marks □ ■ ● ▲ in the type number by codes indicated in parenthesis.

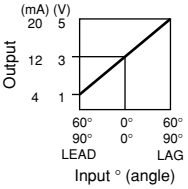
Input-output

Input	Output
LEAD LAG 60° –0– 60°	0–5V 0–10V
LEAD LAG 90° –0– 90°	0–1mA 0–5mA



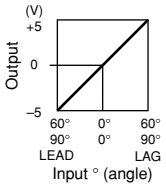
Input-output

Input	Output
LEAD LAG 60° –0– 60°	1–5V 4–20mA
LEAD LAG 90° –0– 90°	

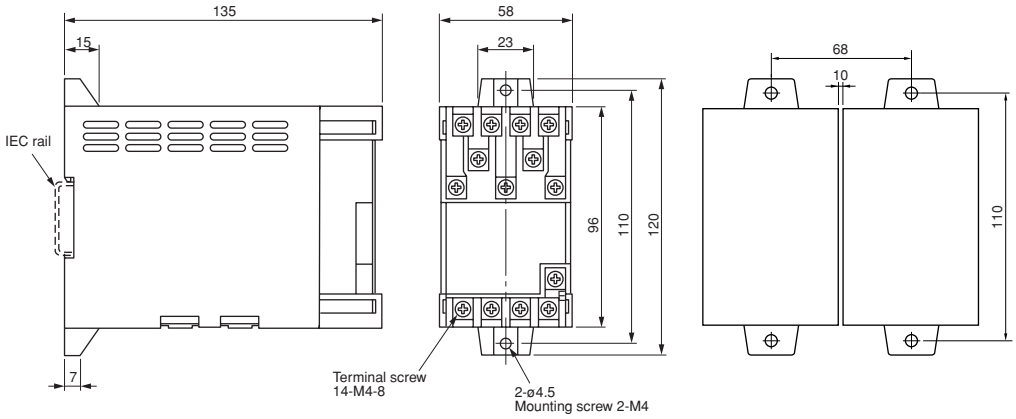


Input-output

Input	Output
LEAD LAG 60° –0– 60°	–5–0 +5V
LEAD LAG 90° –0– 90°	



■ Dimensions, mm

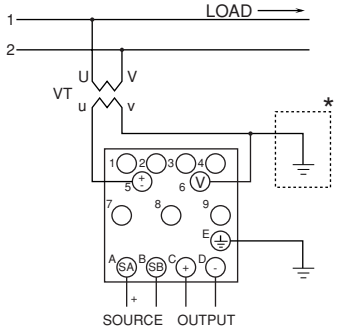


■ Mass

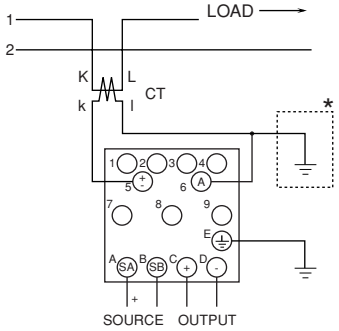
Type	Mass
CAC	0.3kg
CW1, CW3, CW4	0.5kg
CR1, CR3, CR4	0.5kg
CF1	0.4kg
CC1	0.5kg
CC3, CC4	0.55kg
CP1	0.5kg
CP3, CP4	0.55kg

■ Wiring diagrams

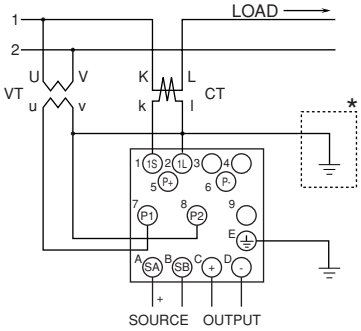
CAC (Voltage input), CF1



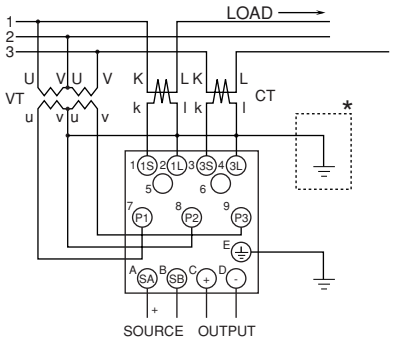
CAC (Current input)



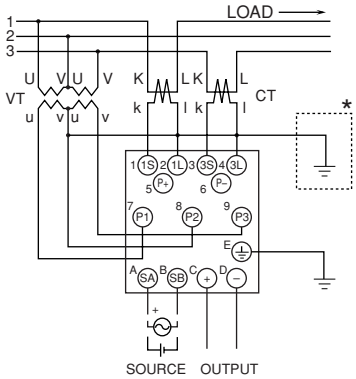
CW1, CR1, CC1, CP1



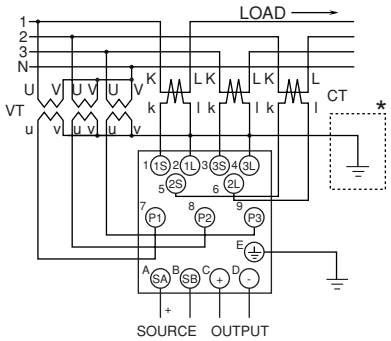
CR3, CC3, CP3 (3-phase, 3-wire)



CW3 (3-phase, 3-wire)



CR4, CC4, CP4, CW4 (3-phase, 4-wire)



Note: * Never ground when VT and CT are not used.

09

■ Type number nomenclature

• AC voltage and current transducers

CAC- □□□□ **1**

Input signal
AC voltage or current

Input rating
010: 0–1A AC
050: 0–5A AC
150: 0–150V AC
300: 0–300V AC

Conversion method
1: Effective value method
2: Mean value method

Control power supply
1: 100/110V AC, 50/60Hz
2: 200/220V AC, 50/60Hz

Output rating
A: 1–5V DC
B: 0–5V DC
C: 0–10V DC
H: 4–20mA DC

• Active and reactive power transducers

CW□ **-** □□□□

Input signal
CW1: 1ϕ 2W active power
CW3: 3ϕ 3W active power
CW4: 3ϕ 4W active power

CR1: 1ϕ 2W reactive power
CR3: 3ϕ 3W reactive power
CR4: 3ϕ 4W reactive power

Input rating (AC)
See the table below.

Control power supply
1: 100/110V AC, 50/60Hz
2: 200/220V AC, 50/60Hz
3: 24V DC
4: 110V DC
9: None

Input frequency
5: 50Hz 6: 60Hz

Output rating (DC)
A: 1–5V
B: 0–5V
C: 0–10V
S: –5–0– +5V
J: 0–1mA
K: 0–5mA
H: 4–20mA

Input ratings (AC)

Code	Voltage (V)	Current (A)	Active power (W) 1ϕ (CW1)	Active power (W) 3ϕ 3W 3ϕ 4W (CW3, CW4)	Reactive power (var) 1ϕ (CR1)	Reactive power (var) 3ϕ 3W 3ϕ 4W (CR3, CR4)
11	110	1	100	200	100	200
15	110	5	500	1000	500	1000
21	220	1	200	400	200	400
25	220	5	1000	2000	1000	2000

• Phase angle input transducers

CP□ **-** □□□

Input signal
CP1: 1ϕ 2W phase angle
CP3: 3ϕ 3W phase angle
CP4: 3ϕ 4W phase angle

Input rating
116: 110V 1A, 60°–0–60°
119: 110V 1A, 90°–0–90°
156: 110V 5A, 60°–0–60°
159: 110V 5A, 90°–0–90°
216: 220V 1A, 60°–0–60°
219: 220V 1A, 90°–0–90°
256: 220V 5A, 60°–0–60°
259: 220V 5A, 90°–0–90°

Control power supply
1: 100/110V AC, 50/60Hz
2: 200/220V AC, 50/60Hz
3: 24V DC
9: None

Output rating
A: 1–5V
B: 0–5V
C: 0–10V
S: –5–0– +5V
J: 0–1mA
K: 0–5mA
H: 4–20mA

• Frequency transducers

CF1- □□□

Input signal
Frequency

Input rating
115: 110V 45Hz–110V 55Hz
116: 110V 55Hz–110V 65Hz
225: 220V 45Hz–220V 55Hz
226: 220V 55Hz–220V 65Hz

Control power supply
1: 100/110V AC, 50/60Hz
2: 200/220V AC, 50/60Hz
3: 24V DC
9: None

Output rating (DC)
A: 1–5V
B: 0–5V
C: 0–10V
J: 0–1mA
K: 0–5mA
H: 4–20mA

• Power factor transducers

CC□ **-** □□□

Input signal
CC1: 1ϕ 2W power factor
CC3: 3ϕ 3W power factor
CC4: 3ϕ 4W power factor

Input rating
110: 110V 1A, 0–1–0
115: 110V 1A, 0.5–1–0.5
150: 110V 5A, 0–1–0
155: 110V 5A, 0.5–1–0.5
210: 220V 1A, 0–1–0
215: 220V 1A, 0.5–1–0.5
250: 220V 5A, 0–1–0
255: 220V 5A, 0.5–1–0.5

Control power supply
1: 100/110V AC, 50/60Hz
2: 200/220V AC, 50/60Hz
3: 24V DC
9: None

Output rating
A: 1–5V
B: 0–5V
C: 0–10V
S: –5–0–+5V
J: 0–1mA
K: 0–5mA
H: 4–20mA

■ Ordering information

Specify the following:
1. Type number
2. 3-phase or single-phase circuit

WF1MA self-powered, DC-isolated transducers

■ Features
- No power supply is required.
- Isolated between input and output circuits
- Snap-on mounting on IEC 35mm rail
- Safe, secured connection of screw terminal with cover

■ Specifications
• Conversion performance
Accuracy: ±0.1% FS (full scale)
Temperature characteristic: ±0.01%/°C FS (Typ.)
Response: 50ms or less (0 to 90%)
Load fluctuation: +0.1%/100Ω or less (at 250Ω or less)
-0.1%/100Ω or less (at 250Ω or more)

• Input specifications

Input signal		Internal resistance	Max. allowable current
Current input	0 to 20mA DC (common with 4 to 20mA DC)	250Ω	30mA

• Output specifications

Output signal		Allowable load resistance
Current output	0 to 20mA DC (common with 4 to 20mA DC)	1kΩ or less

Internal voltage drop: 3.3V or less
Ripple in output : 0.5% or less (at 250Ω, 200mA load)

• General specifications
Structure: Screw-terminal integrated structure
Connection: M3.5 screw terminal
Housing material: Black PC resin
Insulation resistance:
100MΩ or more (500V DC)
Between input, output circuits, power supply, and ground
Dielectric strength:
1500V AC, 1min
Between input, output circuits, power supply, and ground

• Installation specifications
Power supply: Not required
Operating temperature: –5 to +50°C
Operating humidity: 90%RH or less (no condensation)
Storage temperature: –10 to +70°C
Storage humidity: 60%RH or less (no condensation)

■ Ordering information
Specify the following:
1. Type number

WF1MA AF 03-22

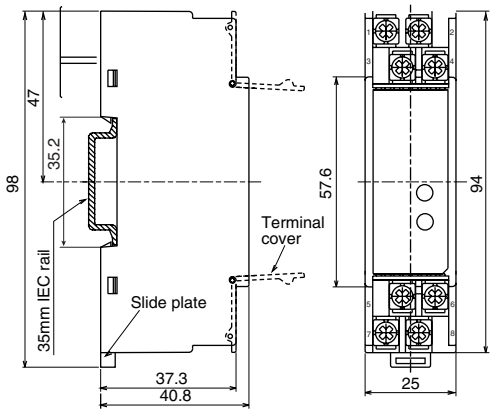
■ Type number nomenclature
WF1MA-22 P 9 1

Input signal
22: 0 to 20mA DC
(common with 4 to 20mA DC)

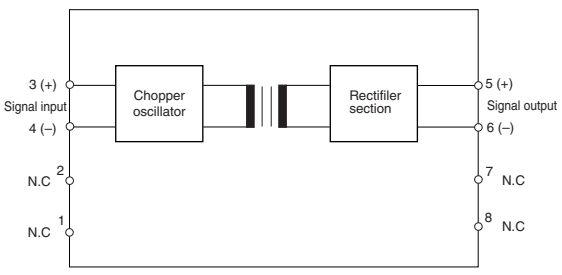
Power supply
9: None

Output signal
P: 0 to 20mA DC
(common with 4 to 20mA DC)

Note: The value of output signal is the same as that of the input signal (ratio: 1-1). Example: 4-20mA DC input — 4-20mA DC output

■ Dimensions, mm


Mass: Approx. 80g

■ Wiring diagram


09

WF5HS high-speed, DC-isolated transducers

■ Features
- 3 ports isolated between input, output circuits, and power supply
- Snap-on mounting on IEC 35mm rail
- Saves wiring time by using push-terminal

■ Specifications
● Conversion performance
Accuracy: ±0.25% FS (full scale)
Temperature characteristic: ±0.02%/°C FS (Typ.)
Response: 1ms or less (0 to 90%)

● Input specifications

Input signal		Input impedance
Voltage input	0 to 5V, 1 to 5V, 0 to 10V DC -10 to 10V, 0 to 1V, 0 to 100mV DC	Input impedance: 1MΩ or more
Current input	4 to 20mA DC	Internal resistance: 250Ω

● Output specifications

Output signal		Allowable load resistance
Voltage output	0 to 5V, 1 to 5V DC 0 to 10V, -10 to 10V DC	550Ω or more
Current output	4 to 20mA DC	550Ω or less

Output adjustment – adjustable from front
Zero adjustment: -5 to +5%
Span adjustment: 95 to 105%

● General specifications
Structure: Push-terminal integrated structure
Connection: Push-terminal
Solid wire of 1.4mm dia., stranded wire of 1.5mm² or less
Housing material: Black polycarbonate resin
Insulation resistance:
100MΩ or more (500V DC)
Between input, output circuits, power supply, and ground
Dielectric strength:
1500V AC, 1min
Between input, output circuits, power supply, and ground

● Installation specifications
Power supply: 24V DC±0%, 80mA or less
Operating temperature: –5 to +50°C
Operating humidity: 90%RH or less (no condensation)
Storage temperature: –10 to +70°C
Storage humidity: 60%RH or less (no condensation)

■ Ordering information
Specify the following:
1. Type number

WF5HS AF 02-161

■ Type number nomenclature

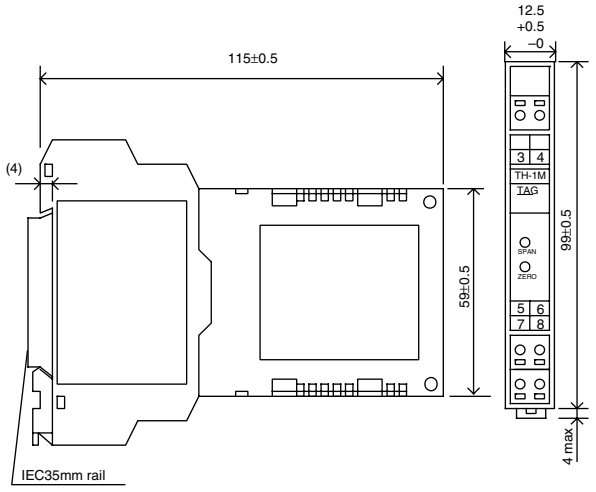
WF5HS-□ □ 3 1

Input signal
11: 0 to 100mV DC
12: 0 to1V DC
13: 0 to 5V DC
14: 0 to 10V DC
15: 1 to 5V DC
24: -10 to +10V DC
16: 4 to 20mA DC

Power supply
3: 24V DC±10%

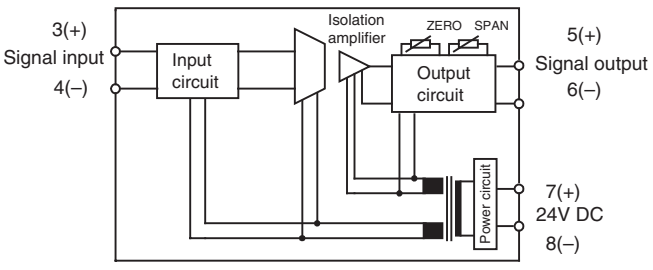
Output signal
A: 1 to 5V DC
B: 0 to 5V DC
C: 0 to 10V DC
K:-10 to +10V DC
H: 4 to 20mA DC

■ Dimensions, mm



Mass: Approx. 80g

■ Wiring diagram



WF5PM potentiometer transducers

■ Features
- WF5PM can be used irrespective of potentiometer's resistance, if the value is within the range between 100Ω and 10kΩ.
- 3 ports isolated between input, output circuits, and power supply
- Snap-on mounting on IEC 35mm rail
- Saves wiring time by using push-terminal

■ Specifications
● Conversion performance
Accuracy: ±0.25% FS (full scale)
Temperature characteristic: ±0.02%/°C FS (Typ.)
Response: 50ms or less (0 to 90%)

● Input specifications

	Input signal	Input resistance
Potentiometer	100Ω to 10kΩ	0.5V

Note: No adjustment is required if it is used at all resistance values (0 to 100%) of potentiometers.

● Output specifications

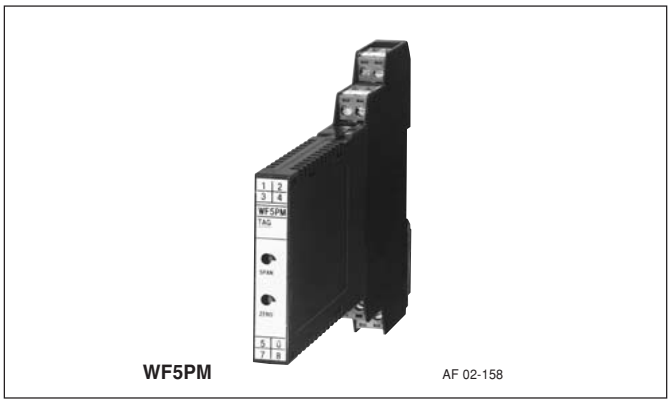
	Output signal	Allowable load resistance
Voltage output	1 to 5V, 0 to 5V DC	2kΩ or more
	0 to 10V, –10 to +10V DC	4kΩ or more
Current output	4 to 20mA DC	550Ω or less

Output adjustment – adjustable from front
Zero adjustment: 0 to +5%
Span adjustment: 50 to 100%

● General specifications
Structure: Push-terminal integrated structure
Connection: Push-terminal
Solid wire of 1.4mm dia., stranded wire of 1.5mm² or less
Housing material: Black polycarbonate resin
Insulation resistance:
100MΩ or more (500V DC)
Between input, output circuits, power supply, and ground
Dielectric strength:
1500V AC, 1min
Between input, output circuits, power supply, and ground

● Installation specifications
Power supply: 24V DC±0%, 80mA or less
Operating temperature: –5 to +50°C
Operating humidity: 90%RH or less (no condensation)
Storage temperature: –10 to +70°C
Storage humidity: 60%RH or less (no condensation)

■ Ordering information
Specify the following:
1. Type number



■ Type number nomenclature

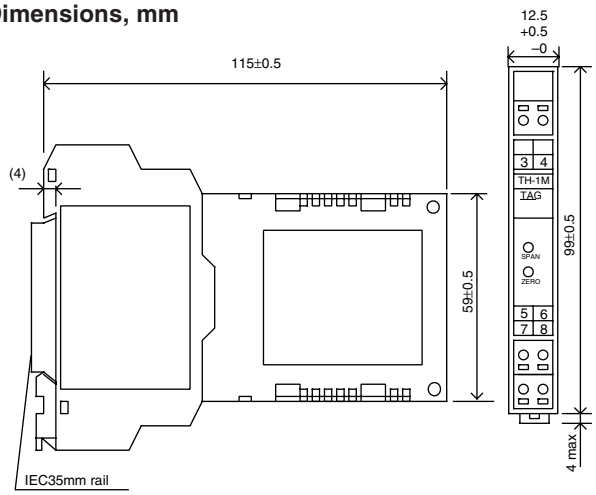
WF5PM-01 □ 3 1

Input signal
01: 100Ω to 10kΩ

Power supply
3: 24V DC±10%

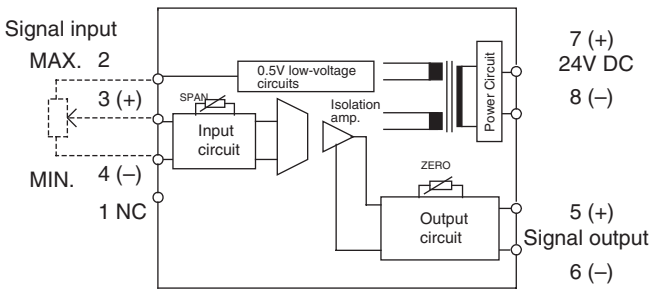
Output signal
A: 1 to 5V DC
B: 0 to 5V DC
C: 0 to 10V DC
K: -10 to +10V DC
H: 4 to 20mA DC

■ Dimensions, mm



Mass: Approx. 80g

■ Wiring diagram



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WF5MA self-powered, DC-isolated transducers

■ Features
- Analog process signal conversion to current output in 1:1 ratio
- No power supply is required.
- Snap-on mounting on IEC35mm rail
- Saves wiring time by using push-terminal

■ Specifications
● Conversion performance

Accuracy: ±0.1% FS (at res. load of 250Ω)
Temperature characteristic:
±0.01%FS/°C FS (at res. load of 250Ω±200Ω)
±0.04%FS/°C FS (at res. load of other than the aboves)
Load fluctuation:
+0.1% FS /100Ω or less (at res. load of ≤ 250Ω max.)
–0.1% FS /100Ω or less (at res. load of ≥ 250Ω min.)
+0.3% FS /100Ω or less (at res. load of ≤ 50Ω max.)
Response: 20ms or less (0 to 90%)
Internal voltage drop: 3V or less

● Input specifications

	Input signal	Internal resistance	Max. allowable input current
Current input	0 to 20mA DC, 4 to 20mA DC (common use)	250Ω	30mA at 30V DC

● Output specifications

	Output signal	Allowable load resistance
Current output	0 to 20mA DC, 4 to 20mA DC (common use)	1kΩ or less

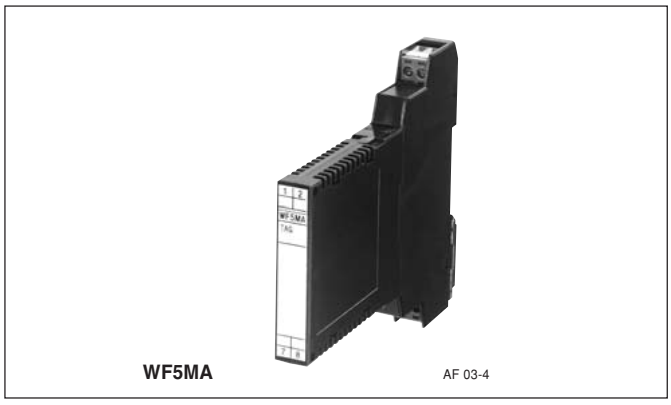
● General specifications

Structure: Push-terminal integrated structure
Connection: Push-terminal
Solid wire of 1.4mm dia., stranded wire of 1.5mm^2 or less
Housing material: Black polycarbonate resin
Insulation resistance:
100MΩ or more (500V DC)
Between input, output circuits, power supply, and ground
Dielectric strength:
2000V AC, 1min
Between input, output circuits, power supply, and ground

● Installation specifications

Power supply: Not required
Operating temperature: –5 to +50°C
Operating humidity: 90%RH or less (no condensation)
Storage temperature: –10 to +70°C
Storage humidity: 60%RH or less (no condensation)

■ Ordering information
Specify the following:
1. Type number



■ Type number nomenclature

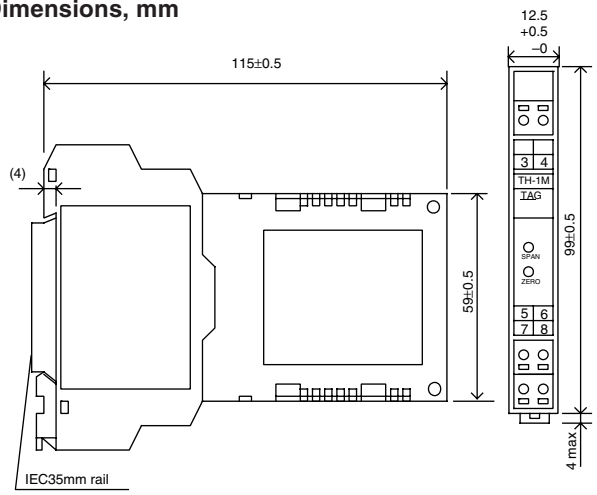
WF5MA-22 P 9 1

Input signal
22: 0 to 20mA DC (common use with 4 to 20mA DC)

Output signal
P: 1 0 to 20mA DC
(common use with 4 to 20mA DC)

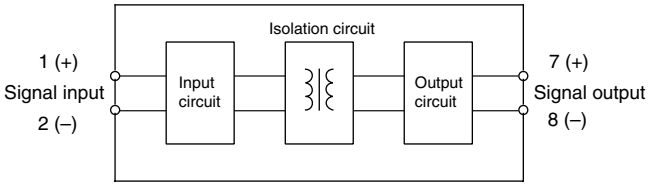
Power supply
9: None

■ Dimensions, mm



Mass: Approx. 80g

■ Wiring diagram



WH7DC isolated DC transducers

WH7DC

■ Description
The WH7DC isolated DC transducer is designed to convert a DC voltage or current values into a DC signal. Input and output circuits are electrically isolated from each other. These transducers are ideal for the amplifying and isolating minute signals that are output from a variety of sensors.

■ Features
- Power supply of 24V DC. I/O circuits isolated from the power supply.

■ Applications
- Signal exchange between electrically isolated systems
- Prevention of control signal sneak currents
- Remote transmission of output signals

■ Standards
UL recognized and CSA File No. E206961

■ Specifications

Type		WH7DC
Insulation method		Photocoupler
Accuracy		±0.1% (Pulse output: ±0.2%)
Temperature characteristics		±0.015% /˚C
Response time		0.5s max. (0 to 90%)
Insulation resistance		100MΩ or more (500V DC megger)
Dielectric strength		2000V AC, 1 min. between input-output-power supply and ground 1000V AC, 1 min. between output 1 and output 2
Auxiliary power supply		24V DC ±10%
Power consumption		Approx. 120mA at 24V DC
Ambient temperature and humidity		–5 to 55°C, 90% RH or less (no condensation)
Input signal (Input impedance)	Voltage	0 to 1V DC (1MΩ min.), 0 to 5V DC (1MΩ min.), 0 to 10V DC (1MΩ min.), 1 to 5V DC (1MΩ min.)
	Current	0 to 20mA DC (250Ω), 4 to 20mA DC (250Ω)
Output 1 (Load resistance)	Voltage	0 to 5V DC (1kΩ min.), 0 to 10V DC (2kΩ min.), 1 to 5V DC (1kΩ min.)
	Current	0 to 20mA DC (750Ω max.), 4 to 20mA DC (750Ω max.)
Output 2 (Load resistance)	Voltage	1 to 5V DC (1kΩ min.)
	Current	4 to 20mA DC (350Ω max.)
	Pulse output	Open collector signal: 0 to 0.01Hz min. and 1kHz max. with 100mA max. at 30V Shutdown frequency: 2% of full scale
Zero adjustment range: Approx. -5% to +5% Span adjustment range: Approx. 95% to 105%		• Only output 1 is adjustable with the WH7AJ adjuster.

■ Type number nomenclature

WH7DC - □ □ □ 3 1

Input signal
13: 0 to 5VDC
14: 0 to 10V DC
15: 1 to 5V DC
16: 4 to 20mA DC
22: 0 to 20mA DC

Output 1
A: 1 to 5V DC
B: 0 to 5V DC
C: 0 to 10V DC
H: 4 to 20mA DC
P: 0 to 20mA DC

Output 2
A : 1 to 5V DC
H : 4 to 20mA DC
W: Pulse
Y : None

Power supply
3: 24V DC ± 10%

■ Ordering information
Specify the following:
1. Type number

■ Dimensions and wiring diagrams
See page 09/49.

09

WH7TC thermocouple temperature transducers

WH7TC

■ Description

The WH7TC transducer converts a thermocouple input into a DC voltage or current signal output with reference point compensation of thermal-electromotive force. Input and output circuits are electrically isolated from each other.

■ Features

- Power supply of 24V DC. I/O circuits isolated from the power supply.
- Reference point compensation function, linearizer function, and upper limit burnout function

■ Applications

- Temperature input control of electric, gas, or heavy oil furnaces

■ Standards

UL recognized and CSA File No. E206961

■ Specifications

Type (Ordering code)		**WH7TC**
Insulation method		Photocoupler
Accuracy		±0.3% (±0.5% for low-range)
Temperature characteristics		±0.02%/˚C (±0.04% /˚C for low-range)
Response time		1s max. (0% to 90%)
Reference point compensation accuracy		±1˚C max.
Burnout time		10s max.
Permissible external resistance		10Ω max.
Input thermocouple (Input impedance)		J, K, E, T, B, R, S, N (1MΩ min.)
Output 1	Voltage	0 to 5V DC (1kΩ min.), 0 to 10V DC (2kΩ min.), 1 to 5V DC (1kΩ min.)
(Load resistance)	Current	0 to 20mA DC (750Ω max.), 4 to 20mA DC (750Ω max.)
Output 2	Voltage	1 to 5V DC (1kΩ min.)
(Load resistance)	Current	4 to 20mA DC (350Ω max.)
Zero adjustment range: Approx. -5% to +5%		Only output 1 is adjustable with the WH7AJ adjuster.
Insulation resistance		100MΩ or more (500V DC megger)
Dielectric strength		2000V AC, 1 min. between input-output-power supply and ground 1000V AC, 1 min. between output 1 and output 2
Auxiliary power supply		24V DC ±10%
Power consumption		Approx. 120mA at 24V DC
Ambient temperature and humidity		–5 to 55°C, 90% RH or less (no condensation)

■ Input thermocouple range

Thermocouple code	Available temperature	Min. measurable temperature range	Thermocouple code	Available temperature	Min. measurable temperature range	Thermocouple code	Available temperature	Min. measurable temperature range
J	-100 to 1000˚C	100˚C	T	-150 to 400˚C	100˚C	S	0 to 1760˚C	500˚C
K	-100 to 1200˚C	100˚C	B	0 to 1820˚C	900˚C	N	-100 to 1200˚C	150˚C
E	0 to 700˚C	100˚C	R	0 to 1760˚C	500˚C			

■ Type number nomenclature

WH7TC - □ □ □ □ 3 1

Input thermocouple
J, K, E, T, B, R, S, N
(see table left)

Measurement temperature range

	J	K	E	T	B	R	S	N
08: 0 to 100˚C	●	●	●	●				
09: 0 to 150˚C	●	●	●	●				●
10: 0 to 200˚C	○	●	○	●				●
11: 0 to 250˚C	○	○	○	○				○
12: 0 to 300˚C	○	○	○	○				○
13: 0 to 350˚C	○	○	○					○
14: 0 to 400˚C	○	○	○					○
15: 0 to 500˚C	○	○	○					○
16: 0 to 600˚C	○	○	○					○
17: 0 to 800˚C		○						○
18: 0 to 1000˚C		○			○	○	○	○
19: 0 to 1200˚C		○			○	○	○	○
20: 0 to 1400˚C					○	○	○	
21: 0 to 1800˚C					○			

Power supply
3: 24V DC ± 10%

Output 2
A: 1 to 5V DC
H: 4 to 20mA DC
Y: None

Output 1
A: 1 to 5V DC
B: 0 to 5V DC
C: 0 to 10V DC
H: 4 to 20mA DC
P: 0 to 20mA DC

Note: • Black circles ● indicate low-range types.
• White circles ○ indicate standard-range types that can be manufactured (the guaranteed accuracy ranges of thermocouples R and B are over 400˚C and 800˚C respectively).
• Compensation wires are used to compensate the difference in temperature between thermocouples and transducer terminals. Types of compensation wires are classified by color. Select the right one according to the thermocouple at site.
• Each transducer is shipped in combination with an RJC temperature resistance thermometer block. Use them in pairs.
• A transducer with a lower limit burnout function is available on request.
• When the lower limit burnout function is triggered, the output of the transducer will scale out for a moment, then it will be set to the minimum value.

■ Ordering information

Specify the following:
1. Type number

■ Dimensions and wiring diagrams

See page 09/49.

WH7PT resistance transducers

WH7PT

■ Descriptions
The WH7PT transducer converts resistance changes in a temperature resistance thermometer into a DC voltage or current signal. Input and output circuits are electrically isolated.

■ Features
- Power supply of 24V DC. I/O circuits isolated from the power supply.
- Linearizer function and upper limit burnout function

■ Applications
- Temperature input control from electric, gas, or heavy oil furnaces.
- Temperature input control of cold-storage warehouse.

■ Standards
UL recognized and CSA File No. E206961

■ Specifications

Type (Ordering code)		**WH7PT**
Insulation method		Photocoupler
Accuracy		±0.2% (±0.4% for low-range, span 100˚C max.)
Temperature characteristics		±0.02% /˚C (±0.04% low-range)
Response time		1s max. (0% to 90%)
Burnout time		10s max.
Permissible external resistance		20Ω max. per wire (Use three wires with the same resistance.)
Input resistance thermometer		Pt100Ω
Output 1	Voltage	0 to 5V DC (1kΩ min.), 0 to 10V DC (2kΩ min.), 1 to 5V DC (1kΩ min.)
(Load resistance)	Current	0 to 20mA DC (750Ω max.), 4 to 20mA DC (750Ω max.)
Output 2	Voltage	1 to 5V DC (1kΩ min.)
(Load resistance)	Current	4 to 20mA DC (350Ω max.)
Zero adjustment range: Approx. -5% to +5%		Only output 1 is adjustable with the WH7AJ adjuster.
Insulation resistance		100MΩ or more (500V DC megger)
Dielectric strength		2000V AC, 1 min. between input-output-power supply and ground 1000V AC, 1 min. between output 1 and output 2
Auxiliary power supply		24V DC ±10%
Power consumption		Approx. 120mA at 24V DC
Ambient temperature and humidity		–5 to 55°C, 90% RH or less (no condensation)

■ Type number nomenclature

WH7PT - 2 □ □ □ 3 1

Input temperature resistance thermometer
2: Pt100Ω

Measurement temperature range
10: 0 to 50˚C/For low-range
11: 0 to 100˚C/For low-range
12: 0 to 150˚C
13: 0 to 200˚C
14: 0 to 250˚C
15: 0 to 300˚C
16: 0 to 350˚C
17: 0 to 400˚C
18: 0 to 500˚C
19: 0 to 600˚C
20: -20 to +80˚C/For low-range
21: -40 to +60˚C/For low-range
22: -50 to +50˚C/For low-range
23: -50 to +100˚C
24: -50 to +150˚C
25: -100 to +100˚C

Power supply
3: 24V DC ± 10%

Output 2
A: 1 to 5V DC
H: 4 to 20mA DC
Y: None

Output 1
A: 1 to 5V DC
B: 0 to 5V DC
C: 0 to 10V DC
H: 4 to 20mA DC
P: 0 to 20mA DC

Note: When the lower limit burnout function is triggered, the output of the transducer will scale out for a moment, then it will be set to the minimum value.

■ Ordering information

Specify the following:
1. Type number

■ Dimensions and wiring diagrams

See page 09/49.

WH7PM potentiometer transducers

■ Description
The WH7PM transducer converts resistance changes in potentiometers into a DC voltage or current signal.

■ Features
- Power supply of 24V DC
  I/O circuits isolated from the power supply

■ Applications
- Float water gages
- Solenoid valve, gate, and damper valve opening meters
- Plunger pump and jack stroke detectors

WH7PM AF99-356

■ Standards
UL recognized and CSA File No. E206961

■ Specifications

Type		WH7PM
Insulation method		Photocoupler
Accuracy		±0.1%
Temperature characteristics		±0.015% /˚C
Response time		0.5s max. (0% to 90%)
Input signal		Entire resistance range of potentiometer 100Ω to 10kΩ
Input span		50% min. of entire resistance range of potentiometer
Output 1	Voltage	0 to 5V DC (1kΩ min.), 0 to 10V DC (2kΩ min.), 1 to 5V DC (1kΩ min.)
(Load resistance)	Current	0 to 20mA DC (750Ω max.), 4 to 20mA DC (750Ω max.)
Output 2	Voltage	1 to 5V DC (1kΩ min.)
(Load resistance)	Current	4 to 20mA DC (350Ω max.)
Zero adjustment range: Approx. -5% to +5%		Only output 1 is adjustable with the WH7AJ adjuster.
Insulation resistance		100MΩ or more (500V DC megger)
Dielectric strength		2000V AC, 1 min. between input-output-power supply and ground 1000V AC, 1 min. between output 1 and output 2
Auxiliary power supply		24V DC ±10%
Power consumption		Approx. 120mA at 24V DC
Ambient temperature and humidity		–5 to 55°C, 90% RH or less (no condensation)

■ Type number nomenclature

WH7PM - 0 1 □ □ 3 1

Input signal
01: 0Ω to 100Ω min.
0Ω to 10kΩ max.

Output 1
A: 1 to 5V DC
B: 0 to 5V DC
C: 0 to 10V DC
H: 4 to 20mA DC
P: 0 to 20mA DC

Power supply
3: 24V DC ± 10%

Output 2
A: 1 to 5V DC
H: 4 to 20mA DC
Y: None

■ Ordering information
Specify the following:
1. Type number
2. Input signal range (Potentiometer resistance range)

■ Dimensions and wiring diagrams
See page 09/49.

WH7RV reverse transducers

■ Description
The WH7RV reverse transducer inversely converts an input signal into an output signal. Input and output circuits are electrically isolated from power supply.

■ Features
- Power supply of 24V DC.
  I/O circuits isolated from the power supply.

■ Applications
- Reversing control operation from input
- Fail-safe circuits and output subtraction circuits

■ Standards
UL recognized and CSA File No. E206961

WH7RV AF99-354

■ Specifications

Type		WH7RV
Insulation method		Photocoupler
Accuracy		±0.1%
Temperature characteristics		±0.015%/˚C
Response time		0.5s max. (0% to 90%)
Input signal	Voltage	0 to 5V DC (1MΩ min.), 0 to 10V DC (1MΩ min.), 1 to 5V DC (1MΩ min.)
(Input impedance)	Current	0 to 20mA DC (250Ω), 4 to 20mA DC (250Ω)
Output 1	Voltage	5 to 0V DC (1kΩ min.), 10 to 0V DC (2kΩ min.), 5 to 1V DC (1kΩ min.)
(Load resistance)	Current	20 to 0mA DC (750Ω max.), 20 to 4mA DC (750Ω max.)
Output 2	Voltage	5 to 1V DC (1kΩ min.)
(Load resistance)	Current	20 to 4mA DC (350Ω max.)
Zero adjustment range: Approx. -5% to +5%		Only output 1 is adjustable with the WH7AJ adjuster.
Insulation resistance		100MΩ or more (500V DC megger)
Dielectric strength		2000V AC, 1 min. between input-output-power supply and ground 1000V AC, 1 min. between output 1 and output 2
Auxiliary power supply		24V DC ±10%
Power consumption		Approx. 120mA at 24V DC
Ambient temperature and humidity		–5 to 55°C, 90% RH or less (no condensation)

■ Type number nomenclature

WH7RV - □ □ □ 3 1

Input signal
13: 0 to 5VDC
14: 0 to 10V DC
15: 1 to 5V DC
16: 4 to 20mA DC
22: 0 to 20mA DC

Output 1
A: 5 to 1V DC
B: 5 to 0V DC
C: 10 to 0V DC
H: 20 to 4mA DC
P: 20 to 0mA DC

Power supply
3: 24V DC ± 10%

Output 2
A: 5 to 1V DC
H: 20 to 4mA DC
Y: None

■ Ordering information
Specify the following:
1. Type number

■ Dimensions and wiring diagrams
See page 09/49.

WH7SP slow pulse transducers

■ Description

The WH7SP slow pulse transducers are designed to convert ON-OFF pulse and voltage pulse signals into a DC voltage or current signal, isolating input and output circuits.

■ Features

- Power supply of 24V DC, with dielectric strength 2000V AC for 1min and 4 ports isolated. (1000V AC for 1 min between output 1 and output 2)

■ Applications

- Flow rate control combined with various types of flow meters
- Monitoring automated machines and wind force combined with rotary encoder
- Speed control of rotating machines combined with pulse transmitter and controller

WH7SP AF99-355

■ Standards

- UL recognized and CSA File No. E206961 (24V DC power supply models only)

■ Specifications

Type			**WH7SP**
Insulation method			Photocoupler
Accuracy			±0.1%
Temperature characteristics			±0.015%/˚C
Response time			0.5s + twice of input cycle (0% to 90%)
Shut down frequency			Approx. 5% of input frequency
Input signal	ON/OFF pulse	Relay	0.01 to 50Hz (pulse width: 10ms or more)
		Open collector (NPN)	0.01 to 10kHz (12V at OFF, approx. 3mA at ON)
	DC voltage pulse		0.01 to 10kHz (Duty ratio 20-80% with pulse width 50μs or more, $2V^{P-P}$ to $50V^{P-P}$)
			AC voltage 50 to 10kHz ($2V^{P-P}$ to $50V^{P-P}$)
Output 1 (Load resistance)	Voltage		0 to 5V DC (1kΩ min.), 0 to 10V DC (2kΩ min.), 1 to 5V DC (1kΩ min.)
	Current		0 to 20mA DC (750MΩ max.)
			4 to 20mA DC (750MΩ max.)
Output 2 (Load resistance)	Voltage		1 to 5V DC (1kΩ min.)
	Current		4 to 20mA DC (350MΩ max.)
Zero adjustment range: Approx. -5% to +5%			Only the output 1 is adjustable with the WH7AJ adjuster.
Insulation resistance			100MΩ or more (500V DC megger)
Dielectric strength			2000V AC, 1 min. between input-output-power supply and ground
			1000V AC, 1 min. between output 1 and output 2
Auxiliary power supply			24V DC ±10%
Power consumption			Approx. 120mA at 24V DC
Ambient temperature and humidity			–5 to 55°C, 90% RH or less (no condensation)

■ Type number nomenclature

WH7SP - □ □ □ □**1**

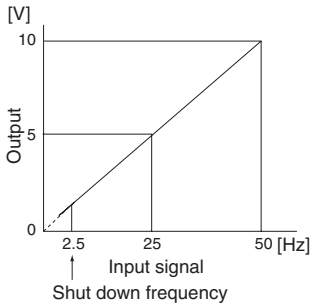
Input signal
10: Relay (Specify 0.01-50Hz)
20: Open collector (Specify 0.01-10kHz)
30: DC voltage pulse (Specify 0.01-10kHz)
40: AC voltage (Specify 50-10kHz)

Output 1
A: 1-5V DC
B: 0-5V DC
C: 0-10V DC
H: 4-20mA DC
P: 0-20mA DC

Power supply
3: 24V DC ±10%

Output 2
A: 1-5V DC
H: 4-20mA DC
Y: None

• Shut down frequency
When the input frequency becomes too low against the full scale. the output ripple cannot be removed. Hence, when the input frequency becomes 5% lower than the full scale, the output is forcibly zero.



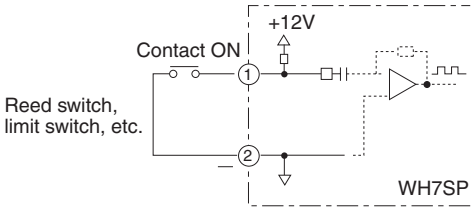
■ Ordering information

Specify the following:
1. Type number
2. Input frequency

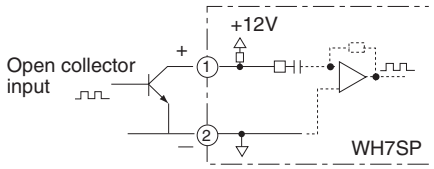
■ Input circuit diagram

● ON-OFF pulse input circuit

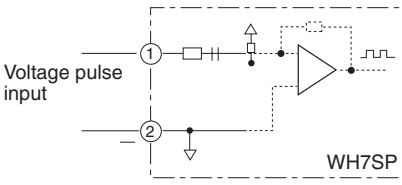
Relay input pulse

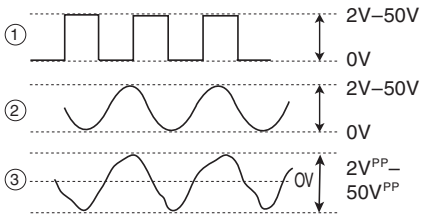


Open collector pulse



● Voltage pulse input circuit





P-P: peak to peak

■ Dimensions and wiring diagrams

See page 09/49.

09

WH7DY isolation type transducers

■ Description

The WH7DY transducers (isolation type distributor) are designed to use by combining 2-wire type transmitter. The WH7DY supplies DC power to the transmitters on site through signal line and converts 4 to 20mA DC signal generated by the transmitters into input signals suitable for monitoring and control equipment, isolating input and output circuits from each other. Pulse output signal can be output as the output 2.

■ Features

- Power supply of 24V DC, with dielectric strength 2000V AC for 1min and 4-port isolated. (1000V AC 1 min, between output 1 and output 2)
- Short-circuit protection

■ Standards

- UL recognized and CSA File No. E206961 (24V DC power supply models only)

■ Specifications

Type		**WH7DY**
Power supply fro transmitter	Voltage	24 to 28V DC at no load
	Current	Max. 22mA DC (short-circuit current: approx. 30mA)
	Ripple	$0.1V^{P-P}$ or less
	Allowable short-circuit time	No limitation
	Tolerance against load fluctuation	2% or less at 0 to 100% load
Insulation method		Photocoupler
Accuracy		±0.1%
Temperature characteristic		±0.02%/˚C
Response time		0.5s or less (0% to 90%)
Input signal (input impedance)		4 to 20mA DC (250Ω)
Input signal (with square root operation)		$Y = \sqrt{\frac{X = (\text{Input 0\% value})}{\text{Input span}}} \times \text{Output span} + (\text{Output 0\% value})$ Where: X = Input value, Y = Output value E.g. If input = 4-20mA, output range = 4-20mA; $\text{Output } Y = \sqrt{\frac{20-4}{16}} \times 16 + 4 = 20\text{mA}$
Output 1 (Load resistance)	Voltage	0 to 5V DC (1kΩ min.), 0 to 10V DC (2kΩ min.), 1 to 5V DC (1kΩ min.)
	Current	0 to 20mA DC (500MΩ max.), 4 to 20mA DC (500MΩ max.)
Output 2 (Load resistance)	Voltage	1 to 5V DC (1kΩ min.)
	Current	4 to 20mA DC (350MΩ max.)
Zero adjustment range: Approx. -5% to +5%		Only the output 1 is adjustable with the WH7AJ adjuster.
Insulation resistance		100MΩ or more (500V DC megger)
Dielectric strength		2000V AC, 1 min. between input-output-power supply and ground 1000V AC, 1 min. between output 1 and output 2
Auxiliary power supply		24V DC ±10%
Power consumption		Approx. 120mA at 24V DC
Ambient temperature and humidity		–5 to 55°C, 90% RH or less (no condensation)

Note: *1 The addressing of RS-485 can be set by the WH7PD PC loader.
• When ordering, specify the output frequency. The frequency can also be changed by the WH7PD PC loader.

■ Type number nomenclature

WH7DY - □ □ □ □1

Power supply for transmitter
01: 24-28V DC
02: 24-28V DC with square root operation

Output 1
A: 1-5V DC
B: 0-5V DC
C: 0-10V DC
H: 4-20mA DC
P: 0-20mA DC

Power supply
3: 24V DC ±10%

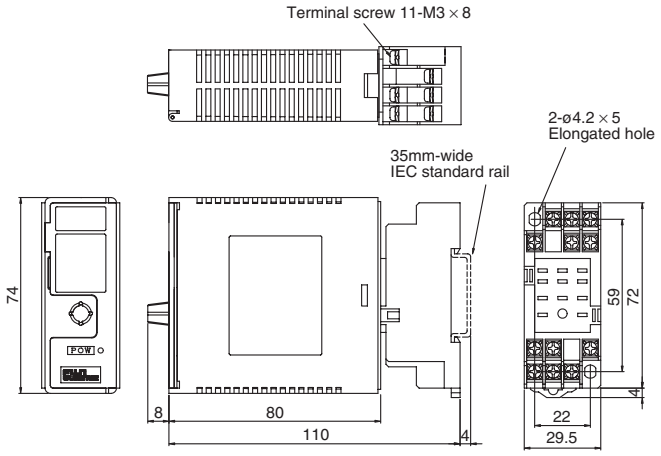
Output 2
A: 1-5V DC
H: 4-20mA DC
W: Pulse
Y: None

■ Ordering information

Specify the following:
1. Type number

■ Dimensions, mm

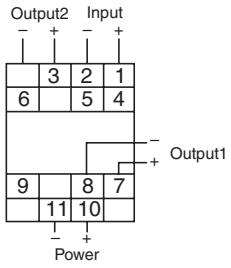
WH7DC, WH7PT, WH7PM, WH7RV, WH7SP, WH7DY



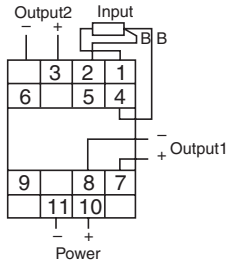
Mass: 150g

■ Wiring diagrams

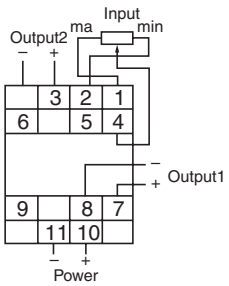
WH7DC, WH7RV, WH7DY



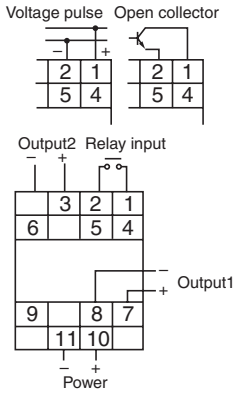
WH7PT



WH7PM

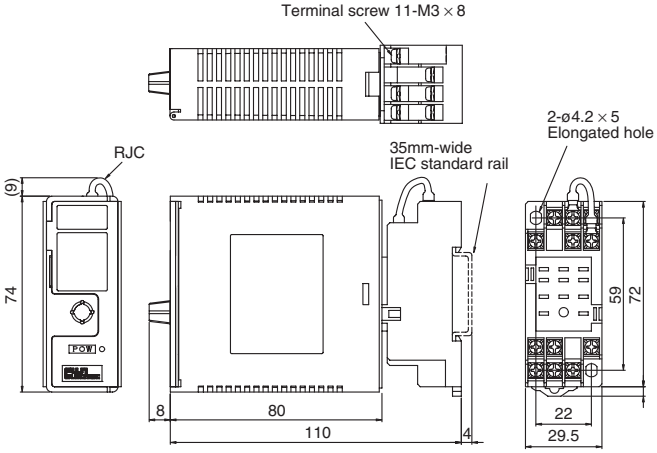


WH7SP



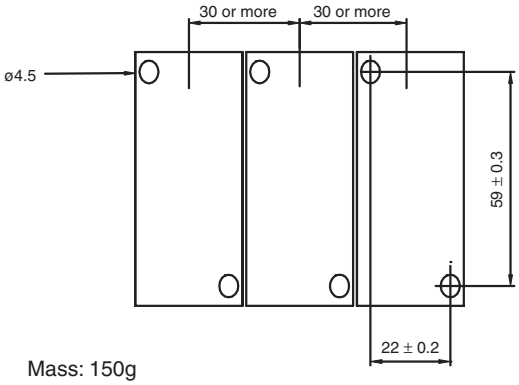
09

■ Dimensions, mm
WH7TC



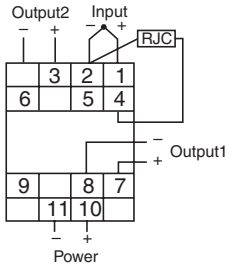
Mass: 150g

Panel drilling



Mass: 150g

■ Wiring diagrams
WH7TC



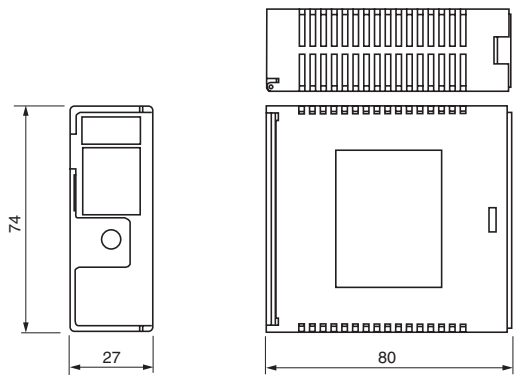
Optional accessories

Simplified adjuster WH7AJ, cable WH7CB

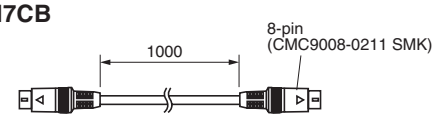
■ Description
- The adjuster WH7AJ is connected to a WH7 series transducer to do zero point adjustment or span adjustment.
- Use a dedicated cable WH7CB (separately sold) to connect the adjuster WH7AJ to a WH7 series transducer.

■ Ordering information
Specify the following:
1. Type number

■ Dimensions, mm
● Simplified adjuster WH7AJ



● Cable WH7CB



WT2AC AC voltage and current transducers

■ Features

FUJI WT2AC AC voltage and current transducers convert AC voltage/current into DC voltage/current, and also isolate input/output circuits and power supplies.

- Select from an 85 to 264V AC, 24V DC, or 110V DC auxiliary power supply
- Three isolated ports: input, output, and power supply
- Thin profile and excellent cost performance
- Use either IEC 35mm rail mounting or screw mounting
- Screw terminals with cover ensure safe, sure connection.

■ Performance

Accuracy: ±0.4% FS
Temperature characteristic: ±0.2%/10°C FS(Typical)
Response time: 0.5s max. (0 to 90%)
Insulation resistance: 100MΩ (500V DC megger)
Withstand voltage: 2000V AC 1min

■ Input specifications

	Input signal	Input frequency
Voltage input	0 to 110V AC	50Hz, 60Hz
	0 to 150V AC	
	0 to 300V AC	
Current input	0 to 1A AC	
	0 to 5A AC	

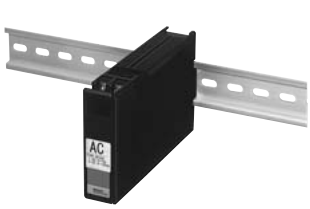
■ Output specifications

	Output signal	Permissible external resistance
Voltage output	0 to 10mV	10kΩ or more
	0 to 100mV	100kΩ or more
	0 to 1V	200Ω or more
	0 to 5V DC, 1 to 5V DC	1kΩ or more
	0 to 10V DC	2kΩ or more
Current output	0 to 1mA DC	5kΩ or less
	0 to 5mA DC	3kΩ or less
	0 to 10mA DC	1.5kΩ or less
	0 to 16mA DC	900Ω or less
	0 to 20mA DC	750Ω or less
	1 to 5mA DC	3kΩ or less
	2 to 10mA DC	1.5kΩ or less
	4 to 20mA DC	750Ω or less

Output adjustment: Zero adjustment –5 to +5%
Span adjustment 95 to 105%

■ Ordering information

Specify the following:
1. Type number



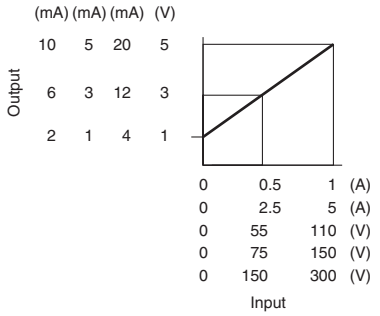
Rail mounting WT2AC

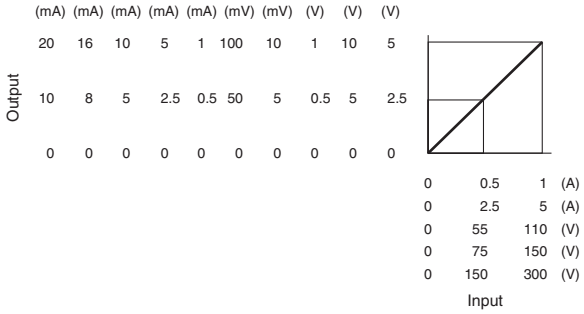
Screw mounting WT2AC

■ Specifications

Type	**WT2AC**
Terminal connection	M3.5 screw
Housing material	Enclosure: Polycarbonate resin UL94V-0
	Terminal: ABS UL94V-0
Insulation resistance	100MΩ (500V DC megger)
Dielectric strength	2000V AC 1min
Auxiliary power supply	85 to 264V±10% (50/60Hz), approx. 3VA
	24V DC±10%, approx. 100mA
	110V DC±10%, approx. 30mA
Operating temperature	–5 to +50°C
Operating humidity	90%RH or less (no condensation)
Storage temperature	–20 to +60°C
Storage humidity	90%RH or less (no condensation)

■ Input-output

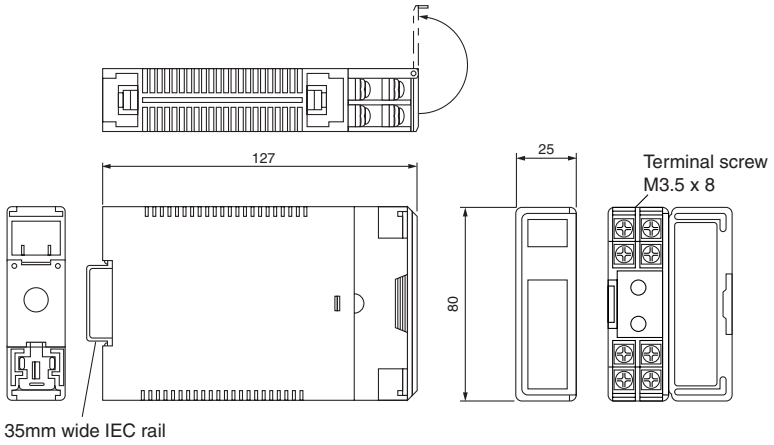




09

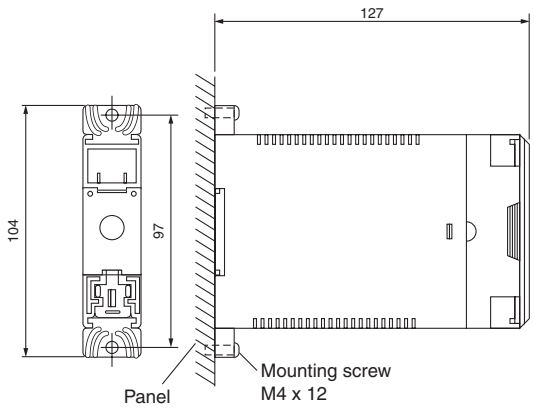
■ Dimensions, mm

• Rail mounting



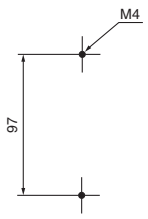
Mass: Approx. 200g

• Screw mounting

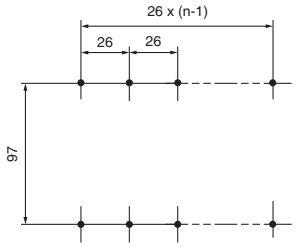


Panel drilling

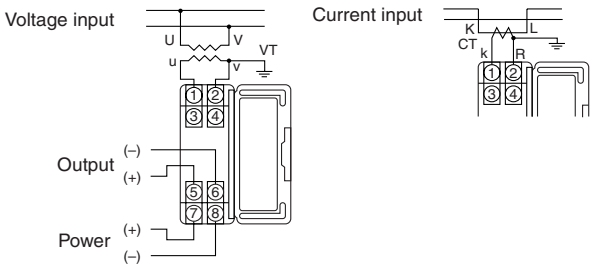
One-unit mounted



n-unit mounted



■ Wiring diagram



CN232 and CN233 arresters (surge protective devices) for low voltage circuit

■ Description
Arresters (surge protective devices) protect devices connected to power supplies from lightning damage by absorbing inductive lightning surges from power supply.

■ Features
- Normal-mode surges and common-mode surges can be absorbed using only one arrester.
- Coordinated operation of 2 types of varistor enables extremely fast response to surges and a high level of surge absorption.
- Built-in thermal fuses prevent problems such as short-circuit due to deterioration of elements.
- Indicators for easy confirmation of device status (i.e., normal or malfunction)
- Integrated terminal construction reduces space and wiring requirements for easier handling of the arrester.
- Mount to rails, using screws, or to brackets for standardized distribution boards.
- Standard-feature terminal cover to protect against electrical shock

CN23232

CN23332

■ Applications
- Electronic devices, such as computers, measurement devices, and communications devices
- Inverters
- Electronic devices inside distribution boards (e.g., power distribution boards and lighting distribution boards)

■ Specifications

Type	Rated voltage (V)	Reference voltage V_{1mA} Line (V)	Reference voltage V_{1mA} Ground	Clamping voltage V_{1500A} Line (V)	Clamping voltage V_{1500A} Ground	Max. discharge current (kA) Line (kA)*	Max. discharge current (kA) Ground	Operating duty Testing voltage (V)	Operating duty Discharge current (A)
CN23211	Single phase, 2-wire 110	240 to 310	420 to 520	700 max.	1100 max.	5 2 times	10 2 times	110	3000 8/20µs
CN23212	Single phase, 2-wire 220	420 to 520	610 to 750	1100 max.	1500 max.	5 2 times	10 2 times	220	
CN23232	3-phase, 3-wire 220	420 to 520	610 to 750	1100 max.	1500 max.	5 2 times	10 2 times	220	
	Single phase, 3-wire 100/200								
CN2324E For common-mode surges	3-phase, 3-wire 440	–	1700 to 2000	–	3800 max.	–	10 2 times	440	
CN2324L For normal-mode surges	3-phase, 3-wire 440	800 to 1100	–	2000 max.	–	5 2 times	–	440	
CN23311	Single phase, 2-wire 110V	240 to 310	420 to 520	7000 max.	1000 max.	5 2 times	20 2 times	110	5000 8/20µs
CN23312	Single phase, 2-wire 220V	420 to 520	610 to 750	1100 max.	1500 max.	5 2 times	20 2 times	220	
CN23332	3-phase, 3-wire 220V	420 to 520	610 to 750	1100 max.	1500 max.	5 2 times	20 2 times	220	
	Single phase, 3-wire 100/200								
CN2334E For common-mode surges	3-phase, 3-wire 440V (Voltage to ground)	–	850 to 1100	–	2500 max.	–	20 2 times	440	

Note: * Waveform 8/20µs

■ Type number nomenclature
CN23 2 32

Rated voltage
- 11: Single-phase 2-wire, 110V
- 12: Single-phase 2-wire, 220V
- 32: 3-phase 3-wire, 220V
  Single phase 3-wire, 100/200V
- 4E: 3-phase 3-wire, 440V (for common-mode surges)
- 4L: 3-phase 3-wire, 440V (for normal-mode surges)

Discharge current (ground)
2: 10kA 3: 20kA

Basic type

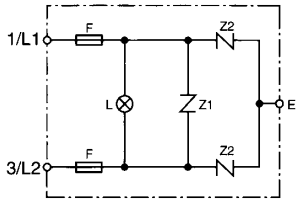
■ Ambient conditions
- Ambient operating temperature: –20 to 50˚C (No condensation)
- Relative operating humidity: 45 to 85% (No condensation)
- For indoor use

■ Ordering information
Specify the following :
1. Type number or ordering code

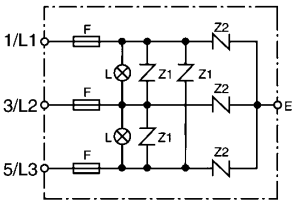
09

■ Internal circuit diagrams

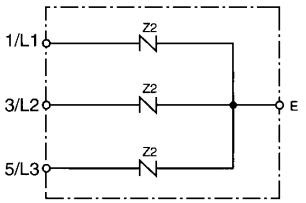
CN23211, CN23212
CN23311, CN23312



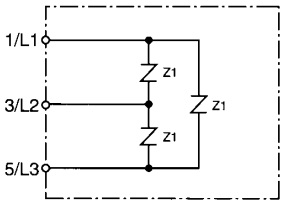
CN23232
CN23332



CN2324E
CN2334E



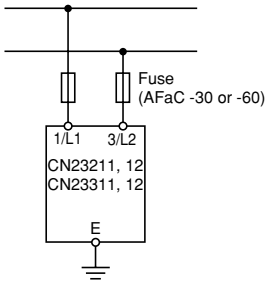
CN2324L



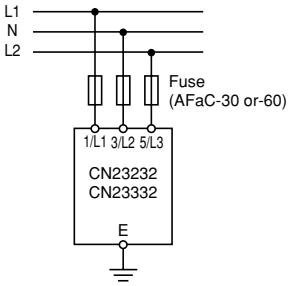
F: Thermal fuse
L: Indicator
Z_1, Z_2: Components for surge protective devices

■ Application examples

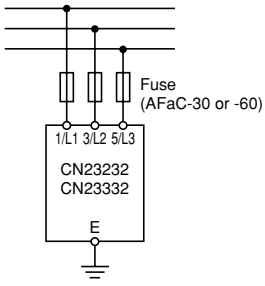
Single-phase 2-wire, 110V, 220V AC



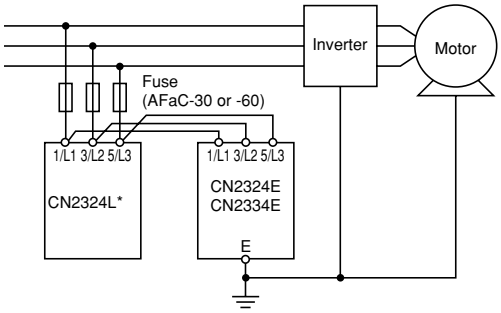
Single-phase 3-wire, 100/200V AC



3-phase 3-wire, 220V AC



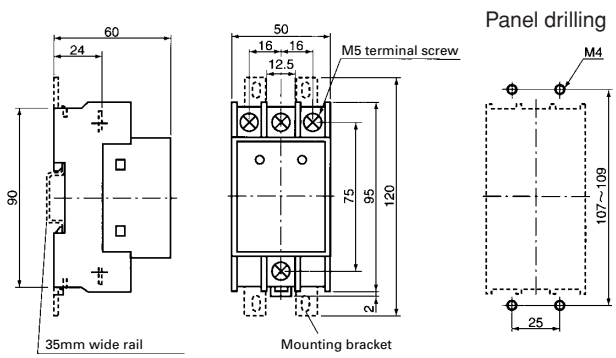
3-phase 3-wire, 440V AC



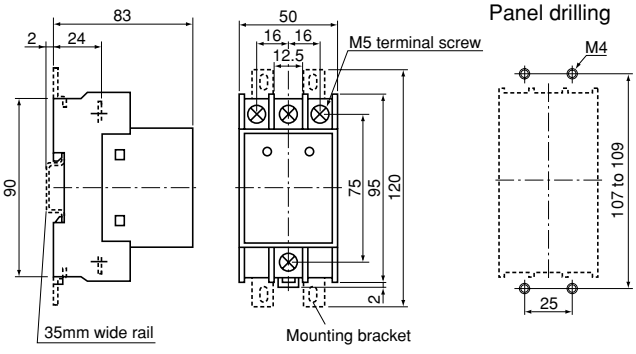
* Do not wire to the black-colored screw terminal.

■ Dimensions, mm

CN232



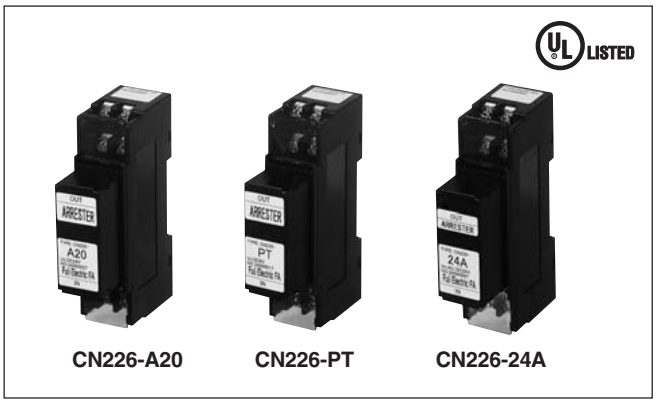
CN233



CN226 series arresters (surge protective devices) for signal line and control circuit

■ Features

- Highly effective surge suppression using protection method combining gas discharge tube, varistor, and avalanche diode.
- Large surge discharge current
- Fast response to surges reduces influence on device.
- A comprehensive lineup to suit all kinds of signal line applications (e.g., transducers, remote terminals, and sensors).
- Simple mounting to IEC rail.
- The arrester mounts to the terminal block using a plug-in connection for simple inspection and replacement. Signal lines are not opened even if the arrester is removed.



CN226-A20 CN226-PT CN226-24A

■ Specifications

• For signal line circuit

Type		CN226-A20	CN226-A50	CN226-TC	CN226-PT	CN226-PM	CN226-SP	CN226-24	CN226-48	CN226-100
Application		4-20mA	10-50mA	Thermocouple	Resistance thermometer	Potentiometr	Slow pulse	24V DC	48V DC	100V DC
Rated voltage		24V DC	48V DC	5V DC	8V DC	5V DC	12V DC	24V DC	48V DC	100V DC
Rated current		100mA						200mA		
Leakage current		5μA max.		10μA max.	2μA max.	10μA max.		5μA max.		
Reference voltage (1mA)	L-L	30V min.	61V min.	6.7V min.	11V min.	6.7V min.	14V min.	30V min.	60V min.	150V min.
Discharge voltage (1mA)	L-E	150V min.								180V min.
Clamping voltage	L-L	40V max.	100V max.	14V max.	22V max.	14V max.	25V max.	55V max.	130V max.	700V max.
(1,000A)	L-E	300V max.								800V max.
Internal resistance		10Ω ±10% (Single)			2Ω ±10% (Single)	10Ω ±10% (Single)		1Ω ±10% (Single)		
No. of ports		2-port, combination type								
Response time		0.1μs max.								
Max.discharge	L-L	5,000A								
current 8/20μs	L-E	10,000A								

• For control power supply circuit

Type		CN226-24A	CN226-48A	CN226-100A
Application		24V AC/DC	48V AC/DC	100V AC/DC
Rated voltage		24V AC/DC	48V AC/DC	100V AC/DC
Rated current		2A		
Leakage current		10μA max.		
Reference voltage (1mA)	L-L	40V min.	84V min.	180V min.
Discharge voltage (1mA)	L-E	300V min.		350V min.
Clamping voltage	L-L	250V max.	400V max.	
(1,000A)	L-E	400V max.		800V max.
Internal resistance		–	–	–
No. of ports		1-port, combination type		
Response time		0.1μs max.		
Max.discharge	L-L	2,000A		5,000A
current 8/20μs	L-E	2,000A		5,000A

■ Type number nomenclature

CN226 - □

Application circuit
- A20: 4 to 20mA
- A50: 10 to 50mA
- TC: Thermocouple
- PT: Resistance thermometer
- PM: Potentiometer
- SP: Slow pulse

- 24: Signal circuit 24V DC
- 48: Signal circuit 48V DC
- 24A: Control power supply circuit 24V AC/DC
- 48A: Control power supply circuit 48V AC/DC
- 100A: Control power supply circuit 110V AC/DC

Basic type

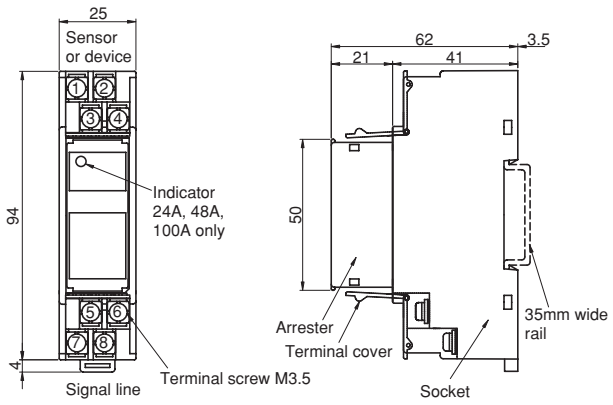
■ Ambient conditions

- Ambient operating temperature: –20 to 50˚C (No condensation)
- Relative operating humidity: 45% to 85% (No condensation)
- For indoor use

■ Ordering information

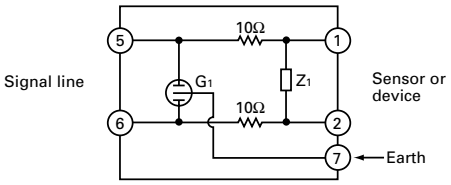
Specify the following:
1. Type number or ordering code

■ Dimensions, mm

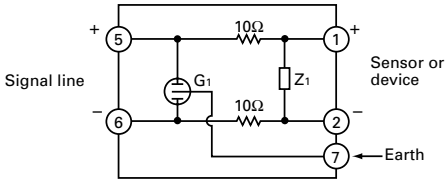


■ Internal circuit diagrams

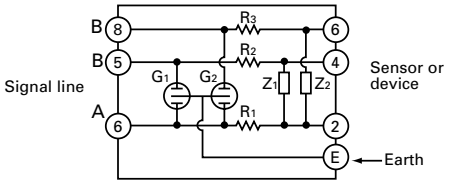
4-20mA, 10-50mA



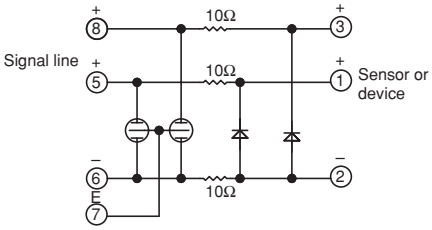
Thermocouple



Resistance thermometer

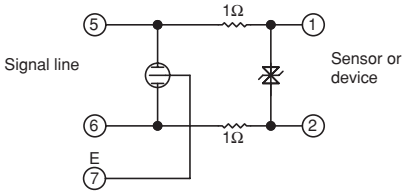


Potentio meter, slow pulse



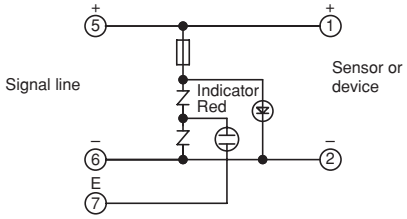
Signal line

24V, 48V DC

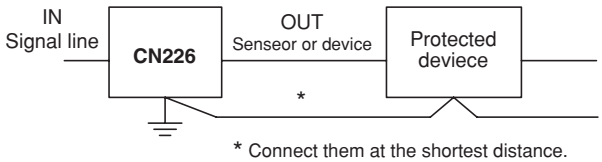


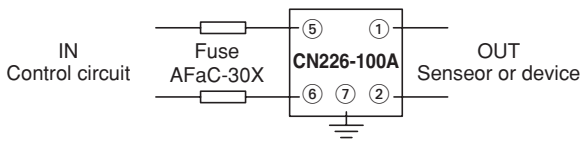
Control power supply

48V, 100V AC/DC



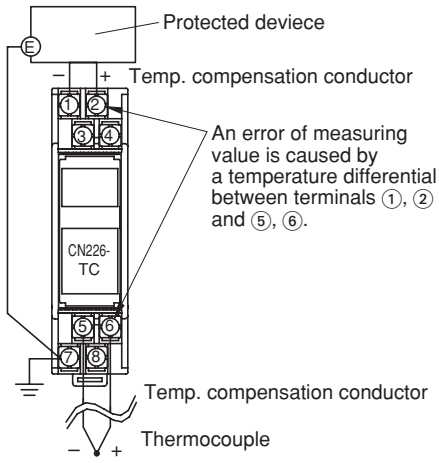
■ Examples of application effects





Note: When using an arrester CN226-100A, use a FUJI current-limiting fuse AFaC-30X for disconnection and short-circuit protection.

Note for thermocouple CN226-TC



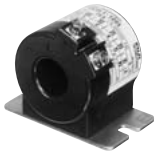
■ Description

The FUJI low-voltage instrument transformers are available as current transformers and potential transformers. These transformers have a *maximum voltage of 1150V and are suitable for circuits up to 600V. Windings have excellent mechanical, thermal and electrical performance since CT's are molded in polyester resin and VT's in epoxy resin. They are also moisture proof and have good insulation properties. The laminated iron core is made of oriented silicon steel strip. Both VT's and CT's have a class 1.0 accuracy rating, and conform to the requirements of JIS C 1731, JEC 1201 and other standards.
Current transformers are available in either through-type or primary-winding versions.

*Maximum voltage: $\frac{\text{Nominal voltage}}{1.1} \times 1.15$

■ Low voltage current transformers

CC3L



AF00-103

The CC3L type is a round hole through-type current transformer. The ratio can be changed according to the number of turns of the primary windings. It has excellent insulation characteristics and is both compact and light in weight.

CC3P

AF00-102

The CC3P type is a current transformer which has a primary winding thus facilitating connection work.
The installation angle can be varied from the standard position through 90°. They can be supplied with the primary current rating from 5 to 50 Amps.

CC3M

AF00-107

The CC3M type is a current transformer which has a flat terminal primary winding. It is used in the bus section of the load center or the control center. It can be mounted either horizontally or vertically.

CC2

AF99-266

The CC2D, 2C, and 2N current transformers are split-types. The CTs can be mounted to existing panels, such as control centers or load centers, to measure or monitor the wattage. These can be mounted without removing existing cables for easier installation. Rated primary currents are available from 5 to 1200A.

■ Low voltage potential transformers

CD 32, 34

AF00-215

The CD32 and CD34 transformers are low-voltage types. Types with a fuse of a 100kA interrupting capacity have been added to the series. This series is available for burdens of 15 and 50VA.

■ Varieties of instrument transformers

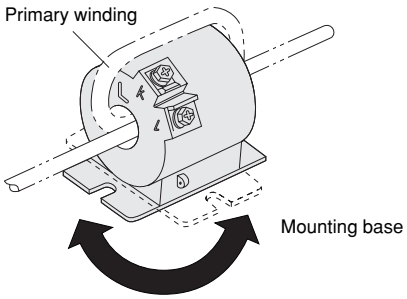
Description		Type	Burden	Primary current	Secondary current
CT	Round hole through-type	**CC3L1**	5VA	60–750A	5 or 1A
		CC3L2	15VA	100–750A	5 or 1A
		CC3L3	40VA	150–750A	5 or 1A, 5A
	With primary winding	**CC3P1**	5VA	1–50A	5 or 1A
		CC3P2	15VA	1–50A	5 or 1A
		CC3P3	40VA	1–50A	5 or 1A
	Rectangular hole through type	**CC3M1**	5VA	150– 600A	5A
		CC3M2	15VA	150–2000A	5 or 1A
		CC3M3	40VA	200–6000A	5 or 1A, 5A
	Split type	**CC2D**	0.2693mVA–0.5VA	5– 400A	7.34mA–1A
		CC2C	0.5VA	800–1200A	1A
		CC2N	0.5–2.5VA	100– 500A	5 or 1A

Description		Type	Burden	Primary voltage	Secondary voltage
VT	Single-phase	**CD32F**	15VA	220, 440V	110V
		CD32N	15VA	220, 440V	110V
		CD34F	50VA	220, 440V	110V
		CD34N	50VA	220, 440V	110V

09

CC3L round hole through-type current transformers

Primary current: 60 to 750A
Secondary current: 5A or 1A




CC3L AF00-103

■ **Description**

The CC3L transformers are round-hole through-types. A double-mold structure gives CC3L transformers excellent moisture resistance and good insulation properties.

The CT ratio can be changed freely by changing the number of primary winding turns. Consequently, these CTs are highly adaptable and economical.
Select from a lineup of three types with rated burdens of 5VA, 15VA, and 40VA.
The mounting base can be rotated anywhere in a 90˚ range to facilitate installation.

■ **Types and ratings**

Burden (VA)	Rated primary current (A)	Secondary current (A)	Accuracy class	Thermal limit current	Max voltage (kV rms.)	Dielectric strength (kV 1min)	Diameter of window (mm)	Mass (kg)	Type* (secondary current: □)
5	60 75	5 or 1	1.0	40 times rated primary current, 1 second	1.15	4.0	26	1.9	**CC3L1-060□** **CC3L1-075□**
	100 120 150 160 180						23	0.5	**CC3L1-100□** **CC3L1-120□** **CC3L1-150□** **CC3L1-160□** **CC3L1-180□**
	200							0.4	**CC3L1-200□**
	250 300						32	0.6	**CC3L1-250□** **CC3L1-300□**
	400							0.5	**CC3L1-400□**
	500	5 or 1					50	0.7	**CC3L1-500□**
	600 750							0.6	**CC3L1-600□** **CC3L1-750□**
15	100 120	5 or 1	1.0	40 times rated primary current, 1 second	1.15	4.0	26	2.0	**CC3L2-100□** **CC3L2-120□**
	150 160 180 200						25	1.0	**CC3L2-150□** **CC3L2-160□** **CC3L2-180□** **CC3L2-200□**
	240 250 300 400						32	0.6	**CC3L2-240□** **CC3L2-250□** **CC3L2-300□** **CC3L2-400□**
	500 600 750	5 or 1					50	0.8	**CC3L2-500□** **CC3L2-600□** **CC3L2-700□**
40	150 160 180 200	5 or 1	1.0	40 times rated primary current, 1 second	1.15	4.0	26	2.0	**CC3L3-150□** **CC3L3-160□** **CC3L3-180□** **CC3L3-200□**
	240 250 300 400						32	1.2	**CC3L3-240□** **CC3L3-250□** **CC3L3-300□** **CC3L3-400□**
	500 600 750	5					50	0.8	**CC3L3-5005** **CC3L3-6005** **CC3L3-7505**

Notes: * Replace the □ mark by the secondary current code. 5: 5A 1: 1A

■ Type number nomenclature

CC3L □ - □ □

Basic type

Burden

1: 5VA 3: 40VA
2: 15VA

Secondary current

1: 1A 5: 5A

Rated primary current *See page 09/58.*

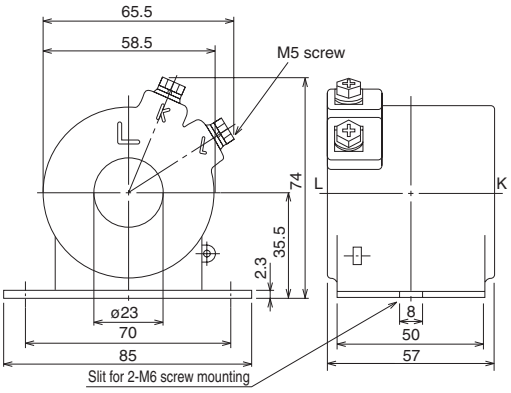
060: 60 ampere turn
I
750: 750 ampere turn

■ Ordering information

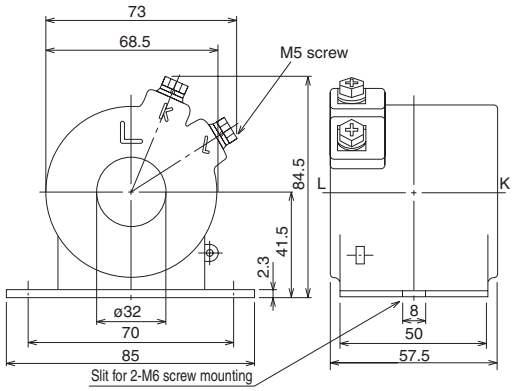
Specify the following:
1. Type number

■ Dimensions, mm

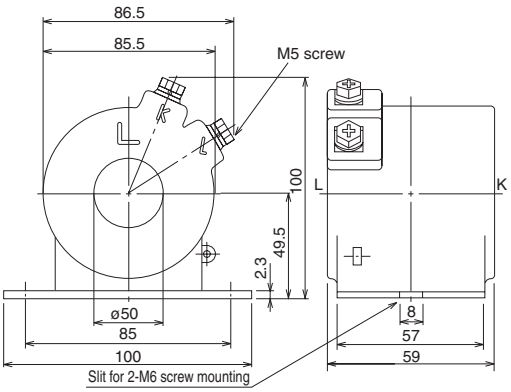
CC3L1: 100, 120, 150, 160, 180, 200A



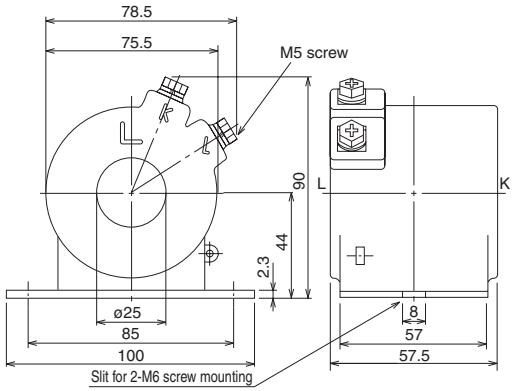
CC3L1: 250, 300, 400A
CC3L2: 240, 250, 300, 400A



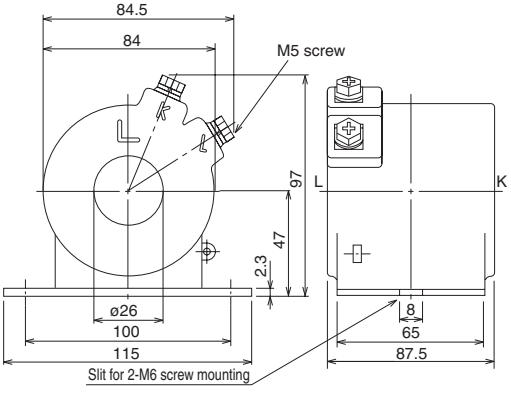
CC3L1, L2, L3: 500, 600, 750A



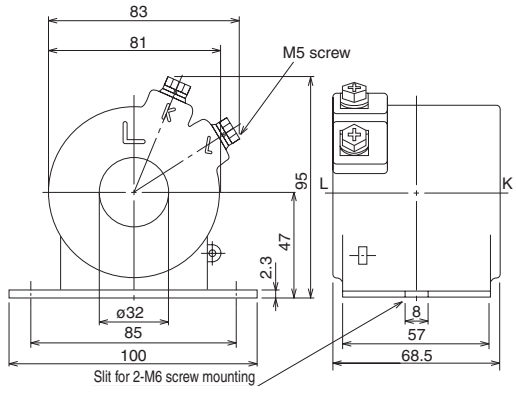
CC3L2: 150, 160, 180, 200A



CC3L1: 60, 75A CC3L2: 100, 120A
CC3L3: 150, 160, 180, 200A



CC3L3: 240, 250, 300, 400A



09

■ Number of turns in the primary winding and CT ratio

The following table lists the rated primary current, number of turns of primary windings, and the maximum nominal cross-section area of the 600V IV cable that can pass through. (ø indicates the diameter of a single wire.) The table data satisfies allowable current for a 600V IV cable at an ambient temperature of 40°C.

● 5VA CC3L1

Rated primary current (Ampere turn AT)	Primary current (A)	No. of turns	Primary conductor (mm^2)
60	10	6	5.5
	15	4	14
	20	3	22
	30	2	22
	60	1	150
75	15	5	8
	25	3	22
	75	1	150
100	10	10	ø2
	20	5	8
	25	4	14
	50	2	22
	100	1	150
120	15	8	5.5
	20	6	8
	30	4	14
	40	3	22
	60	2	22
	120	1	150
150	15	10	ø2
	25	6	8
	30	5	8
	50	3	22
	75	2	22
	150	1	150
160	20	8	5.5
	40	4	14
	80	2	22
	160	1	150
180	20	9	ø2
	30	6	8
	60	3	22
	180	1	150
200	20	10	ø2
	25	8	5.5
	40	5	8
	50	4	14
	200	1	150
250	25	10	8
	50	5	22
	125	2	60
	250	1	325
300	30	10	8
	50	6	14
	60	5	22
	75	4	38
	100	3	60
	150	2	60
	300	1	325
400	40	10	8
	50	8	14
	100	4	38
	400	1	325
500	50	10	22
	100	5	60
	125	4	100
	250	2	200
	500	1	500
600	60	10	22
	75	8	38
	100	6	60
	150	4	100
	200	3	150
	300	2	200
	600	1	500
750	75	10	22
	150	5	60
	750	1	200 2 pcs.

Note: The rated primary current is given for one turn of the primary winding.

● 15VA CC3L2

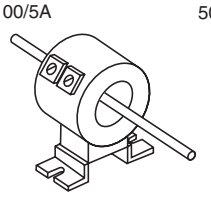
Rated primary current (Ampere turn AT)	Primary current (A)	No. of turns	Primary conductor (mm^2)
100	10	10	5.5
	20	5	14
	25	4	22
	50	2	38
	100	1	200
120	15	8	8
	20	6	14
	30	4	22
	40	3	22
	60	2	38
	120	1	200
150	10	15	3.5
	15	10	5.5
	25	6	8
	30	5	14
	50	3	22
	75	2	38
	150	1	200
160	20	8	8
	40	4	22
	80	2	38
	100	1	200
180	20	9	5.5
	30	6	8
	60	3	22
	90	2	38
	180	1	200
200	20	10	5.5
	25	8	8
	40	5	14
	50	4	22
	100	2	38
	200	1	200
240	30	8	8
	40	6	14
	60	4	38
	80	3	60
	120	2	60
	240	1	325
250	25	10	8
	50	5	22
	125	2	60
	250	1	325
300	30	10	8
	50	6	14
	60	5	22
	75	4	38
	100	3	60
	150	2	60
	300	1	325
400	40	10	8
	50	8	14
	100	4	38
	400	1	325
500	50	10	22
	100	5	60
	125	4	100
	250	2	200
	500	1	500
600	60	10	22
	75	8	38
	100	6	60
	150	4	100
	200	3	150
	300	2	200
	600	1	500
750	75	10	22
	150	5	60
	750	1	200 2 pcs.

● 40VA CC3L3

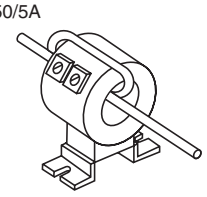
Rated primary current (Ampere turn AT)	Primary current (A)	No. of turns	Primary conductor (mm^2)
150	10	15	3.5
	15	10	5.5
	25	6	14
	30	5	14
	50	3	22
	75	2	38
	150	1	200
160	20	8	8
	40	4	22
	80	2	38
	160	1	200
180	20	9	5.5
	30	6	14
	60	3	22
	90	2	38
	180	1	200
200	25	8	8
	40	5	14
	50	4	22
	100	2	38
	200	1	200
240	40	6	14
	60	4	22
	80	3	38
	120	2	60
	240	1	325
250	25	10	8
	50	5	22
	125	2	60
	250	1	325
300	30	10	8
	50	6	14
	60	5	22
	75	4	38
	100	3	60
	150	2	60
	300	1	325
400	40	10	8
	50	8	14
	100	4	38
	400	1	325
500	50	10	22
	100	5	60
	125	4	100
	250	2	200
	500	1	500
600	60	10	22
	75	8	38
	100	6	60
	150	4	100
	200	3	150
	300	2	200
	600	1	500
750	75	10	22
	150	5	60
	750	1	200 2 pcs.

Example: 100AT, secondary 5A

• 1-ampere turn
100/5A

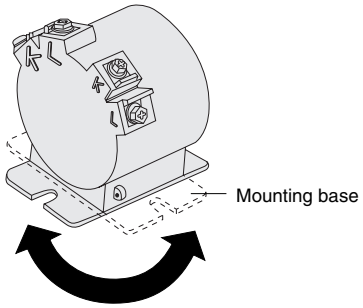


• 2-ampere turn
50/5A



CC3P current transformers with primary winding

Primary current: 5 to 50A
Secondary current: 5A or 1A




CC3P
AF00-102

■ **Description**

CC3P CTs support primary winding for easy wiring.
The mounting base can be rotated anywhere in a 90° range to facilitate installation.
A double-mold structure gives CC3P CTs excellent moisture resistance and good insulation properties.
Select from a lineup of three types with rated burdnes of 5VA, 15VA, and 40VA.

■ **Types and ratings**

Burden (VA)	Rated primary current (A)	Secondary current (A)	Accuracy class	Thermal limit current	Max. voltage (kV rms.)	Dielectric strength (kV 1 min.)	Mass (kg)	Type
5	1	5 or 1	1.0	40 times rated primary current	1.15kV	4.0kV	0.7	**CC3P1-001**□
	2							**CC3P1-002**□
	3							**CC3P1-003**□
	5							**CC3P1-005**□
	7.5							**CC3P1-7P5**□
	10							**CC3P1-010**□
	15							**CC3P1-015**□
	20							**CC3P1-020**□
	25							**CC3P1-025**□
	30							**CC3P1-030**□
	40	5 or 1	1.0		1.15kV	4.0kV	1.1	**CC3P1-040**□
	50							**CC3P1-050**□
15	1	5 or 1	1.0	40 times rated primary current	1.15kV	4.0kV	1.1	**CC3P2-001**□
	2							**CC3P2-002**□
	3							**CC3P2-003**□
	5							**CC3P2-005**□
	7.5							**CC3P2-7P5**□
	10							**CC3P2-010**□
	15							**CC3P2-015**□
	20							**CC3P2-020**□
	25							**CC3P2-025**□
	30							**CC3P2-030**□
	40							**CC3P2-040**□
	50							**CC3P2-050**□
40	1	5 or 1	1.0	40 times rated primary current, 1 second	1.15kV	4.0kV	1.1	**CC3P3-001**□
	2							**CC3P3-002**□
	3							**CC3P3-003**□
	5							**CC3P3-005**□
	7.5							**CC3P3-7P5**□
	10							**CC3P3-010**□
	15							**CC3P3-015**□
	20							**CC3P3-020**□
	30							**CC3P3-030**□
	40	5 or 1	1.0		1.15kV	4.0kV	1.2	**CC3P3-040**□
	50							**CC3P3-050**□

Notes: * Replace the □ mark by the secondary current code.
5: 5A 1: 1A

CT with primary winding/CC3P

■ Type number nomenclature

CC3P □ - □ □

Secondary current
1: 1A
5: 5A

Rated primary current

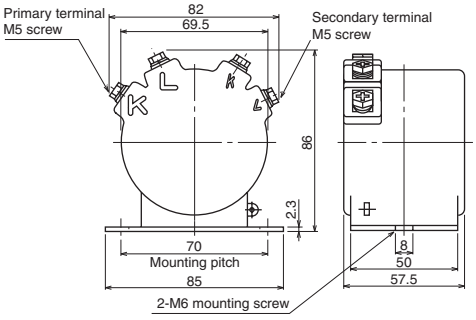
001: 1A	7P5: 7.5A	025: 25A
002: 2A	010: 10A	030: 30A
003: 3A	015: 15A	040: 40A
005: 5A	020: 20A	050: 50A

Burden
1: 5VA
2: 15VA
3: 40VA

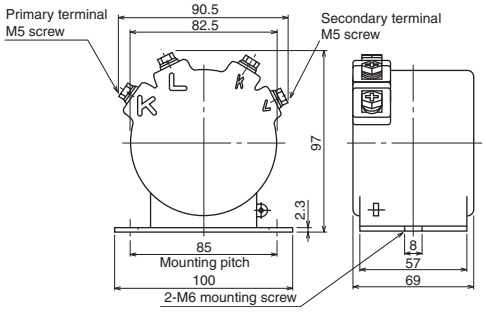
Basic type

■ Dimensions, mm

CC3P1: 1 to 30A



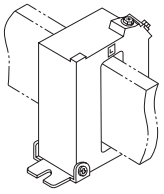
CC3P1: 40, 50A CC3P2, CC3P3



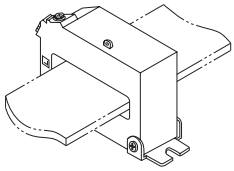
CC3M rectangular hole through-type current transformers
Primary current: 150 to 6000A
Secondary current: 5A

■ Description

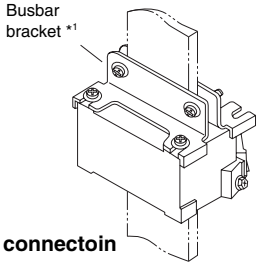
CC3M CTs can be mounted vertically or horizontally by changing the position of the mounting base. Also, the busbar can be mounted directly using a mounting bracket as illustrated, so a busbar mounting angle or holes are not required.



Vertical mounting



Horizontal mounting



Busbar connectoin

CC3M

AF00-107

■ Types and ratings

Burden (VA)	Rated primary current (A)	Secondary current (A)	Accuracy class	Thermal limit current	Max. voltage (kV rms.)	Dielectric strength (kV 1 min.)	Mass (kg)	Type
5	150	5	1.0	40 times rated primary current	1.15kV	4.0kV	2.1	**CC3M1-1505**
	200 300						1.1	**CC3M1-2005** **CC3M1-3005**
	400 500 600						0.6	**CC3M1-4005** **CC3M1-5005** **CC3M1-6005**
15	150	5 or 1	1.0	40 times rated primary current	1.15kV	4.0kV	2.1	**CC3M2-150□**
	200 250 300	5 or 1	1.0		1.15kV	4.0kV	1.1	**CC3M2-200□** **CC3M2-250□** **CC3M2-300□**
	400 500	5 or 1	1.0		1.15kV	4.0kV	0.6	**CC3M2-400□** **CC3M2-500□**
	600 750 800						0.5	**CC3M2-600□** **CC3M2-750□** **CC3M2-800□**
	1000 1200 1500 2000						1.2	**CC3M2-10X□** **CC3M2-12X□** **CC3M2-15X□** **CC3M2-20X□**
40	200 250	5 or 1	1.0	40 times rated primary current	1.15kV	4.0kV	2.3	**CC3M3-200□** **CC3M3-250□**
	300 400 500	5 or 1	1.0		1.15kV	4.0kV	1.1	**CC3M3-300□** **CC3M3-400□** **CC3M3-500□**
	600 750 800	5 or 1	1.0		1.15kV	4.0kV	1.1	**CC3M3-600□** **CC3M3-750□**
							0.9	**CC3M3-800□**
	1000 1200 1500 2000	5 or 1	1.0		1.15kV	4.0kV	1.3	**CC3M3-10X□**
							1.2	**CC3M3-12X□**
							1.5	**CC3M3-15X□** **CC3M3-20X□**
	2500 3000 4000	5	1.0		1.15kV	4.0kV	4.8	**CC3M3-25X5** **CC3M3-30X5**
							6.3	**CC3M3-40X5**
	5000 *2 6000 *2	5	1.0		1.15kV	4.0kV	14	**CC3M3-50X5** **CC3M3-60X5**

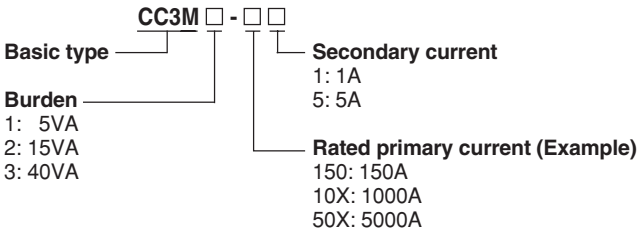
Notes: *1 Busbar mounting brackets are sold separately. When ordering, specify the CT type number and rated primary current. If the rated primary current is 1000 to 2000A, also specify the number of busbars required.
*2 Epoxy resin mold is used to isolate rated primary currents of 5000 or 6000A.

- CC3M CTs are mounted vertically at the factory.
- Replace the □ mark by the secondary current code. 5: 5A 1: 1A

09

Through-type CT/CC3M

■ Type number nomenclature



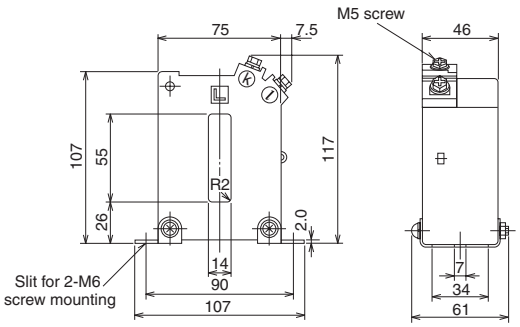
■ Ordering information

Specify the following:
1. Type number
2. Busbar mounting bracket if required.
   Primary current

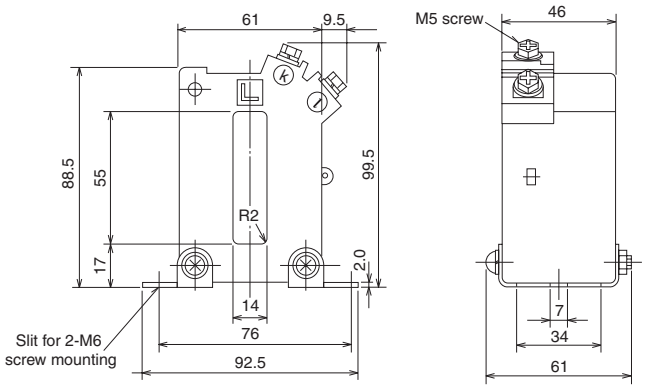
■ Dimensions, mm

● Vertical mounting

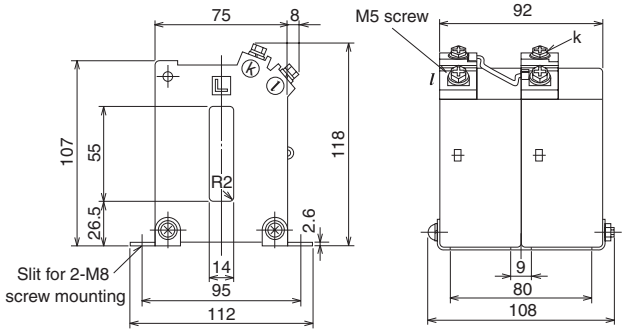
CC3M1: 150 to 300A CC3M2: 200 to 300A
CC3M3: 300 to 500A



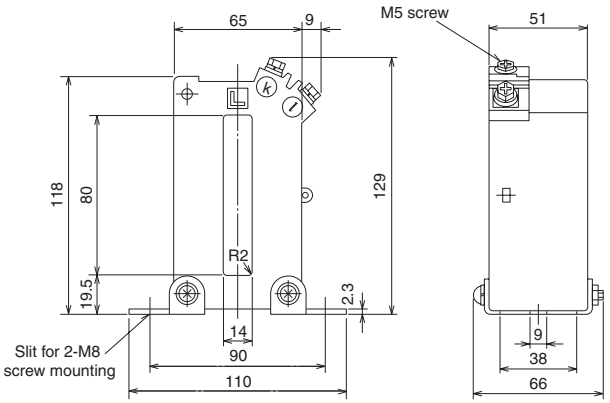
CC3M1: 400 to 600A CC3M2: 400 to 750A



CC3M2: 150A
CC3M3: 200, 250A

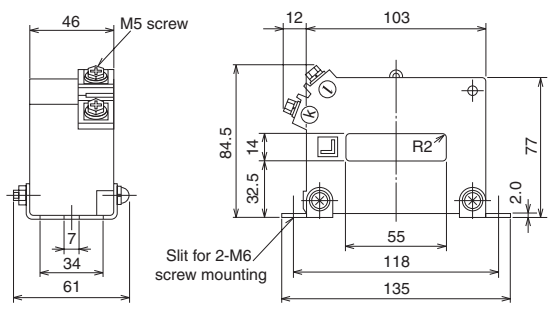


CC3M2: 800A CC3M3: 600 to 800A

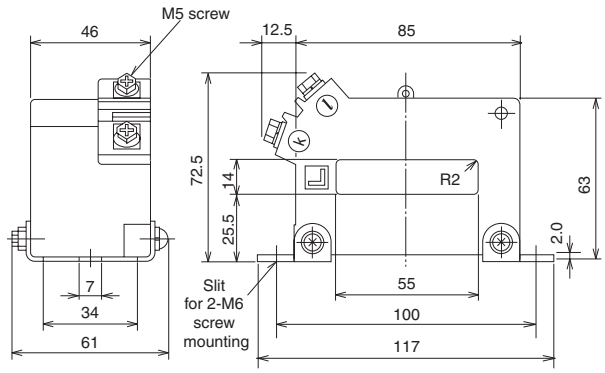


● Horizontal mounting

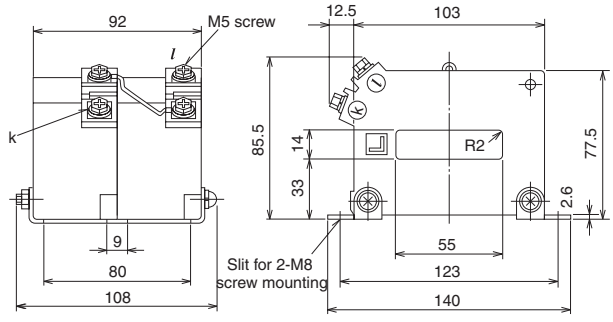
CC3M1: 150 to 300A CC3M2: 200 to 300A
CC3M3: 300 to 500A



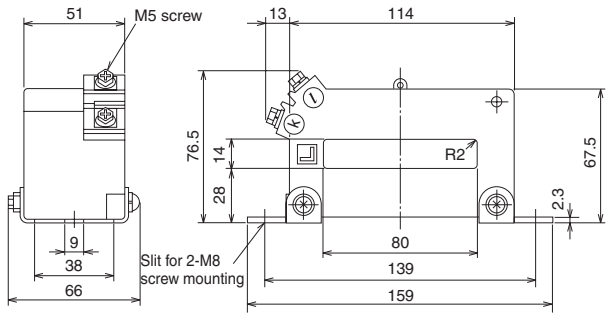
CC3M1: 400 to 600A CC3M2: 400 to 750A



CC3M2: 150A
CC3M3: 200, 250A



CC3M2: 800A CC3M3: 600 to 800A

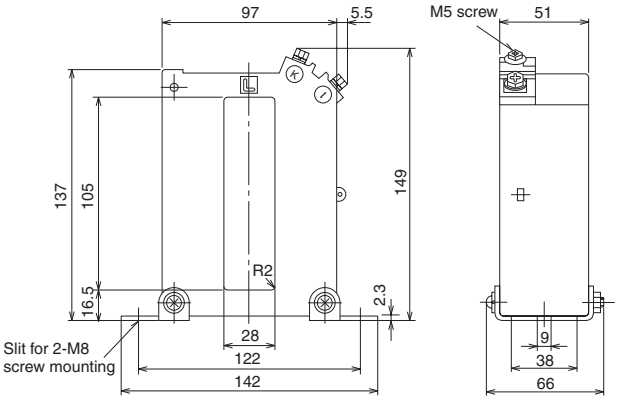


09

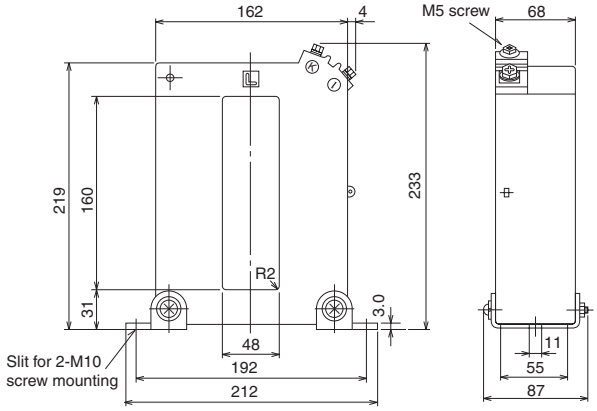
■ Dimensions, mm

● Vertical mounting

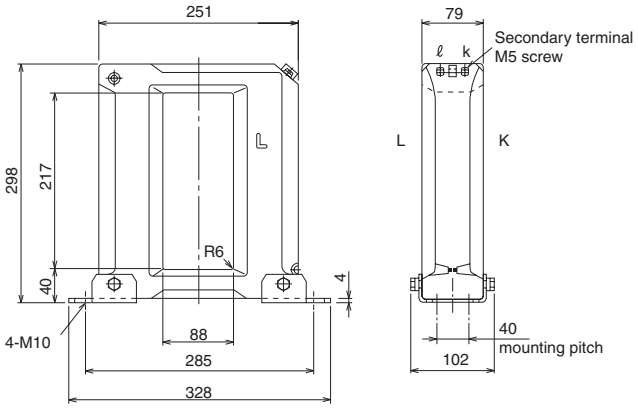
CC3M2, CC3M3: 1000 to 2000A



CC3M3: 2500 to 4000A

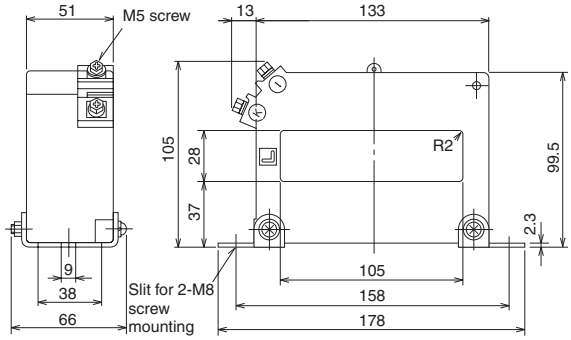


CC3M3: 5000, 6000A

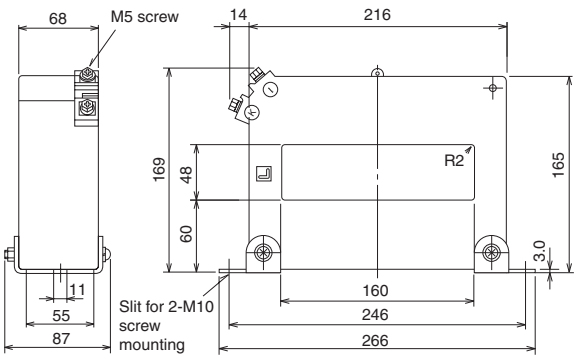


● Horizontal mounting

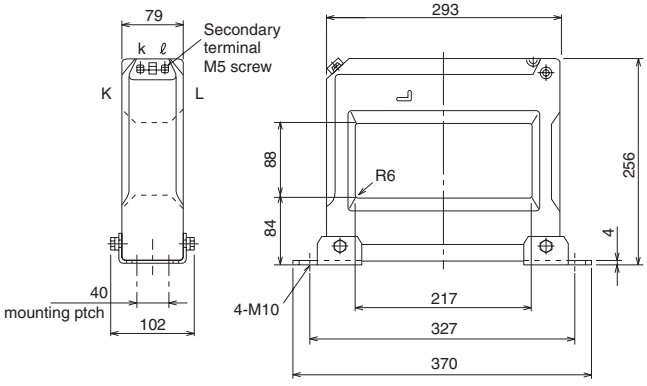
CC3M2, CC3M3: 1000 to 2000A



CC3M3: 2500 to 4000A



CC3M3: 5000, 6000A



■ Dimensions, mm

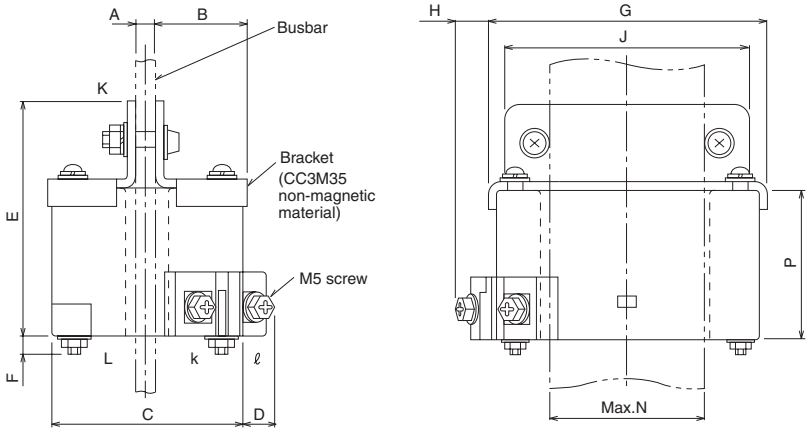
Direct busbar mounting

CC3M2 CTs with a rated primary current of 150A or CC3M3 CTs with a rated primary current of 200A, 250A or 4000 to 6000A cannot be mounted directly to a busbar because the CT is too heavy for the cross section of the busbar.

The busbar must be located in the center of the through hole of the CT. Be sure that the busbar does not come into contact with the wall of the through hole.

● Single busbar mounting

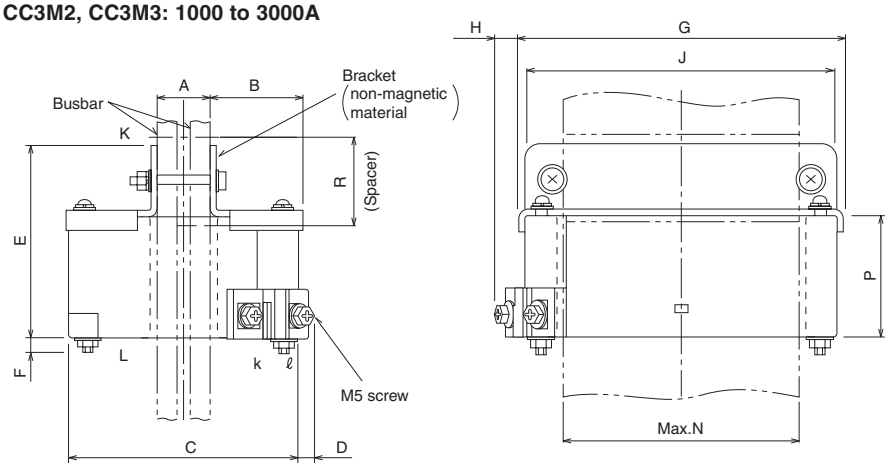
CC3M1: 150 to 600A CC3M2: 200 to 2000A CC3M3: 300 to 2000A



Type	Primary current (A)	Bracket type	A	B	C	D	E	F	G	H	J	N	P
CC3M1	150 to 300	**CC3M33**	5 to 10	33.5	75	7.5	74	6.5	110	8.5	90	50	46
	400 to 600	**CC3M22**	5 to 10	26.5	61	9.5	73.5	7	90.5	9.5	81	50	46
CC3M2	200 to 300	**CC3M33**	5 to 10	33.5	75	7.5	74	6.5	110	8.5	90	50	46
	400 to 750	**CC3M22**	5 to 10	26.5	61	9.5	73.5	7	90.5	9.5	81	50	46
	800	**CC3M34**	5 to 10	27.5	65	9	79	6.5	121	9	107	75	51
	1000 to 2000	**CC3M35**	6 to 12	43.5	97	5.5	80.5	7	139	10	129	100	51
CC3M3	300 to 500	**CC3M33**	5 to 10	33.5	75	7.5	74	6.5	110	8.5	90	50	46
	600 to 800	**CC3M34**	5 to 10	27.5	65	9	79	6.5	121	9	107	75	51
	1000 to 2000	**CC3M35**	6 to 12	43.5	97	5.5	80.5	7	139	10	129	100	51

● Two-busbar mounting

CC3M2, CC3M3: 1000 to 3000A



Primary current (A)	Bracket type	A	B	C	D	E	F	G	H	J	N	P	R
1000, 1200, 1500, 2000	**CC3M36**	15 to 24	39	97	5.5	80.5	7	139	10	129	100	51	Approx. 40
2500, 3000	**CC3M37**	15 to 45	72	162	4	102	17	223	11	210	150	68	Approx. 60

Split type current transformers, CC2
Primary current: 5 to 1200A
Secondary current: 7.34mA to 1A

■ Description

The CC2D and CC2C are split-type current transformers. The CT can be mounted to existing panels, such as control centers or load centers, to measure or monitor wattage. These CTs can be mounted without removing existing cables for easier installation.
Five rated burdens are available: 0.26mVA, 44.4mVA, 0.18VA, 0.5VA

Split square
CC2D

Split toroidal
CC2C

■ Types and ratings

Description	Burden	Rated primary current (A)	Secondary current	Dia. of hole (mm)	Overcurrent resistance (A)	Connection	Mass (g)	Type
Split square	0.2693mVA Load resistance 5Ω	5	7.34mA	10	40 In/1.0s	Heat-resistant IV cable AWG22 1000mm supplied	45	**CC2D81-0057**
	26.93mVA Load resistance 5Ω	50	73.4mA	10	10 In/1.0s		45	**CC2D81-0506**
	44.4mVA Load resistance 10Ω	200	66.67mA	24	40 In/1.0s	Heat-resistant IV cable AWG18 1000mm supplied	200	**CC2D65-2008**
	0.18VA Load resistance 10Ω	400	133.33mA	36			300	**CC2D54-4009**
Split toroidal	0.5VA Load resistance 5Ω	100 200 400	1A	36			300	**CC2D74-1001** **CC2D74-2001** **CC2D74-4001**
		800 1200	1A	60			500	**CC2C76-8001** **CC2C76-12X1**

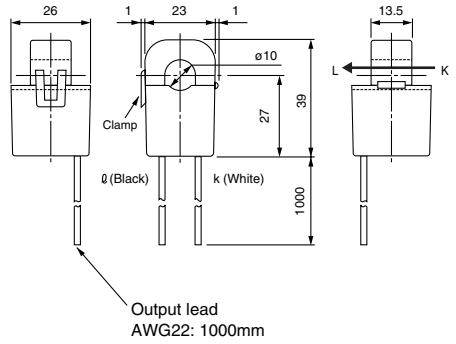
■ Performance

Application	Type	Ratio error	Phase difference	Insulation resistance	Dielectric strength	Output protection
For F-MPC	**CC2D81-0057**	±1% In	150' ±90' /In	100MΩ	2000V AC/1min, between	Not provided
	CC2D81-0506	±1.5%/0.2 In	180' ±120' /0.2 In	(500V DC megger)	sensor core and output	
	CC2D65-2008	±1% In	±60' /In	100MΩ	2000V AC/1min, between	Provided, built-in
	CC2D54-4009	±1.5%/0.2 In	±90' /0.2 In	(500V DC megger)	sensor core and output	clamping diode ±3Vp
General purpose	**CC2D74-1001**	±1% In ±1.5%/0.2 In	±80' /In ±100' /0.2 In	100MΩ (500V DC megger)	2000V AC/1min, between sensor core and output	Provided, built-in clamping diode ±1.4Vp
	CC2D74-2001	±1% In ±1.5%/0.2 In				
	CC2D74-4001	±1% In ±1.5%/0.2 In				
	CC2C76-8001	±1% In	±80' /In	100MΩ	2000V AC/1min, between	Provided, built-in
	CC2C76-12X1	±1.5%/0.2 In	±100' /0.2 In	(500V DC megger)	sensor core and output	clamping diode ±1.4Vp

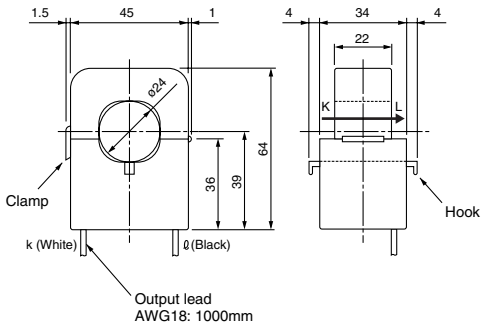
■ Dimensions, mm

• Split-toroidal

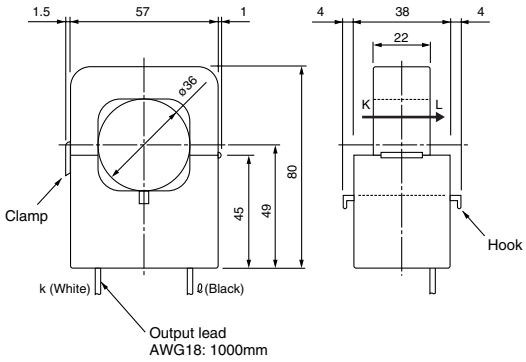
CC2D81



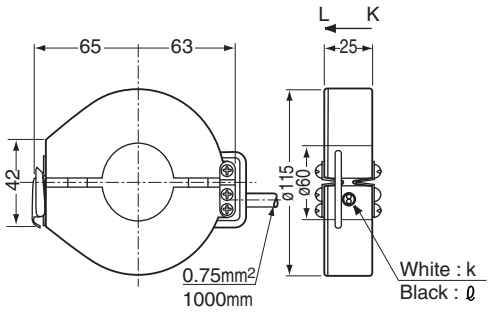
CC2D65



CC2D54, 74



CC2C76



■ Ordering information

Specify the following:
1. Type number

09

CD32 and CD34 potential transformers
Primary: 220V, 440V
Secondary: 110V

■ Description

The CD32 and CD34 transformers are of double-mold structure that provide excellent characteristics, such as thermal resistance and moisture resistance.
VTs with a fuse of a 100kA interrupting capacity have been added to the series.
The accuracy class of a type with a rated burden of 15VA is 1.0, 1P and that of a type with a rated burden of 50VA is 3.0, 3P.
A transparent insulation cover is available for the terminal and fuse mounting blocks.

CD32F With fuse

CD34N Without fuse

■ Types and ratings

Burden (VA)	Primary voltage (V)	Secondary voltage (V)	Accuracy class	Dielectric strength	Fuse* Type	Fuse* Rating	Applicable load (VA, Max.)	Mass (kg)	Type
15	220, 50/60Hz 440, 50/60Hz	110 110	1.0 · 1P	2000V, 1 minute 3000V, 1 minute	CD3F	600V, 2A(T) IC: 100kA	100	3.5	**CD32F-21** **CD32F-41**
	220, 50/60Hz 440, 50/60Hz	110 110	1.0 · 1P	2000V, 1 minute 3000V, 1 minute	Not provided		100	3.5	**CD32N-21** **CD32N-41**
50	220, 50/60Hz 440, 50/60Hz	110 110	3.0 · 3P	2000V, 1 minute 3000V, 1 minute	CD3F	600V, 2A(T) IC: 100kA	100	3.5	**CD34F-21** **CD34F-41**
	220, 50/60Hz 440, 50/60Hz	110 110	3.0 · 3P	2000V, 1 minute 3000V, 1 minute	Not provided		100	3.5	**CD34N-21** **CD34N-41**

Notes: T: Fuse for transformer protection. IC: Interrupting capacity
* When the load limit is 100VA, the maximum tolerance is 5% or less.

■ Characteristics

Type		**CD32F, 34F**
Primary voltage (V)		220, 440
Applicable load (VA, max.)	Continuos rating 2-second rating (For transformer protection)	100 200
Error at max. applicable load (%)	Continuos rating 2-second rating (For transformer protection)	-5 -10
Fuse	Rated current (A) Interrupting capacity (kA)	T2 100
% impedance voltage	% resistance voltage (%) % reactance voltage (%) % impedance voltage (%)	0.69 0.15 0.71

Note: The 2-second rating is the value provided considering a 10-cycle duty on condition that the current is provided for 0.2s at 1.8s intervals.

■ Type number nomenclature

CD3 □ □ - □ 1

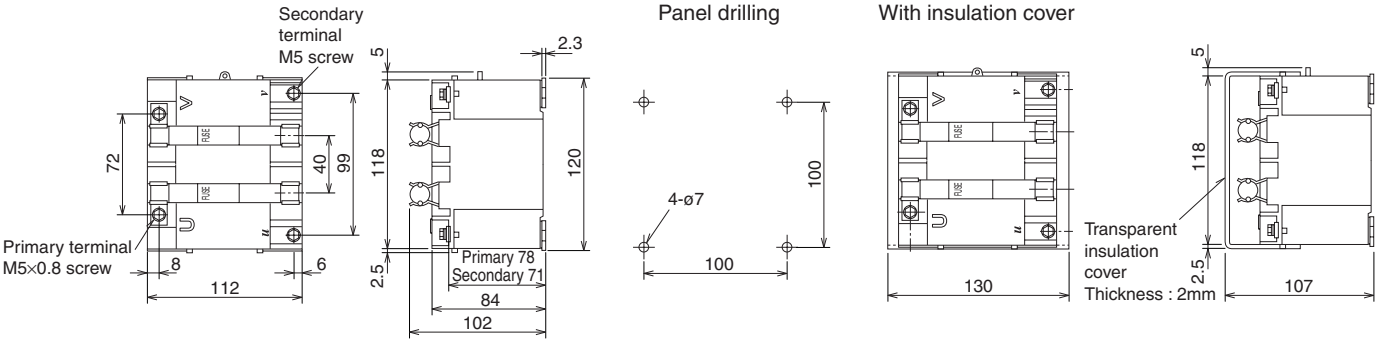
- **Secondary voltage**
  1: 110V
- **Primary voltage**
  2: 220V
  4: 440V
- **Fuse**
  F: Provided
  N: Not provided
- **Burden**
  2: 15VA
  4: 50VA
- **Basic type**

■ Ordering information

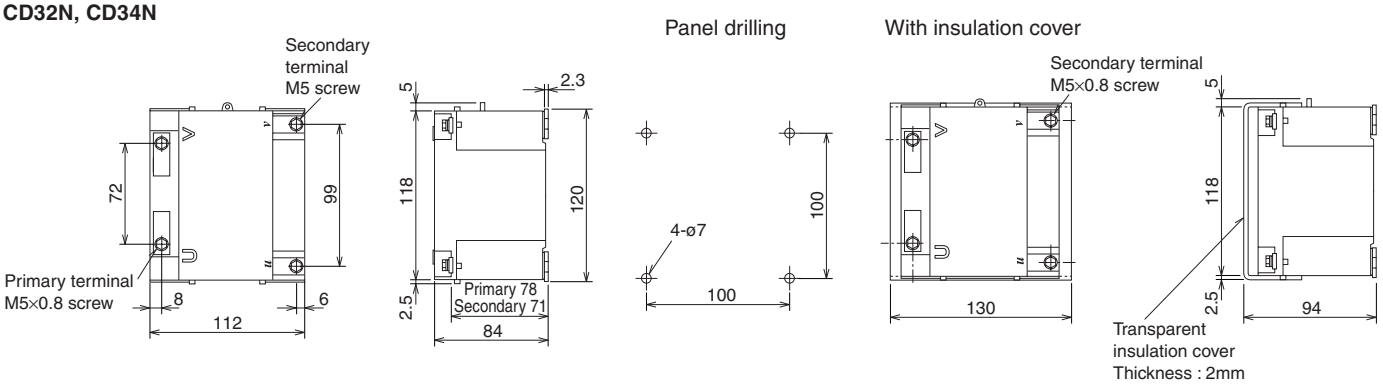
Specify the following:
1. Type number

■ Dimensions, mm

CD32F, CD34F



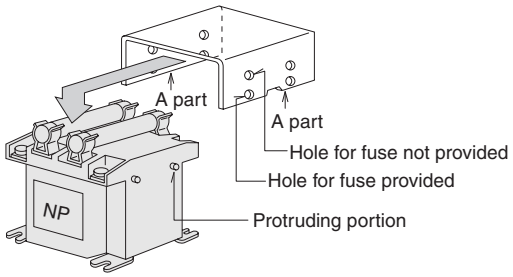
CD32N, CD34N



■ Optional accessories

• Insulation cover

Type: **CD3C**
Applicable VT: CD32, 34



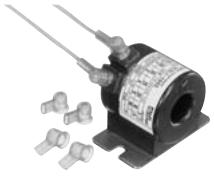
Mounting insulation cover
Slightly open the A-part of the insulation cover outward. Mount the cover to the VT so that the protruding portions of the VT are inserted into the holes of the insulation cover.

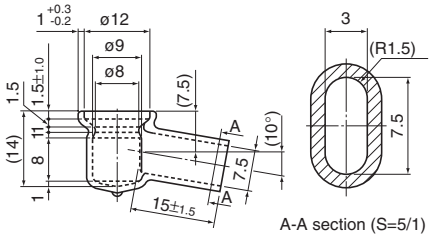
• Insulation caps for low-voltage current transformer

Type: **SB-4064-23**
Applicable CT: CC3L, CC3P and CC2N

Insulation caps can be mounted without removing the crimp terminals on the CT.
The terminals are completely covered with the insulation caps so that no live part is exposed.
These caps are translucent to that the terminal connections can be checked externally.

Dimensions, mm


AF00-170



A-A section (S=5/1)

09

Watthour and varhour meters

■ Description

It is essential that electricity meters used for billing purposes retain a high standard of accuracy over long period of operation as well as requiring little attention.
These meters have earned an excellent reputation for their extreme accuracy, rugged construction and stable performance in extended service often in unfavorable conditions. This has been achieved through FUJI's high standards of production combined with the efforts of its R and D laboratories, which have made it possible to produce quality meters in volume at competitive prices with early delivery.
FUJI watthour meters have been developed in close cooperation with leading power companies and are capable of meeting all legal, mechanical and electrical requirements.

■ Design features – F series

• Block construction

FUJI watthour meters are built on the 'block' system. When sections require inspection or replacement single elements can be detached without disturbing the other parts of the meter. And guide points make sure that components are accurately returned to their original positions. FUJI meters are simple to adjust, repair and service.

• High dielectric strength – Low current requirements

The driving elements and voltage coils have high dielectric strength to guard against impulse and short circuits. The drive has a low friction value and draws very little current in operation.

• Low watt losses

Both voltage and current coil laminated cores are fabricated from high quality silicon electric steel strip. This results in an improved electromagnetic performance and reduced power losses.
The shape and position of the cores are so arranged to produce the most effective magnetic flux.

• Precision mounted in a sturdy protective case

The metering element is affixed to a sturdy diecast aluminum alloy frame, and is installed in a protective sealable case of either metal or plastic. Driving elements, brake magnets, register, rotor assembly and other components are secured with fixing screws and are accurately located by means of setting guides.

• Low friction losses

The register and other moving parts use wear-resistant gears to reduce friction and so increase accuracy. Bearings require no oil.
Low friction torque, responsive electrical components and highly efficient mechanical parts all combine to reduce error and improve performance.

• Stable performance over a long service life

Two types of bottom bearing can be supplied. A highly efficient double jewelled ball bearing or a magnetic thrust bearing. Both types keep friction at negligible values even after prolonged use. A worm gear on the rotor shaft drives the register with a drive reduction ratio of 80:1.
Power losses are very small, and the large driving torque of the rotor is more than sufficient to operate the register train.

• Space-saving one-disk type three phase meter

FUJI watthour meters are more compact and lighter than conventional two-disk types. This results in neater, more efficient installations.

• Simple adjustment

All adjustments are micrometric and are easily carried out from the front of the meter using only a screw driver.

• Additional equipment

Various special purpose accessories are available which can easily be installed on the standard meter.

Standard type watthour meters

Single-phase 2-wire system

Surface mounting

SP-754

F11F

Flush mounting

SP-763

F13F-V

Single-phase 3-wire system

Surface mounting

SP-750

F21F

Flush mounting

SP-740

F23F-V

3-phase 3-wire system

Surface mounting

SP-750

F31F

Flush mounting

SP-740

F33F-V

3-phase 4-wire system

Surface mounting

SP-745

F41F

Watthour meters with pulse initiator

CP00-2789

F11F-K23

Precision-type watthour meters with pulse initiator, solid-state type

FP3C-S22VR

Watthour and varhour meters with pulse initiator, solid-state type

F3C-S22VR, FV3C-S22VR

- **Watthour meters with pulse initiator**

These meters transmit electric signals indicating the amount of power consumed to indicating, controlling or recording instruments at a distance by cable.
For further information see page 09/79.

- **Precision-type watthour meters with pulse initiator, solid-state type**

These are used for the accurate and reliable measurement of energy.
For further information see page 09/84.

- **Watthour and varhour meters with pulse initiator, solid-state type**

These are watthour and varhour meters with a wide variety of output pulses and easy-to-read display.
For further information see page 09/84.

Standard type watthour meters, single and 3-phase

	Phase and wiring	No. of elements	Loading capacity (%)	Rated voltage (V)	Basic current (A)	Surface mounting Type
 SP-754 **F11F**	Single-phase 2-wire	1	300	100, 110, 120, 127 200, 220, 230, 240 Other voltages between 100 and 440V are also available.	10 40	**F11F** **F12F**
	Single-phase 3-wire	2	300	100/200 110/220 115/230 Other voltages between 100/200 and 220/440V are also available.	10 15 20 40	**F21F** **F22F** **F22F** **F22F**
 SP-750 **F31F**	3-phase 3-wire	2	300	100, 200, 220, 240 Other voltages between 100 and 440V are also available.	10 15 20 40	**F31F** **F32F** **F32F** **F32F**
	3-phase 4-wire	3	300	127/220, 220/380 230/400, 240/415 Other voltages between 58/100 and 265/460V are also available.	10 15 20 40	**F41F** **F42F** **F42F** **F42F**

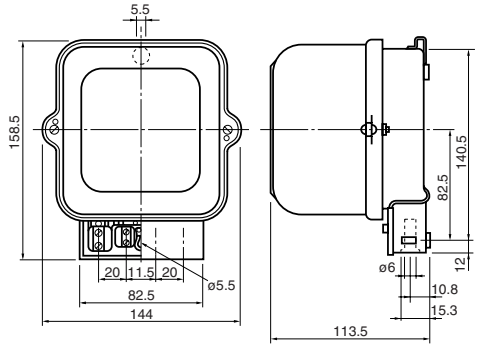
Instrument transformer operated type

	Phase and wiring	No. of elements	Loading capacity (%)	Rated voltage (V)	Max. current (A)	Surface mounting Type	Flush mounting Type
 SP-875 **F43F**	Single-phase 2-wire	1	120	100, 120, 200, 240 □/110*1	□/5*2	**F13F**	**F13F-V**
	Single-phase 3-wire	2	120	100	□/5*2	**F23F**	**F23F-V**
	3-phase 3-wire	2	120	200, □/110*1	□/5*2	**F33F**	**F33F-V**
	3-phase 4-wire	3	120	63.5/110, 100/173 110/190, 220/380 240/415, 265/440	□/5*2	**F43F**	**F43F-V**

Notes: *1 □ : VT primary voltage
*2 □ : CT primary current

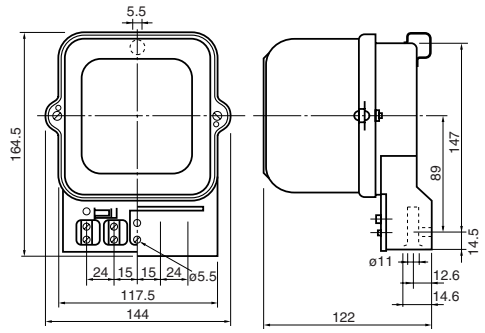
■ Dimensions, mm/surface mounting

F11F



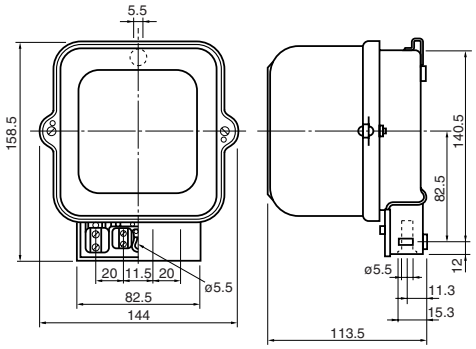
Mass: 1.75kg

F12F



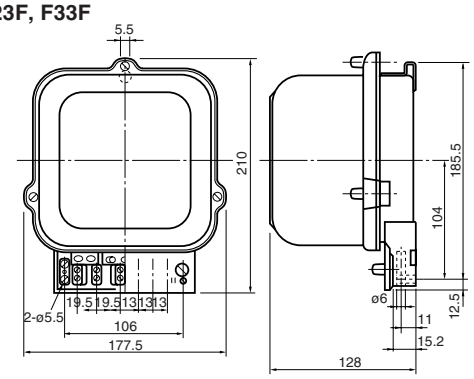
Mass: 2.3kg

F13F



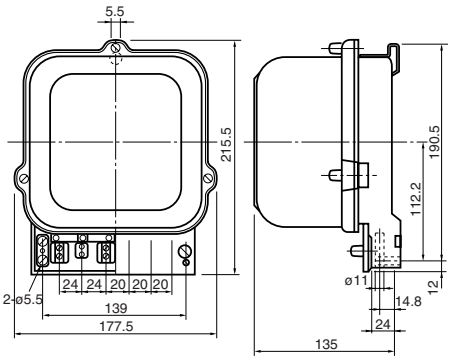
Mass: 1.75kg

F21F, F31F
F23F, F33F



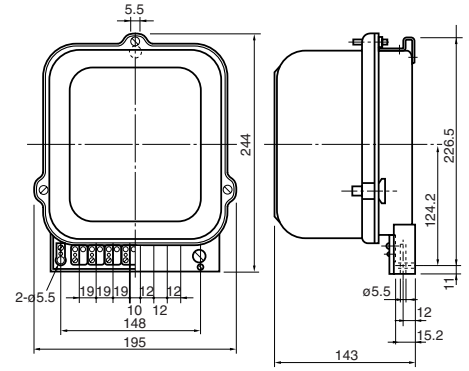
Mass: 3.3kg

F22F, F32F



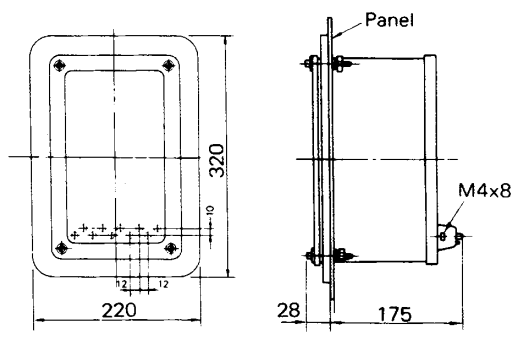
Mass: 4kg

F41F, F43F



Mass: 4.6kg

F42F



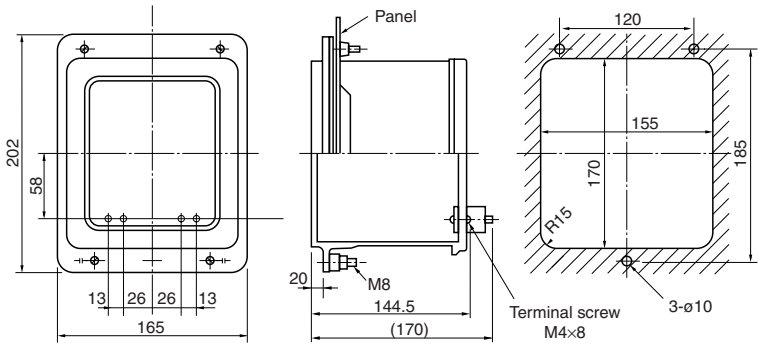
Mass: 5.6kg

09

■ Dimensions, mm/Flush mounting

F13F-V

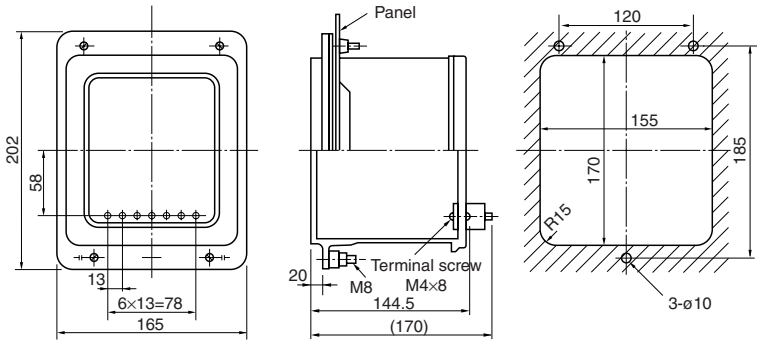
Panel cutting and drilling



Mass: 2.4kg

F23F-V
F33F-V

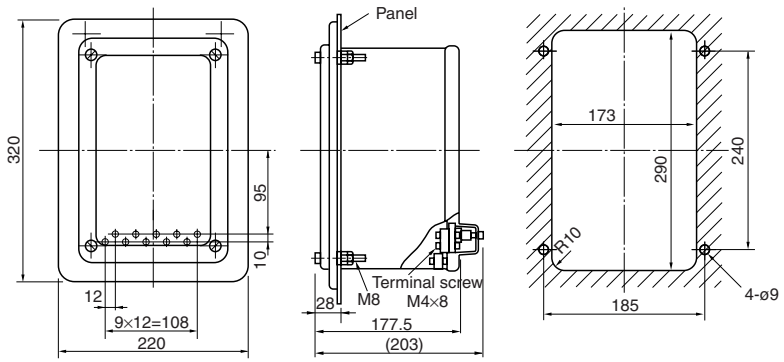
Panel cutting and drilling



Mass: 3.2kg

F43F-V

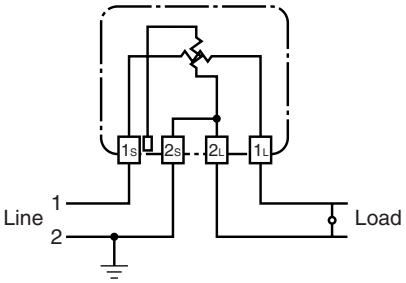
Panel cutting and drilling



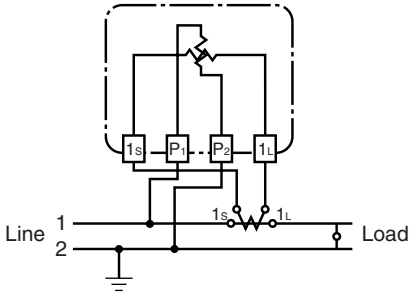
Mass: 4.2kg

■ Wiring diagrams/Surface mounting

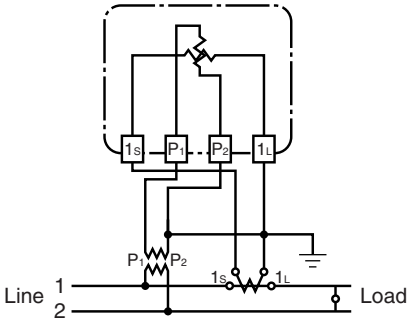
1φ 2W F11F, F12F
Without VT, CT



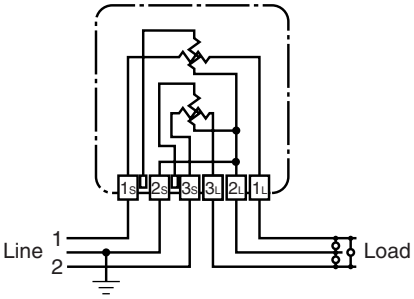
1φ 2W F13F
Connection to CT



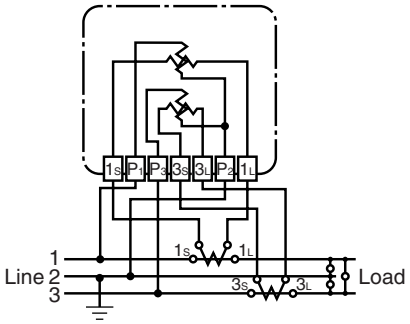
Connection to VT and CT



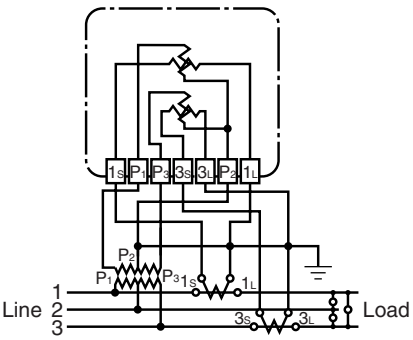
1φ 3W F21F, F22F
3φ 3W F13F, F32F
Without VT, CT



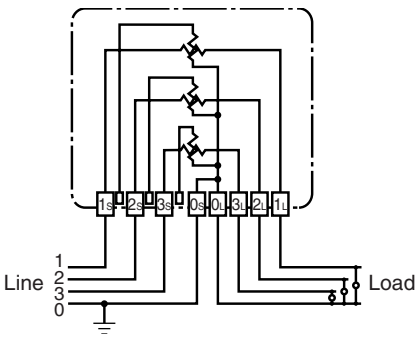
1φ 3W F23F
3φ 3W F33F
Connection to CT



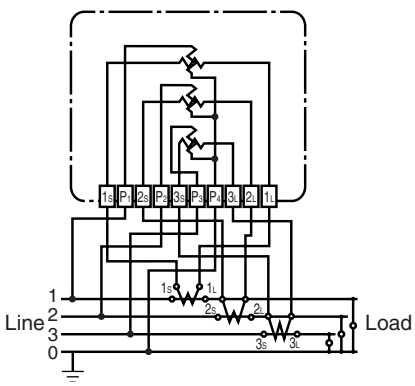
3φ 3W F33F
Connection to VT and CT



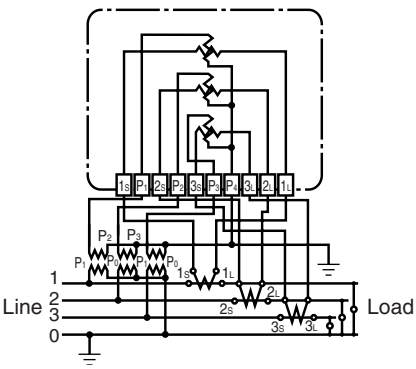
3φ 4W F41F
Without VT, CT



3φ 4W F43F
Connection to CT



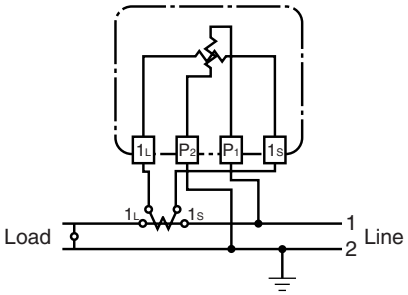
Connection to VT and CT



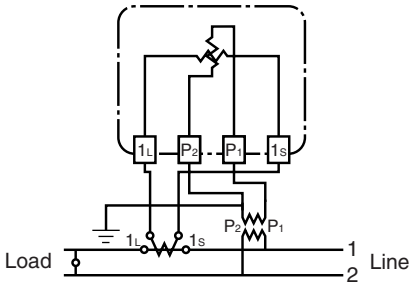
09

■ Wiring diagrams/Flush mounting

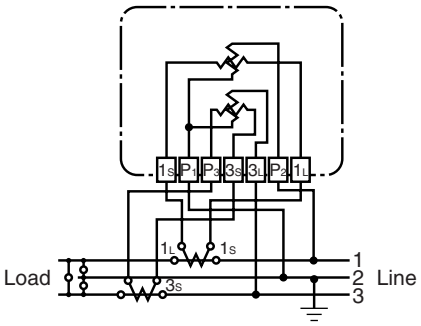
1φ 2W F13F-V
Connection to CT



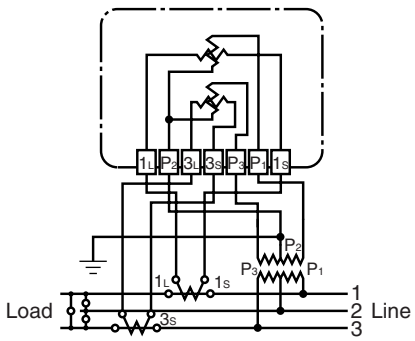
Connection to VT and CT



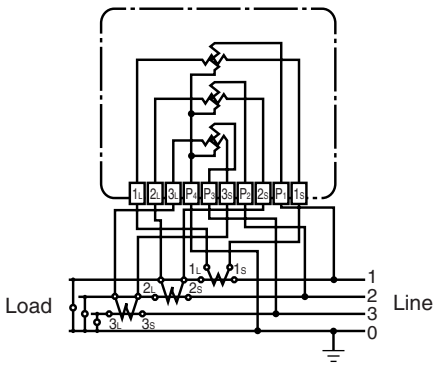
1φ 3W F23F-V
3φ 3W F33F-V
Connection to CT



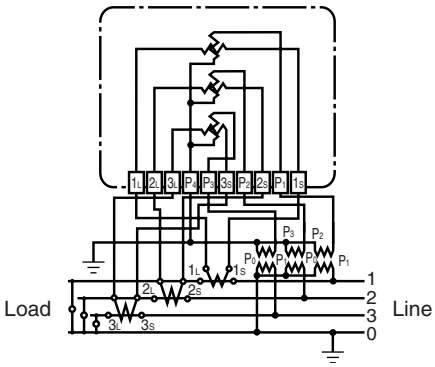
3φ 3W F33F-V
Connection to VT and CT



3φ 4W F43F
Connection to CT



Connection to VT and CT



Watthour meters with pulse initiators

■ Description

These meters are fitted with pulse initiators which transmit a pulse signal corresponding to the amount of power consumed. The pulse initiator consists of a signal disk on a rotor shaft and a pulse initiating circuit with a photo sensor. The disk is provided with a slot. When the rotor of the meter rotetes, the slot passes the sensor and the signal is output. Meters with pulse initiators are simply designed and robust so that they will give troublefree service over long periods with little attention. They are generally used with counters, recorders, maximum demand meters and other receiving equipment.

CP00-2789
F11F-K23

SP-740
F23F-K23V

SP-745
F41F-K23

kWh meters

Phase and wiring	Class	Max. current (A)	Rated voltage (V)	Frequency (Hz)	Pulse initiator and rating	Surface mounting Type	Flush mounting Type
1φ2W	2.0	30	100, 120, 200, 240	50, 60	Contact: • PhotoMOS relay • 125V AC, 0.1A • 125V DC, 0.1A Pulse width: 1.05±0.05 sec.	**F11F-K23**	–
		120	100, 120, 200, 240	50, 60		**F12F-K23**	–
		*1 □/5	100, 120, 200, 240, □/110	50, 60		**F13F-K23**	**F13F-K23V**
1φ3W	2.0	30	100	50, 60		**F21F-K23**	–
		120	100	50, 60		**F22F-K23**	–
		*1 □/5	100	50, 60		**F23F-K23**	**F23F-K23V**
3φ3W	2.0	30	100, 200	50, 60		**F31F-K23**	–
		120	100, 200	50, 60		**F32F-K23**	–
		*1 □/5	100, 200; *2 □/110	50, 60		**F33F-K23**	**F33F-K23V**
3φ4W	2.0	30	100, 240	50, 60		**F41F-K23**	–
		120	100, 240	50, 60		**F42F-K23**	–
		*1 □/5	*2 □/63.5, 100, □/110, 240	50, 60		**F43F-K23**	**F43F-K23V**

Notes: *1 □: CT primary current *2 □: VT primary voltage

■ Engineering data

Type	Max. current (A)	Pulse initiator Fixed number	Power consumption (VA) Voltage circuit *1		60Hz Current circuit
F11F-K23	30	0.01, 0.1, 1kWh/pulse		2.3	1.0 *2
F12F-K23	120	0.1, 1, 10kWh/pulse		2.3	1.8 *2
F13F-K23	□/5	10^n kWh/pulse		2.5	2.8 *2
F21F-K23	30	0.01, 0.1, 1kWh/pulse	P_1–P_2	4.5	1.2 *2
			P_3–P_2	4.9	
F22F-K23	120	0.1, 1, 10kWh/pulse	P_1–P_2	4.5	1.8 *2
			P_3–P_2	4.9	
F31F-K23	30	0.1, 1, 10kWh/pulse	P_1–P_2	4.7	1.2 *2
			P_3–P_2	5.2	
F32F-K23	120	0.1, 1, 10kWh/pulse	P_1–P_2	4.7	1.8
			P_3–P_2	5.2	
F23F-K23	□/5	10^n kWh/pulse	P_1–P_2	4.5	2.9
			P_3–P_2	4.9	
F33F-K23	□/5	10^n kWh/pulse	P_1–P_2	4.7	2.9
			P_3–P_2	5.2	

■ Ordering information

Specify the following:
1. Type number or ordering code
2. Rated voltage, max. current and frequency
3. VT and CT ratio

Notes: *1 Refer to wiring diagrams
*2 At 50% of rated current

09

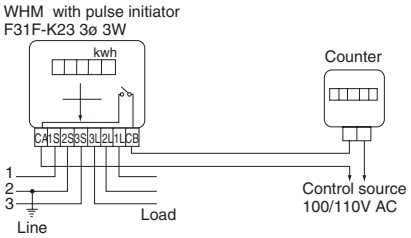
■ Engineering data

Type	Max. current (A)	Pulse initiator Fixed number	Power consumption (VA) 60Hz Voltage circuit *		Current circuit
F41F-K23	30	100V: 0.01, 0.1, 1kWh/pulse 240V: 0.1, 1, 10kWh/pulse	P_1–P_0 P_2–P_0 P_3–P_0	3.2 3.2 4.3	0.85 0.85 0.85
F42F-K23	120	0.1, 1, 10kWh/pulse	P_1–P_0 P_2–P_0 P_3–P_0	3.2 3.2 4.3	1.8 1.8 1.8
F43F-K23	□/5	10^n kWh/pulse	P_1–P_0 P_2–P_0 P_3–P_0	3.7 3.7 5.2	2.4 2.4 2.4

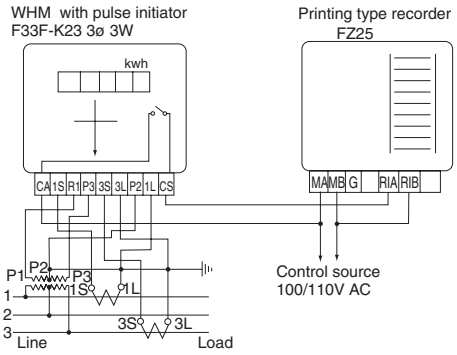
* Refer to wiring diagrams

■ Application examples

● **Combination with counter**

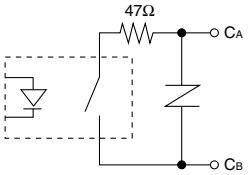


● **Combination with printing type recorder**



Connection with a receiver

Because a semiconductor relay is used as a pulse initiator output contact, a maximum 10Ω on-resistance occurs when the output contact is closed. The output contact is provided with a protective circuit comprising a resistor and surge suppressor as shown. If an inductive load has to be connected, add another surge suppressor on the load side.



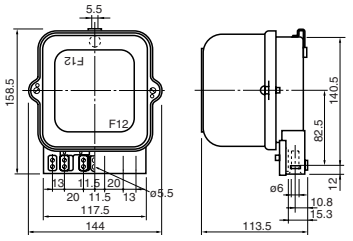
On-resistance (max. 10Ω)

■ Dimensions, mm

Surface mounting

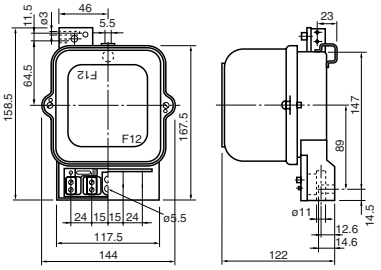
● **1φ2W**

F11F-K23, 30A



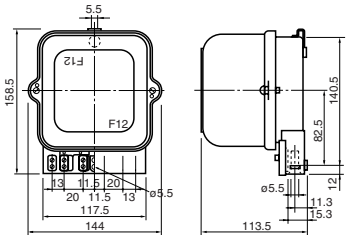
Mass: 2.1kg

F12F-K23, 120A



Mass: 2.5kg

F13F-K23, –/5A

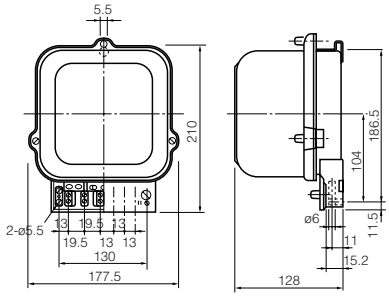


Mass: 2.1kg

● **1φ3W, 3φ3W**

F21F-K23, 30A

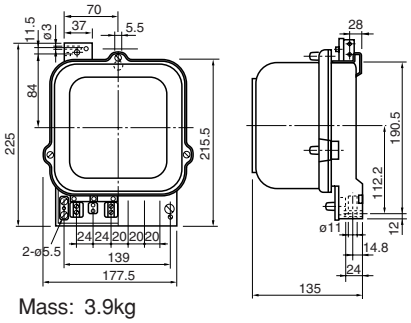
F31F-K23



Mass: 3.6kg

F22F-K23, 120A

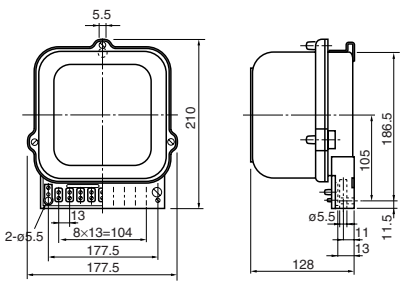
F32F-K23



Mass: 3.9kg

F23F-K23, –/5A

F33F-K23



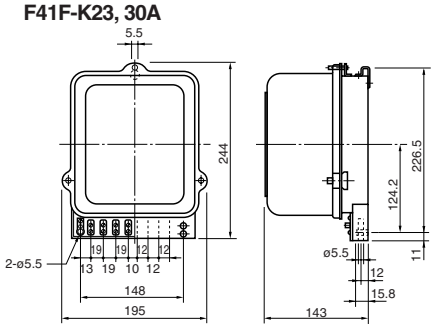
Mass: 3.6kg

■ Dimensions, mm

Surface mounting

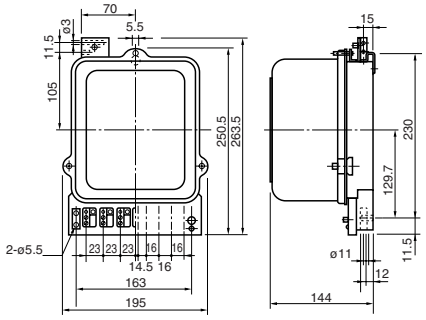
● 3φ 4W

F41F-K23, 30A



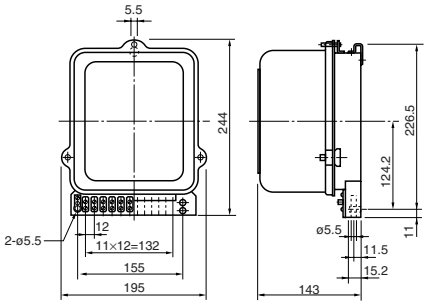
Mass: 4.7kg

F42F-K23, 120A



Mass: 5.7kg

F43F-K23, –/5A

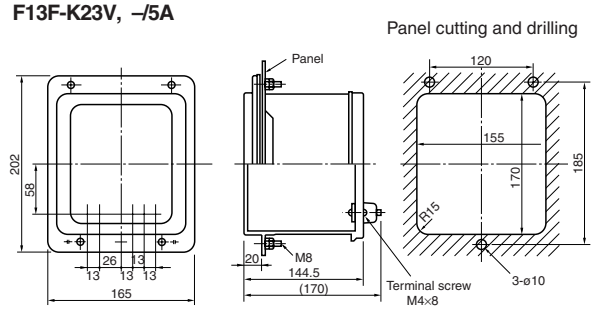


Mass: 4.7kg

Flush mounting

● 1φ 2W

F13F-K23V, –/5A

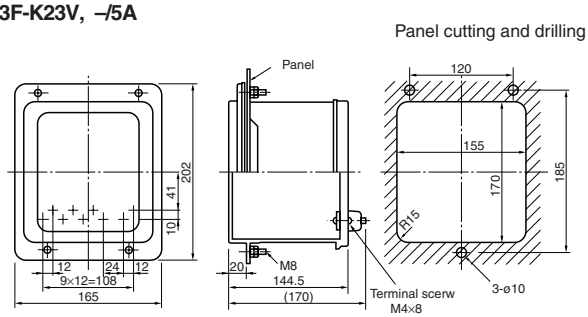


Mass: 2.8kg

● 1φ 3W, 3φ 3W

F23F-K23V

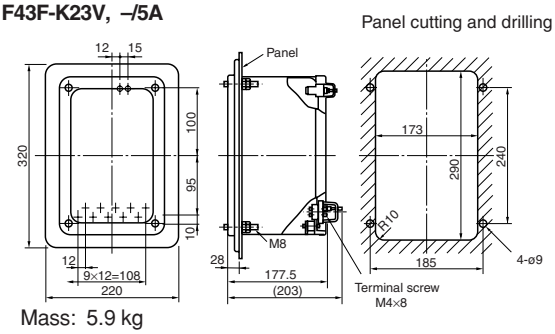
F33F-K23V, –/5A



Mass: 3.5kg

● 3φ 4W

F43F-K23V, –/5A



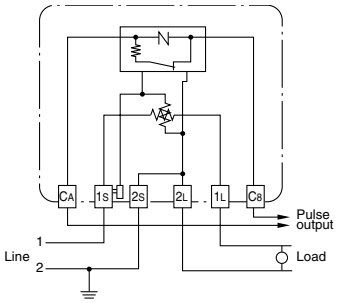
Mass: 5.9 kg

09

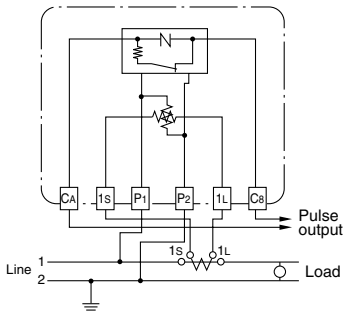
■ Wiring diagrams

● **1φ 2W**

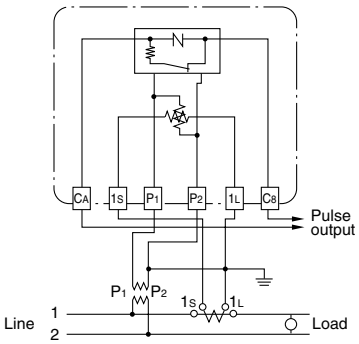
F11F-K23, 30A



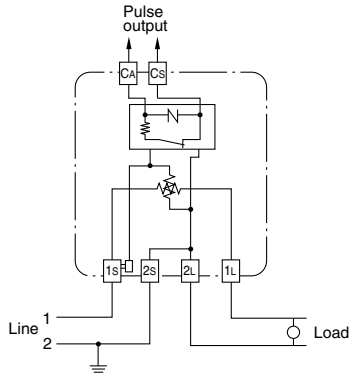
F13F-K23 Connection to CT



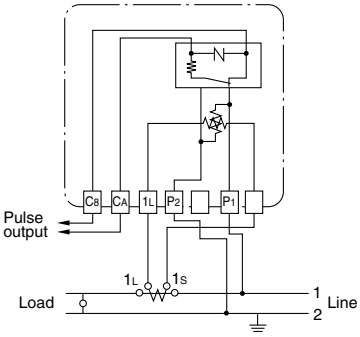
F13F-K23 Connection to VT and CT



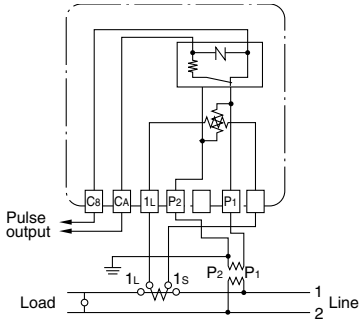
F12F-K23, 120A



F13F-K23V Connection to CT

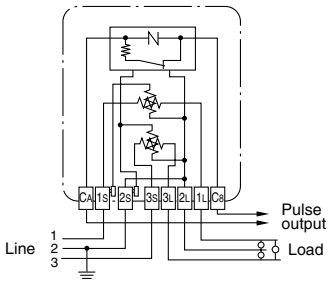


F13F-K23V Connection to VT and CT

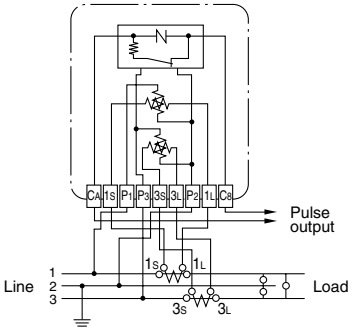


● **1φ 3W, 3φ 3W**

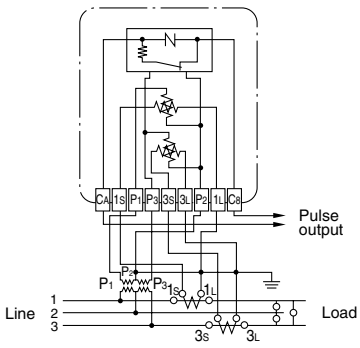
F21F-K23, 30A
F31F-K23



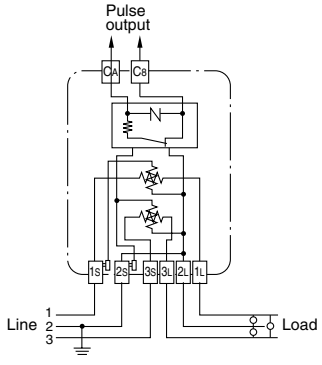
F23F-K23 Connection to CT
F33F-K23



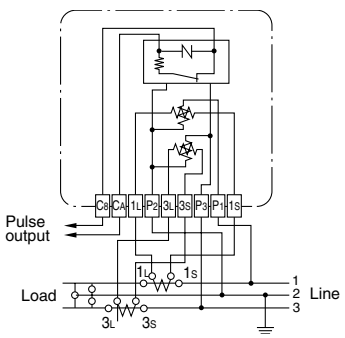
F33F-K23 Connection to VT and CT



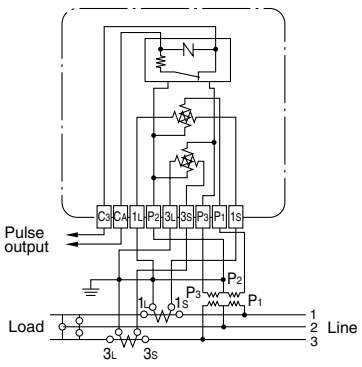
F22F-K23, 120A
F32F-K23



F23F-K23V Connection to CT
F33F-K23V



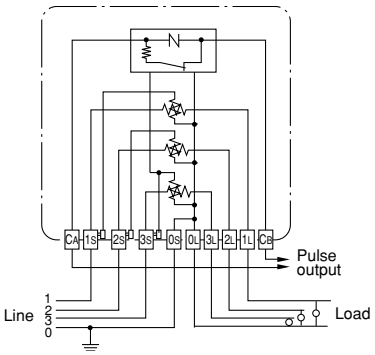
F33F-K23V Connection to VT and CT



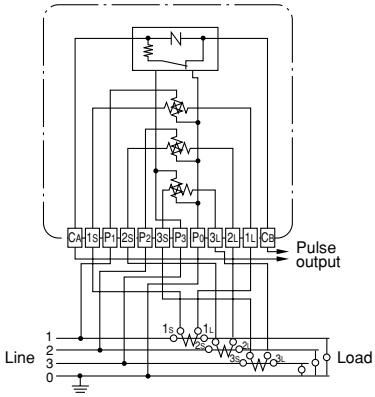
■ Wiring diagrams

● **3ϕ 4W**

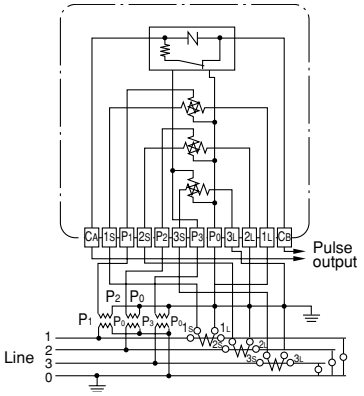
F41F-K23, 30A



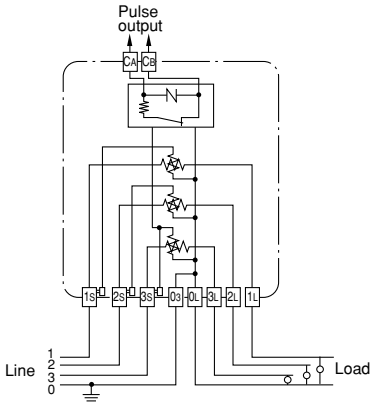
F42F-K23 Connection to CT



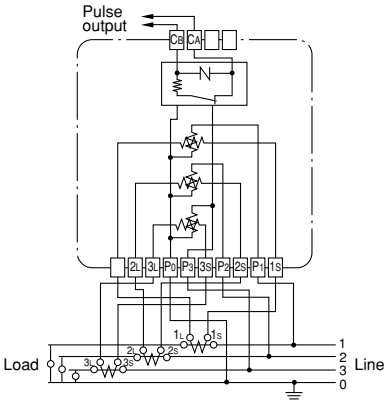
F43F-K23 Connection to VT and CT



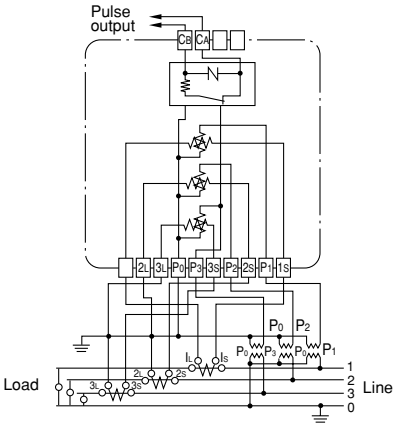
F42F-K23, 120A



F43F-K23V Connection to CT



F43F-K23V Connection to VT and CT



09

Watthour and Varhour Meters
With pulse initiator
Solid-state type

Watthour and varhour meters with pulse initiator

■ Description

These watthour and varhour meters are small in size –72mm wide, 144mm high and 99.5mm deep.
They have easy to read display and operation status indicator using a solid-state circuit.

■ Features

Very compact
- Thin type of 89mm deep (without the front panel)

Easy-to-read display
- Watthour/varhour count shown in large LCD figures
- Operation status indicators for counting, stop, reverse current, and operating
- Bar-type load indicator

Wide variety of output pulses
- Four types of signal outputs available
- One of four output pulse multiplying factors can be selected.
- The meter front has an output pulse terminal for calibration.

Easy parameter setting
- Preset operation can be displayed on the LCD for checking.
- Parameters can be preset even when power to the meter is off.
- Parameters can be preset for all combined transformation ratios.

F3C-S22VR

■ Ordering information

Specify the following:
1. Type number or ordering code
2. Rated voltage, max. current and frequency
3. VT and CT ratio

■ Specifications

Type	Normal watthour meter				Precision watthour meter		Varhour meter	
	F1C-S22VR	**F2C-S22VR**	**F3C-S22VR**	**F4A-S22VR**	**FP3C-S22VR**	**FP4C-S22VR**	**FV3C-S22VR**	**FV4A-S22VR**
Phase and wiring	1ϕ2W	1ϕ3W	3ϕ3W	3ϕ4W	3ϕ3W	3ϕ4W	3ϕ3W	3ϕ4W
Mounting	Flush mounting rear connection							
Rated voltage (V) *Replace the ■ mark in the ordering code by voltage code.*	■ □/110: 1 100: 2 200: 3 240: 5	100	■ □/110: 1 200: 3	■ □/63.5: 1 □/110: 2 100: 3 240: 5	110	■ □/63.5: 1 □/110: 2 240: 5	110	■ □/63.5: 1 □/110: 2 240: 5
Rated current (A)	□/5		□/5 or □/1					
Rated frequency (Hz)	50 or 60							
Multiplying factor	Integral power of 10 composite transformation ratio or 1/10 of composite transformation ratio							
Indication								
Measured value	6 digits (5 integer digits) 00000.0 (LCD display)							
Operation	Indicate loading state every 10% within the range 0 to 120% with bar indicator (LCD)							
Measuring state	Indicate measuring state with blinking speed (LCD display)							
Operating state	Indicate operation state (Operation, No-load, Reverse current, Power ON: LCD display)							
Burden Voltage circuit	P_1-P_2 : 1.0VA Other : 0.1VA			P_1-P_0 : 3.0VA Other : 0.1VA	P_1-P_2 : 1.0VA Other : 0.1VA			P_1-P_0 : 10VA Other : 0.1VA
Burden Current circuit	Each phase : 0.1VA							
Dimensions (mm)	72(W) × 144(H) × 99.5(D)							
Mass (g)	850			870	850	870	850	870

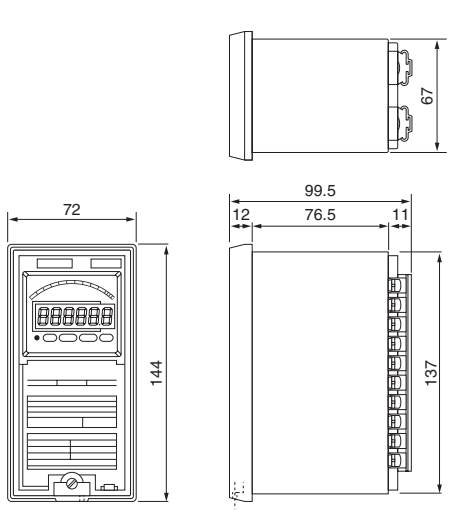
Note: □ : VT primary voltage or CT primary current

■ Pulse output

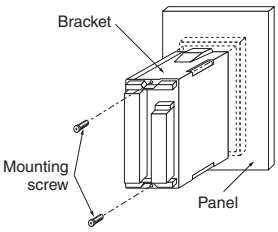
Type	Output	Contact capacity	Pulse width	Pulse factor	Output pulse unit
Output pulse 1	Non-voltage 1NO contact	125V AC 0.1A or less 125V DC 0.1A or less	200 ±50ms	Inherent pulse, or 10^n pulse	Composite transformation ratio / Inherent pulse constant
Output pulse 2	Open collector (Transistor)	35V DC 50mA or less	200 ±50ms or 1050 ±50ms	10^n pulse	Multiplying factor ×10, ×1, ×0.1, ×0.01
Output pulse 3	Open collector (Transistor)	35V DC 50mA or less	15 ±2ms	Inherent pulse	Composite transformation ratio / Inherent pulse constant
For test	Open collector (Transistor)	35V DC 50mA or less	32μs	Just same as the factor of the meters	Composite transformation ratio / Inherent pulse constant ×3600

Notes: 10^n of output 1 and pulse width of output pulse 2 are changed to 30 ±10ms by setting contents of composite transformation ratio and output pulse unit.

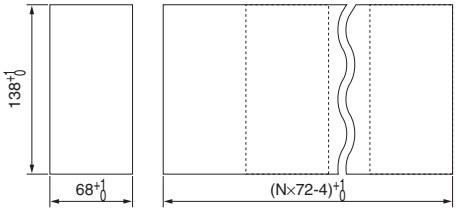
■ Dimensions, mm



■ Mounting



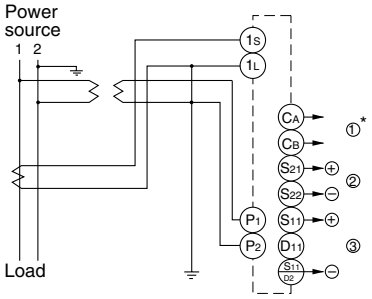
Panel cutting



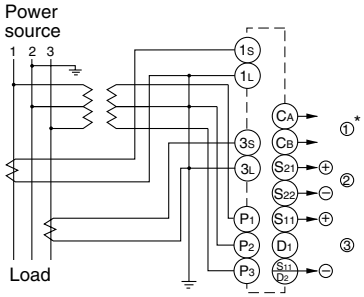
■ Wiring diagrams

● VT/CT operated meters

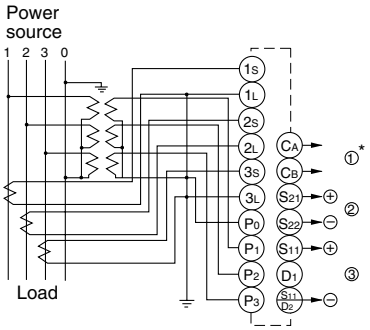
1ϕ 2W



1ϕ 3W / 3ϕ 3W

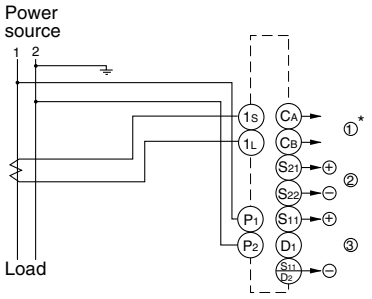


3ϕ 4W

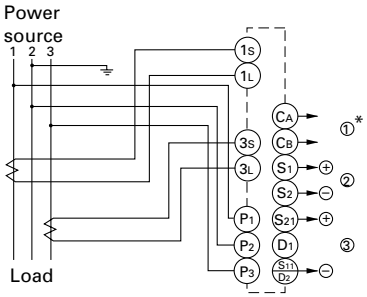


● CT operated meters

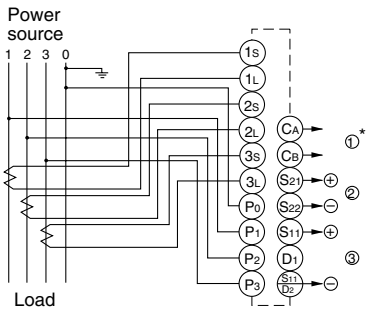
1ϕ 2W



1ϕ 3W / 3ϕ 3W

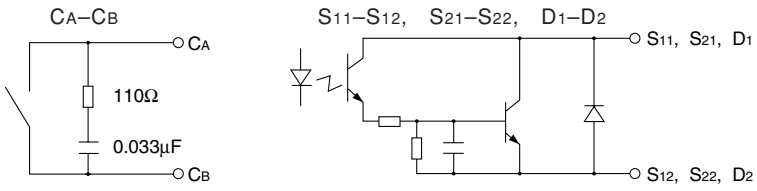


3ϕ 4W



Notes: * ① Non-voltage "NO" contact output
② Open collector output: Integral power of 10 (primary conversion)
③ Open collector output: Inherent (secondary conversion)

■ Circuits of pulse output initiating unit



09

Automatic power factor regulators QC06E and QC12E

Automatic power factor regulator QC06E, QC12E

■ Description

Automatic power factor regulator (APFR) is a device which is designed to maintain the target power factor by regulating lagging or leading current. The APFR is designed to monitor the reactive power within the circuit continuously and to provide ON/OFF signals automatically to control circuit breakers in a capacitor bank. In an electrical network such as an industrial plant using induction motors which produce reactive power, the power factor will drop. This will cause a power loss, a line voltage drop and other disadvantages. In conventional electrical systems the efficiency of transmission and distribution equipment is improved by installing fixed capacitors across the line. However, an over-compensation may arise when there is a light load, such as at night, which would result in an increase in line voltage and excess current. The APFR supervises the power factor in the system, and controls the power factors by switching capacitors ON or OFF as the situation requires in the face of a reactive leading or lagging load.

Low power loss
Correcting the power factor with a power capacitor reduces the line current. This also reduces the power loss caused by the resistances of the power cables and transformer windings.

Effective use of power receiving facility
Correcting the power factor with a power capacitor reduces the line current. Since this produces margins in the transformer capacity and the current-carrying capacity of cables, a heavier load can be carried without adding more facilities.

Stable supply voltage for long equipment service life
A reactive power, especially a leading reactive power at a light load (at night), often produces an overvoltage and shortens the service life of lamps. Use an automatic power factor regulator to suppress a voltage decrease at a heavy load and a voltage increase at a light load.

Laborsaving unmanned operations
This regulator outputs capacitor connection and disconnection commands automatically to maintain an optimum power factor. The simple setup for this output saves labor applied to power factor correction.

■ Features

• Compact (DIN size) and lightweight
The DIN-size compact unit permits easy mounting hole on the panel and enhances work efficiency.
The 6-bank and 12-bank models have front panels of the same size (144mm × 144mm). Since in the panel cutout hole sizes are also the same (138mm × 138mm), it is possible to use panel cutout holes of one uniform size.

QC06E

• 220V and 440V power supplies
The regulator can be connected to a 220V or 440V power supply. Set the voltage input switch on the front panel to the control power supply voltage being used.
Connect control power cables to the correct terminals of the terminal block in accordance with the control power supply voltage being used.

• Automatic setting of control level by microcomputer
The mode and data are set simply by using four keys. The microcomputer automatically sets the levels at which capacitors should be connected or disconnected.

• Three types of capacitor connection and disconnection control by purpose

1. Cyclic control or optimum control (automatic selection)
Under cyclic control, capacitors of the same capacitance are connected and disconnected in ascending order of capacitor number.
Under optimum control to keep the number of connections and disconnections minimal, a capacitance change is calculated from the measured reactive power and the target power factor and a capacitor of the nearest capacitance is connected or disconnected.
Either control is selected in accordance with the set capacitor capacitance.

2. Unconditional cyclic control
Capacitors are controlled cyclically, irrespective of their capacitances.

3. Multistep control
Capacitors having capacitances incremented in multiples of two (e.g. 1:2:2:2:2:2:, 1:2:4:4:4:4, and 1:2:4:8:8:8) are simultaneously connected or disconnected to optimize the capacitance with a minimal number of steps.

• Useful functions

1. Polarity error diagnosis function

If a polarity error in wiring is detected, the regulator lights the alarm lamp and sounds the buzzer to indicate the miswiring.

2. Forced disconnection function

To protect capacitors from being damaged or reactors from being burnt by excessive harmonics, or to disconnect capacitors unconditionally at night, external time switch signals can be input to the regulator. The signals automatically disconnect the connected capacitors in proper order.

• Automatic capacitor disconnection at light load

When the load of a power line decreases at night, the connected capacitors may increase the leading reactive power and cause an overvoltage.
A voltage increase on the power receiving side will shorten the service life of lamps and other load equipment.
To prevent an excessive leading power factor at a light load, the regulator automatically disconnects capacitors.

QC06E

• Abundant regulator status information display

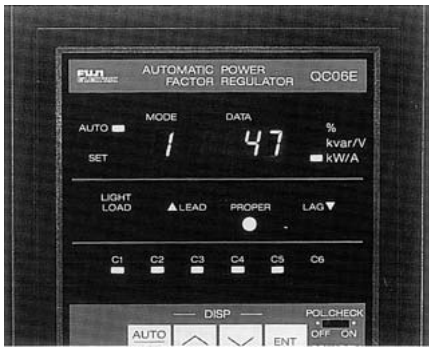
Power factor

Reactive power

Active power

Voltage

Current



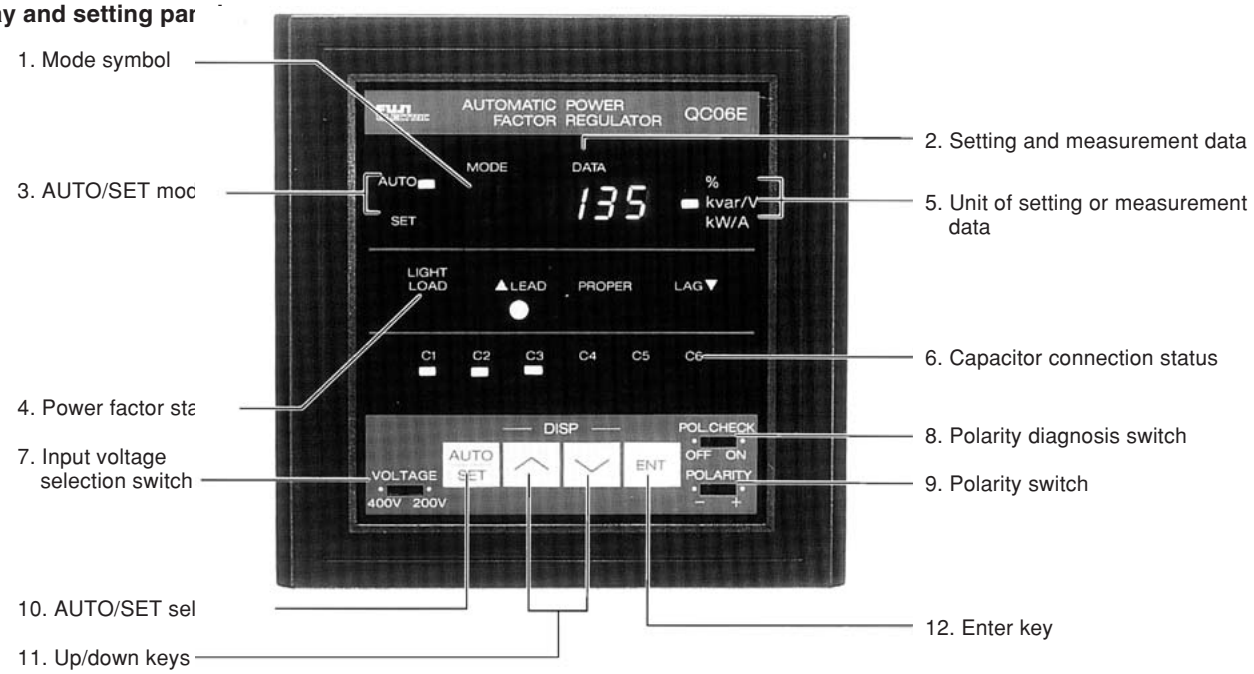
Automatic power factor regulators QC06E and QC12E

■ Specifications

Item		Specification	
		QC06E	**QC12E**
Voltage input	Frequency	50/60Hz	
	Rated voltage	200 – 220V/400 – 440V selectable	
	Allowable voltage fluctuation range	170 – 264V at 220V 323 – 528V at 440V	
	Power consumption	13VA at 220V, 13VA at 440V	15VA at 220V, 15VA at 440V
Current input	Frequency	50/60Hz	
	Rated current	5A	
	Power consumption	1VA	
Reactive power control range	Connection control level (kvar)	Automatic setting in accordance with the target power factor	
	Disconnection control level (kvar)	Already-connected minimum capacitor capacitance × 1.2 – connection control level (When the calculation result becomes negative, the disconnection control level is automatically set to 0).	
	Correct control range (kvar)	Already-connected minimum capacitor capacitance × 1.2 (Automatic setting)	
	Control error	±0.05 (kvar) × CT ratio (at 220V input)	
Light-load disconnection control value		When the active power level falls below the numeric-input minimum load, the capacitor are disconnected successively from the capacitor banks in descending order of capacitance at disconnecting time intervals. When the minimum load is set to 0, however, no capacitors are disconnected even when the active power level falls below the numeric-input minimum load. [Control error: ±0.05 (kvar) × CT ratio] (at 220V input)	
Capacitor control output	No. of connectable banks	6-circuit (NO contact common on one side)	12-circuit (NO contact common on one side)
	Applicable minimum load	1V DC, 1mA	
	On/Off switching capacity	250V AC, 5A 30V DC, 5A 100V DC, 0.5A	
	Electrical life expectancy	Approx. 100.000 operations at 220V AC, 2A inductive load	
Output control system		A1: Cyclic/optimum control, selectable automatically A2: Uncondentional cyclic control A3: Multistep control, 1:2:2:2:2:2------ A4: Multistep control, 1:2:4:4:4:4------ A5: Multistep control, 1:2:4:8:8:8------ (Control modes A3 to A5 are effective for C1 only 0 to 9999)	
Setting item		1. Bank capacitor capacitance C1 to C6 (0kvar *) (Modes 1 to 6) Output control system A3 to A5 are available only for bank C1.	Bank capacitor capacitance C1 to C12 (0kvar *) (Modes 1 to 9, o, b, c) Output control system A3 to A5 are available only for bank C1.
		2. Target power factor cosθ = 98%* Mode F (85 to 100) 3. CT ratio 0* Mode C (1 to 1200) 4. Control mode 1* Mode A (1 to 5) 5. Minimum load 0kW* Mode L (0 to 9999) 6. Delay time 300 sec.* Mode d (30, 60, 120, 300, 600)	
Display	Digital display	Current power factor (%), reactive power (kvar) (no mode symbol: leading, –: lagging), active power (kW), primary voltage (V) and primary current (A) on 7-segment LED panel.	
	Display error: 0.5A or less at CT input Power factor lead (+60%) to lag (–60%)	Power factor: ±5% or less, Reactive/active power: ±0.05kvar/kW × CT ratio or less (at 220V input) Primary current: ±0.1A × CT ratio or less	
	Control status display (LED)	Light load: Active power equal to or lower than the light-load disconnection control level Lagging, leading, optimum: Reactive power lagging, leading, or optimum in the control range	
	Control output display (LED)	Lit: Control output ON, Unlit: Control output OFF	
Operating ambient temperature		–10 to +55°C	
Dielectric strength		2500V AC 1 minute (between all terminals and E terminal)	
Outline dimensions (mm)		Height: 144, Width: 144, Depth: 114.5	Height: 144, Width: 144, Depth: 140
Mass (kg)		Approx. 1.5	Approx. 1.8

Note: * Value at shipment

■ **Display and setting par**



1. Mode symbol
Displays the set mode (mode symbol) or the kind of measurement data.

2. Setting and measurement data
• Data setting mode
The digital LED display displays the following setting data:

Mode symbol	Setting item	Setting data	Setup at shipment
1 to 9	Capacitance of capacitor C1 to C9 *6	0 to 9999kvar *1	0
o, b, c	Capacitance of capacitor C10, C11, C12 *6	0 to 9999kvar *1	0
A	Capacitor control system	1 to 5 *2	1
C	CT ratio	1 to 1200 *3	0
F	Target power factor	85 to 100%	98
L	Disconnection at light load	0 to 9999kW *4	0
d	Delay time	30, 60, 120, 300, or 600s *5	300

Notes:
*1 When the capacitance is set to 0 or 9999, the control output contact goes ON for 0 or OFF for 9999 during automatic operation.

*2 See the table at right for the meanings of the capacitor control system numbers.

*3 The CT ratio is set to 0 when the regulator is shipped from the factory. Set this value to accommodate the use requirements. The regulator does not operate automatically when the set value is 0 or 1201 or greater.

*4 When the set value is 0, the light-load disconnection function is not activated. To disconnect capacitors when the load becomes light, set the minimum capacitor capacitance.

*5 Select an optimum delay time for the capacitor discharging unit. (Set "300" or "600" if a discharging resistor is used.)

*6 The mode symbols are 1 to 6 (C1 to C6) for type QC06E and 1 to 9, o, b, and c (C1 to C12) for type QC12E.

• Auto operation mode
When the Up (^) and Down (v) keys are pressed at the same time, the LED display displays measurement data in the following order:

Model symbol	Display item	Measurement data display
(–) *7	Power factor	–0 to 100 to 0%
(–) *7	Reactive power	–9999 to 0 to 9999kvar *8
A	Active power	0 to 9999kW *8
U	Primary voltage	0 to 9999V *8
I	Primary current	0 to 6000 (5X1200)A
	No display	—

Notes:
*7 No mode symbol is displayed for a lead; a negative sign (–) is displayed for a lag.

*8 The LED display always displays "9999" for any value greater than 9999.

Capacitor control system

Set value	Description
1	Cyclic/optimum control
2	Unconditional cyclic control
3	Multistep control (capacitance ratio: 1:2:2:2:2:2:2:2:2:2:2)
4	Multistep control (capacitance ratio: 1:2:4:4:4:4:4:4:4:4:4)
5	Multistep control (capacitance ratio: 1:2:4:8:8:8:8:8:8:8:8)

3. AUTO/SET mode
The green lamp lights in the auto operation mode and the red one in the data setting mode.

4. Power factor status
Light load: The yellow lamp lights when the active power of the circuit is equal to or lower than the set level for light-load disconnection.
△ Lead:
The red lamp lights when the reactive power of the circuit is leading, compared to the set level for disconnection.
Acceptable:
The green lamp lights when the reactive power of the circuit is within the optimum control range.
Lag ▽:
The red lamp lights when the reactive power of the circuit is lagging, compared to the set level for connection.

5. Unit of setting or measurement data
A green lamp lights at %, kvar, kW, V, or A.

6. Capacitor connection status
The red lamps light at the capacitors for which the capacitor control output contacts are ON (make) and go out at the capacitors for which the contacts are OFF (break).

7. Input voltage selection switch
Set this switch to "200V" for 200/220V input power or "400" for 400/440V input power.

8. Polarity diagnosis switch
The polarity switch must initially be toggled to "+". Toggle the polarity diagnosis switch to the right to check the voltage or current input polarity. If the polarity is incorrect, "E□□□3" is displayed and the buzzer sounds.

9. Polarity switch
If the voltage or current input polarity is incorrect, toggle this switch to "–" and press the enter key to clear the error display and stop the buzzer. The regulator then operates normally because the input polarity is handled as being reversed.

10. AUTO/SET select key
Press this key to select the auto operation or data setting mode.

11. Up/down keys
Use these keys to select a data setting mode.
Use these keys to increment (+1) or decrement (–1) a numeric value in each setting mode.

12. Enter key
After selecting a data setting mode, start numeric input. The numeric display changes from being continuously lit to blinking.
Press this key to confirm a set value in each data setting mode. The value is stored in the internal memory and the numeric display changes from blinking to being continuously lit.

Press two keys of the four keys, (AUTO SET ∨ ∧ and ENT), at the same time for the following operation or display:

● **Data setting mode**

∧ ∨

Clears the set value to 0. (This key operation is effective only when the mode symbol is 1 to 9, o, b, c, C, or L and the numeric display is blinking.)

∧ ∨

Resets the set value to the shipping setup. (This key operation is effective only when the mode symbol is 1 to 9, o, b, c, C, or L and the numeric display is blinking.)
(Keep the keys depressed for five seconds or longer.)

● **Auto operation mode**

∧ ∨

Changes the measurement data display. (Each time the keys are pressed, the display changes in the following order: power factor, reactive power, active power, primary voltage, primary current, and no display. The initial display at power-on is always power factor data.

∧ ENT

Tests a capacitor connection. (Press the keys at the same time for reactive power lag display. Keep the keys depressed to connect the capacitors in the specified order.)

∨ ENT

Tests a capacitor disconnection. (Press the keys at the same time for reactive power lead display. Keep the keys depressed to disconnect the capacitors in the specified order.)

■ **Type number nomenclature and ordering code**

JD006 – E

Series
E: E series

No. of connectable banks
JD006: QC06, 6 circuits
JD012: QC12, 12 circuits

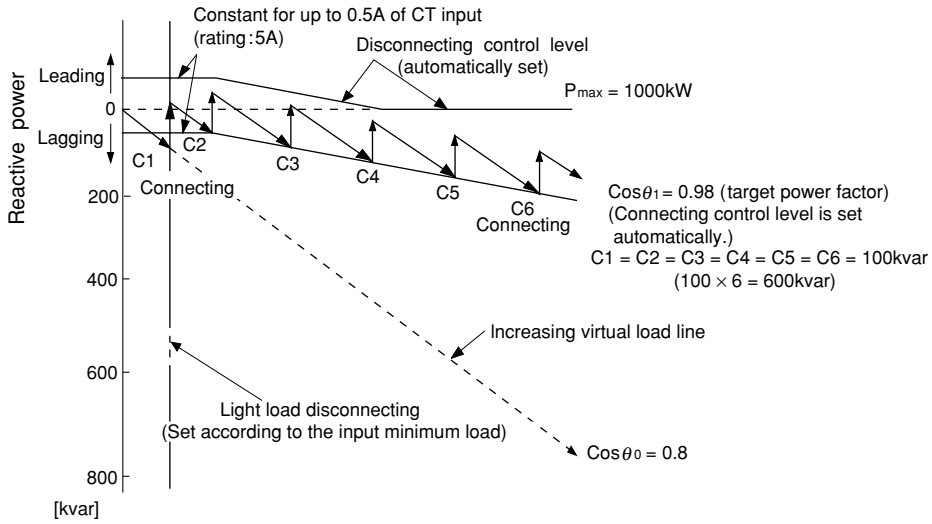
■ **Ordering information**
Specify the following:
1. Type number or ordering code
2. Input voltage and current
3. Operating voltage
4. Number of connectable capactor banks

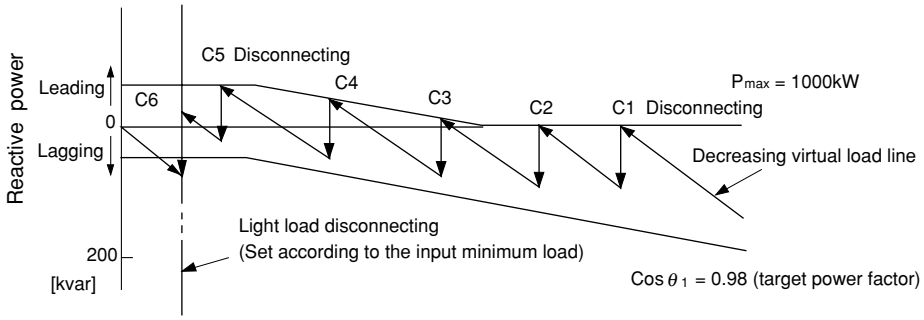
■ Operation of automatic power factor regulator

• Cyclic control
Under cyclic control/optimum control, the regulator connects and disconnects capacitors of the same capacitance cyclically.
Under unconditional cyclic control, the regulator connects and disconnects capacitors of different capacitances cyclically, irrespective of the set capacitance.

1. Capacitor connection
When the reactive power exceeds the level at which more capacitors should be connected, the red lag lamp lights. If the red lamp remains lit for the set delay time or longer, the corresponding capacitor control output goes ON and the red lamp for the capacitor bank lights.
When the reactive power of the circuit is still over the connection control level and the red lag lamp remains lit, the capacitor control output for the next capacitor goes ON after the delay time. The capacitor control outputs go ON one by one at the delay time intervals until the reactive power level of the circuit falls within the allowable range.

2. Capacitor disconnection
The red lead lamp lights when the circuit load decreases and the connected capacitors increase the leading reactive power of the circuit beyond the level at which a capacitor should be disconnected. When the red lead lamp remains lit for the set delay time or longer, the corresponding capacitor control output goes OFF and the red lamp for the capacitor bank goes OFF.
The capacitors are disconnected in the order of their connection.
The capacitor control output for each capacitor is turned OFF at every delay time interval until the reactive power level falls within the allowable range.





Output operation by the connecting or disconnecting control signals for capacitors

Leading △								○	○	○	○				○		○	○		○	
Acceptable	○																				
Lagging ▽		○	○	○	○	○	○					○	○	○		○			○		○
C1		○ ON		○	○	○	○	OFF				○ ON		○	○	○	○	OFF			
C2			○ ON		○	○	○	○	OFF				○ ON		○	○	○	○	○	OFF	
C3				○ ON		○	○	○	○	OFF				○ ON		○	○	○	○	○	○
C4					○ ON		○	○	○	○	OFF					○ ON	○	○	○	○	○
C5						○ ON	○	○	○	○	○	○	○	○	OFF				○ ON	○	○
C6							○ ON	○	○	○	○	○	○	○	○	○	OFF				○ ON

○ : Shows that indicators are lit.

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• Optimum control
Under optimum control, the regulator connects or disconnects the capacitor with the capacitance closest to the change of reactive power among capacitors of different capacitances. If there are two or more capacitors of the same capacitance, the regulator connects or disconnects the capacitors cyclically for optimum control (the number of switchings) match.

1. Capacitor connection
The red lag lamp lights when the reactive power level exceeds the level at which more capacitors should be connected. The regulator calculates the difference between the current reactive power and the level at which more capacitors should be connected, and integrates the calculated value for the set delay time. The average value per unit time is calculated from the integrated total and a capacitor having the capacitance closest to the average value is selected. The capacitor control output for the capacitor is turned ON and the red lamp of the capacitor bank lights.
The regulator continues integrating and averaging the differences between the current reactive power level and the level at which more capacitors should be connected, and selecting optimum capacitors. The capacitor control output is turned ON repeatedly until the reactive power of the circuit falls within the allowable range.

Figure 1 shows an example of a capacitor connection control with a load variation pattern.

2. Capacitor disconnection
When the circuit load decreases, the already-connected capacitors increase the leading reactive power level. If the reactive power level exceeds the level at which capacitors should be disconnected, the red lead lamp lights. The regulator calculates the difference between the current reactive power level and the level at which capacitors should be disconnected, and integrates the calculated value for the set delay time. The average value per unit time is calculated from the integrated total and a capacitor having the capacitance closest to the average value is selected. The capacitor control output for the capacitor is turned OFF and the red lamp of the capacitor bank goes OFF.

The regulator continues integrating and averaging the differences between the current reactive power level and the level at which capacitors should be disconnected, and selecting optimum capacitors. The capacitor control output is turned OFF repeatedly until the reactive power level of the circuit falls within the allowable range.
Figure 2 shows an example of capacitor disconnection control with a load variation pattern.

Fig. 1

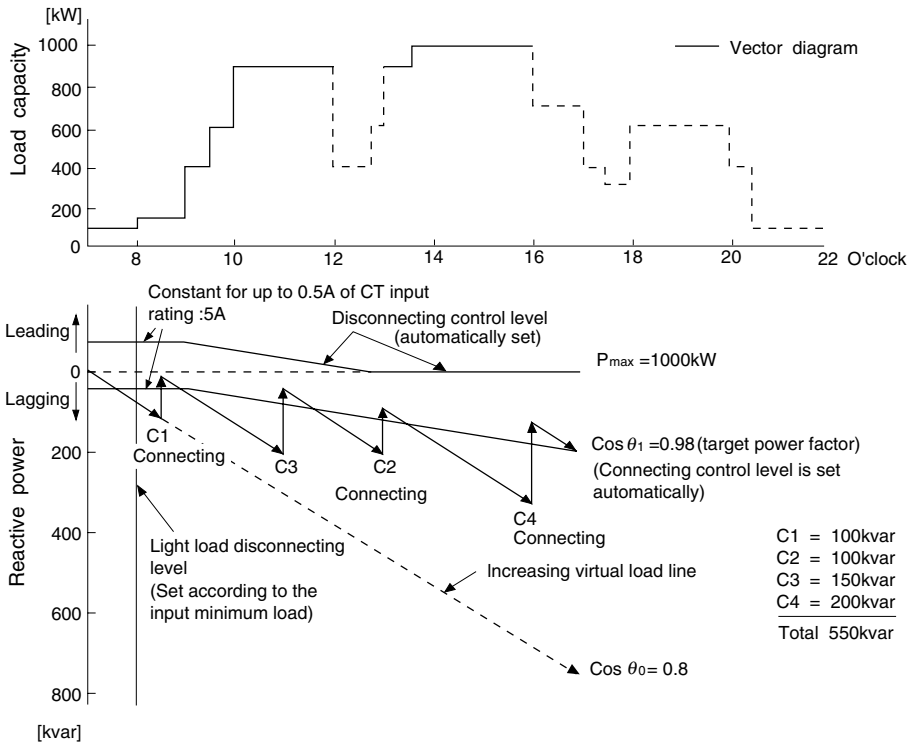
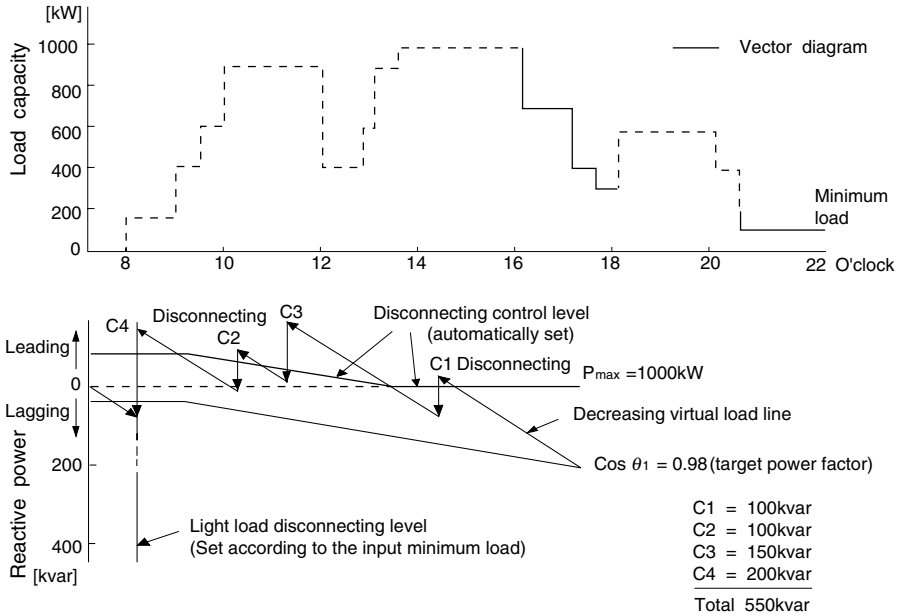


Fig. 2



• Multistep control (step-by-step control)
Under multistep control, the regulator connects or disconnects in units of the minimum capacitance set at C1 in accordance with the changes of the reactive power to approximate the power factor to the target value.
The power factor at a light load can be controlled in the same way.

1. Capacitor connection
When the reactive power level exceeds the level at which more capacitors should be connected, the red lag lamp lights. If the red lamp remains lit for the set delay time or longer, the capacitor control outputs for the next step go ON or OFF and the red lamps of the capacitors light or go OFF. If the reactive power level of the circuit is still over the level at which more capacitors should be connected and the red lag lamp remains lit, the capacitor control outputs for the next capacitor go ON or OFF after the set delay time.

The capacitor control output is turned ON or OFF sequentially at the delay time intervals until the reactive power level of the circuit falls within the allowable range.

2. Capacitor disconnection
The red lead lamp lights when the load decreases and the connected capacitors increase the leading reactive power level of the circuit beyond the level at which capacitors should be disconnected. When the red lamp remains lit for the set delay time or longer, the capacitor control outputs for the next step go OFF or ON and the red lamps of the capacitor banks go OFF or light.
The capacitor control output is turned OFF or ON sequentially at the delay time intervals until the reactive power level of the circuit falls within the allowable range.

Capacitor connection and disconnection signal output operation
Signal output in multistep control mode/QC06E

Example 1

Lag/Lead	Step	C1=10kvar C2=20kvar C3=20kvar C4=20kvar C5=20kvar C6=20kvar Control system [3] Capacitance ratio C1:C2:C3:C4:C5:C6=1:2:2:2:2:2							Lag/Lead	C1=10kvar C2=20kvar C3=20kvar C4=20kvar C5=20kvar C6=20kvar Control system [3] Capacitance ratio C1:C2:C3:C4:C5:C6=1:2:2:2:2:2						
		C1	C2	C3	C4	C5	C6	Total capacitance		C1	C2	C3	C4	C5	C6	Total capacitance
Lag ▽	1	○						10kvar	Lead △	○	○	○	○	○	○	110kvar
	2		○					20			○	○	○	○	○	100
	3	○	○					30		○		○	○	○	○	90
	4		○	○				40				○	○	○	○	80
	5	○	○	○				50		○			○	○	○	70
	6		○	○	○			60					○	○	○	60
	7	○	○	○	○			70		○				○	○	50
	8		○	○	○	○		80						○	○	40
	9	○	○	○	○	○		90		○					○	30
	10		○	○	○	○	○	100							○	20
	11	○	○	○	○	○	○	110		○						10

Example 2

Lag/Lead	Step	C1=10kvar C2=20kvar C3=40kvar C4=40kvar C5=40kvar C6=40kvar Control system [4] Capacitance ratio C1:C2:C3:C4:C5:C6=1:2:4:4:4:4							Lag/Lead	C1=10kvar C2=20kvar C3=40kvar C4=40kvar C5=40kvar C6=40kvar Control system [4] Capacitance ratio C1:C2:C3:C4:C5:C6=1:2:4:4:4:4						
		C1	C2	C3	C4	C5	C6	Total capacitance		C1	C2	C3	C4	C5	C6	Total capacitance
Lag ▽	1	○						10kvar	Lead △	○	○	○	○	○	○	190kvar
	2		○					20			○	○	○	○	○	180
	3	○	○					30		○		○	○	○	○	170
	4			○				40				○	○	○	○	160
	5	○		○				50		○	○		○	○	○	150
	6		○	○				60			○		○	○	○	140
	7	○	○	○				70		○			○	○	○	130
	8			○	○			80					○	○	○	120
	9	○		○	○			90		○	○			○	○	110
	10		○	○	○			100			○			○	○	100
	11	○	○	○	○			110		○				○	○	90
	12			○	○	○		120						○	○	80
	13	○		○	○	○		130		○	○				○	70
	14		○	○	○	○		140			○				○	60
	15	○	○	○	○	○		150		○					○	50
	16			○	○	○	○	160							○	40
	17	○		○	○	○	○	170		○	○					30
	18		○	○	○	○	○	180			○					20
	19	○	○	○	○	○	○	190		○						10

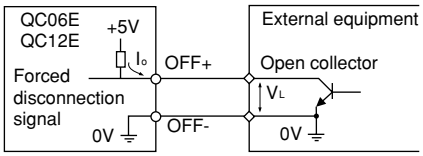
Example 3

Lag/Lead	Step	C1=10kvar C2=20kvar C3=40kvar C4=80kvar C5=80kvar C6=80kvar Control system [5] Capacitance ratio C1:C2:C3:C4:C5:C6=1:2:4:8:8:8							Lag/Lead	C1=10kvar C2=20kvar C3=40kvar C4=80kvar C5=80kvar C6=80kvar Control system [5] Capacitance ratio C1:C2:C3:C4:C5:C6=1:2:4:8:8:8						
		C1	C2	C3	C4	C5	C6	Total capacitance		C1	C2	C3	C4	C5	C6	Total capacitance
Lag ▽	1	○						10kvar	Lead △	○	○	○	○	○	○	310kvar
	2		○					20			○	○	○	○	○	300
	3	○	○					30		○		○	○	○	○	290
	4			○				40				○	○	○	○	280
	5	○		○				50		○	○		○	○	○	270
	6		○	○				60			○		○	○	○	260
	7	○	○	○				70		○			○	○	○	250
	8				○			80					○	○	○	240
	9	○			○			90		○	○	○		○	○	230
	10		○		○			100			○	○		○	○	220
	11	○	○		○			110		○		○		○	○	210
	12			○	○			120				○		○	○	200
	13	○		○	○			130		○	○			○	○	190
	14		○	○	○			140			○			○	○	180
	15	○	○	○	○			150		○				○	○	170
	16				○	○		160						○	○	160
	17	○			○	○		170		○	○	○			○	150
	18		○		○	○		180			○	○			○	140
	19	○	○		○	○		190		○		○			○	130
	20			○	○	○		200				○			○	120
	21	○		○	○	○		210		○	○				○	110
	22		○	○	○	○		220			○				○	100
	23	○	○	○	○	○		230		○					○	90
	24				○	○	○	240							○	80
	25	○			○	○	○	250		○	○	○				70
	26		○		○	○	○	260			○	○				60
	27	○	○		○	○	○	270		○		○				50
	28			○	○	○	○	280				○				40
	29	○		○	○	○	○	290		○	○					30
	30		○	○	○	○	○	300			○					20
	31	○	○	○	○	○	○	310		○						10

■ Terminals

Used for	Terminal symbol	Terminal name	Description
Input	P2 (at 220V) P3	Voltage input (220V)	Connect this terminal directly to a 220V power line. Note: The current for the internal control power supply flows between terminal P2 and P3.
	P2 (at 440V) P3	Voltage input (440V)	Connect this terminal directly to a 440V power line. Note: The current for the internal control power supply flows between terminal P2 and P3.
	1S, 1L	Current input	Connect these terminals to the secondary side of a CT.
	E	Ground	Grounding resistance: 100Ω or less
Contact output	COM	Capacitor control output common	Connect the common cable for capacitor connection and disconnection signals. Be sure to connect the upper and middle COM terminals (QC12E)
	C 1 to C12	Control output terminal for C 1 to C12	This terminal output control signals to the capacitor control section (Ex. VMC*1) connected to the terminal.
External forced disconnection signal input *2	OFF +	Forced disconnection signal input (positive)	Connect this terminal to one side of a contact for a contact signal input. Connect this terminal to a collector for NPN transistor open-collector signal input.
	OFF –	Forced disconnection signal input (negative)	Connect this terminal to opposing side of a contact for a contact signal input. Connect this terminal to 0V for NPN transistor open-collector signal input.

Notes:
*1 VMC: Vacuum magnetic contactor
*2 Signal input circuits
ON voltage VL < 1. 0V
Drain current Io = Approx. 10mA



QC06E and QC12E

Main circuit

Upper terminal arrangement

C6	C5	C4	C3	C2	C1	COM	OFF–	OFF+

Control circuit

Lower terminal arrangement

* NC	* NC	1S	1L	* NC	P3	P2 (220V)	P2 (440V)	E

*NC: No connection

QC12E only

Main circuit

Middle terminal arrangement

C12	C11	C10	C9	C8	C7	COM

Note: For QC12E, the upper and middle COM terminals are not connected internally. Be sure to connect these terminals.

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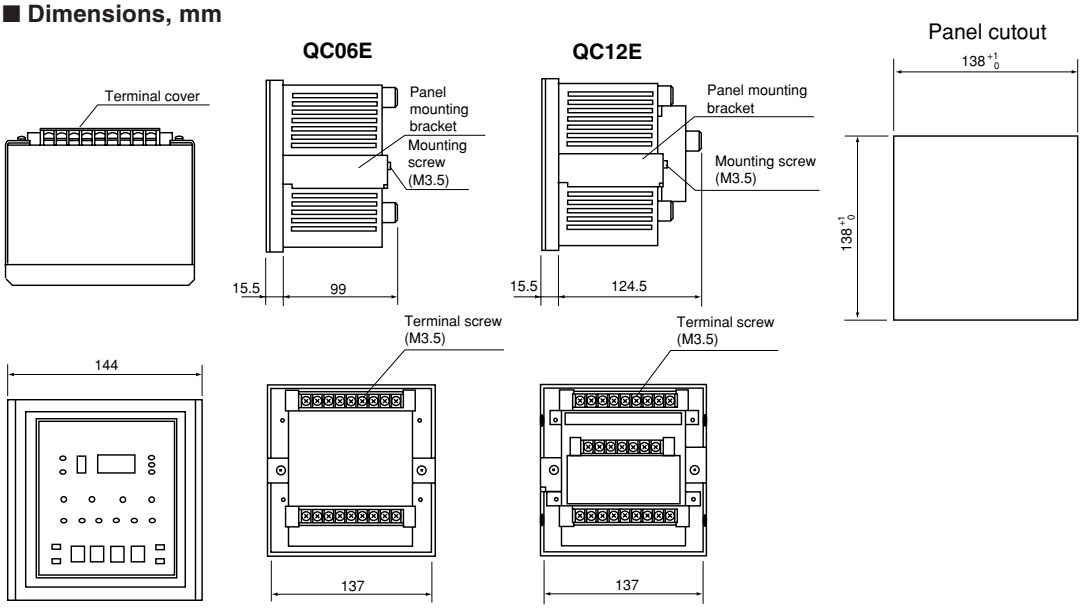
Automatic power factor regulators QC06E and QC12E

■ Dimensions, mm



■ Key operations

● Data setting mode

Operation	Key operation	Remarks
Selecting a setting item	∧ or ∨	
Setting a value	∧ ∨ ENT	
Incrementing the data value (+1)	∧	Control mode (Mode A): 1 to 5 Target power factor (Mode F): 85 to 100 Delay time (Mode d): 30, 60, 120, 300, or 600 For other modes, be sure to enter a four-digit numeric value. The input order is thousands, hundreds, tens, then ones. Change the set value if a high-order digit is not required, skip the digit by pressing the ENT key, then enter a numeric value (1 to 9) to the next digit. (The skipped digit is not displayed.)
Decrementing the data value (–1)	∨	
Shifting the digit up	ENT	
Enter capacitance 0 value	ENT	When the value "0" is blinking, press the ENT key four times to set the value.
Determining the set value	ENT	
Clearing the set value to 0	∧ + ∨ Press at the same time.	This key operation is effective only when the mode symbol is 1 to 9, o, b, c, C, or L and numeric display is blinking.
Resetting all set value	∧ + ∨ Press for five seconds or longer at the same time.	This key operation is effective only when the mode symbol is 1 to 9, o, b, c, C, or L and numeric display is blinking. (All the set items are reset to the shipping setup.)
Stopping the buzzer giving error notification during diagnosis	AUTO SET ∧ ∨ ENT	Any key may be pressed.
Changing mode to auto operation	AUTO SET	

● Auto operation mode

Operation	Key operation	Remarks
Changing measurement display	∧ + ∨ Press at the same time.	The measurement data display changes cyclically in the following order: Power factor, reactive power, active power, primary voltage, primary current, and no display. The initial display at power-on is power factor data.
Testing capacitor connection	∧ + ENT Press continually at the same time.	For the operation sequence, operation time, and other details, refer to the instruction manual.
Testing capacitor disconnection	∨ + ENT Press continually at the same time.	
Stopping the buzzer giving error notification during diagnosis	AUTO SET ∧ ∨ ENT	Any key may be pressed.
Changing mode to data setting	AUTO SET	

■ Data setting procedure

• Set the following items

1. Capacitor capacitance: Capacitor 1 (150kvar) to 3 (150kvar)
2. Capacitor control mode (example): 2
3. CT ratio (example): 20 (current transformation ratio: 100/50)
4. Target power factor: 100(%)
5. Minimum load: 100(kW)
6. Delay time: 120(s)

• Data setting and change procedure

Data setting flow	Key operation	Display status		Explanation
		Mode	Data	
Power-on *1 Mode-1 initial value display	Press AUTO SET key to change already-input data.	1	0	"0" is set at shipping from the factory.
Capacitor-1 capacitance input awaited	1 ENT	1	0000	"0" starts blinking to wait for capacitor-1 capacitance input. An entry in the thousands place is awaited.
Enter 0 in the thousands place	2 ENT	1	0000	The display value dose not change but "0" is set at the thousand place. An entry in the hundreds place is awaited.
Enter 1 in the hundreds place	3 ∧	1	0100	Enter 1 in the hundreds place.
	4 ENT	1	0100	"1" is set at the hundreds place. An entry in the tens place is awaited.
Enter 5 in the tens place	5 Press ∧ key five times	1	0150	Enter 5 in the tens place.
Enter 0 in the ones place	6 ENT	1	150	"5" is set at the tens place. An entry in the ones place is awaited.
	7 ENT	1	0150	Capacitor-1 capacitance input has been completed.
Mode-2 initial value display	∧	2	0	"0" is set at shipping from the factory.
Capacitor-2 capacitance input awaited	ENT	2	0000	"0" starts blinking to wait for capacitor-2 capacitance input. An entry in the thousands place is awaited.
Set each place following the above order	2 to 7			Capacitor-2 capacitance input has been completed.
Mode-3 initial value display	∧	3	0	"0" is set at shipping from the factory.
Enter capacitor-3 capacitance	1 to 7			Capacitor-3 capacitance input has been completed.
Enter 0 for capacitance of capacitor 4 to 12	∧	4 to C	0	The confirmation of capacitance setup (0) has been completed.
To correct an input error or change a set value	ENT	Each mode	0000	Data can be entered in a blinking field.
Control-mode initial value display	∧	A	1	Capacitor control mode: 1 is set at shipment from the factory.
Control-mode input awaited	ENT	A	1	Capacitor control mode: An entry in the control mode is awaited.
Enter 2 in control mode	∧ or ∨	A	2	Capacitor control mode input is in progress.
	ENT	A	2	The input in capacitor control mode has been completed.
CT ratio initial display	∧	C	0	CT ratio setting mode: "0" is set at shipping from the factory.
CT ratio input awaited	ENT	C	0000	"0" starts blinking to wait for CT ratio input. An entry in the thousand place is awaited.
Enter 0 in the thousands place	ENT	C	0000	"0" is set at the thousands place. An entry in the hundreds place is awaited.
Enter 0 in the hundreds place	ENT	C	0000	"0" is set at the hundreds place. An entry in the tens place is awaited.
Enter 2 in the tens place	∧ two times	C	0020	Enter 2 in the tens place.

Note:

*1 The initial value setup in mode 1 is always displayed at the first power-on after the unit is delivered from the factory, or displayed if all data have been reset to the factory setup.

*2 Although 0 is set at shipping from the factory, check the setup by incrementing the capacitor numbers with this key.

Data setting flow	Key operation	Display status		Explanation
		Mode	Data	
Enter 0 in the ones place	ENT	C	0020	"2" is set at the tens place. An entry in the ones place is awaited.
	ENT	C	0020	CT ratio input has been completed.
Target power factor initial display	^	F	98	Target power factor: "98" is set at shipping from the factory.
Target power factor input awaited	ENT	F	98	An entry of target power factor is awaited.
Enter target power factor "100"	^ or v	F	100	Target power factor input is in progress.
	ENT	F	100	Target power factor input has been completed.
Minimum load initial display	^	L	0	Minimum load: "0" is set at shipping from the factory.
Minimum load input awaited	ENT	L	0000	"0" is set at the thousands place. An entry in the thousand place is awaited.
Enter 0 in the thousands place	ENT	L	0000	"0" is set at the thousands place. An entry in the hundreds place is awaited.
Enter 1 in the hundreds place	^	L	0100	Enter "1" in the hundreds place.
Enter 0 in the tens place	ENT	L	0100	"1" is set at the hundreds place. An entry in the tens place is awaited.
Enter 0 in the ones place	ENT	L	0100	"0" is set at the tens place. An entry in the ones place is awaited.
	ENT	L	100	Minimum load input has been completed.
Delay time initial display	^	d	300	Delay time: "300" is set at shipping from the factory.
Delay time input awaited	ENT	d	300	An entry of delay time is awaited.
Enter delay time 120	^ or v	d	120	Delay time input is in progress.
	ENT	d	120	Delay time input has been completed.
Data setting completed	AUTO SET	Display item	Measured data	Measured data is displayed.

• Supplemental explanations

1. Mode symbols 1 to 9 and o, b, c.

- The capacitor bank is never connected when the capacitance is set to 0.
- The capacitor bank is never disconnected when the capacitance is set to 9999.
- When multistep control is selected, only the capacitance of mode symbol 1 becomes valid. No data needs to be set for mode symbols 2 to 9 and o, b, c.

2. Capacitor connection and disconnection

Mode symbol	Set value	Description
A	1	Cyclic/optimum control
	2	Uncondentional cyclic control
	3	Multistep control, capacitance ratio 1:2:2:2:2:2:2:2:2:2:2
	4	Multistep control, capacitance ratio 1:2:4:4:4:4:4:4:4:4:4
	5	Multistep control, capacitance ratio 1:2:4:8:8:8:8:8:8:8:8

A capacitor discharger recommended for multistep control of A3, A4, or A5 is a discharging coil which reduces the residual voltage of the capacitor to 50 volts or less within five seconds.

3. If “100%” is set as the target power factor of mode symbol F, a control of leading reactive power is performed.

4. Set the minimum load value to one slightly higher than the actual minimum load of the equipment to ensure an accurate light-load disconnection even when the measuring error or circuit constant fluctuates slightly.

Example: When the actual minimum load of the equipment is 100kW, set the value to 120kW (100 × 1.2).

Note:
Select a delay time suitable for the capacitor discharger. When using a discharging resistor, set the delay time to 300s (5min) or 600s (10min). An inappropriate delay time may damage capacitors or reduce their service lives.

■ Calculating CT ratios

• CT ratio

Example: When the primary current is 400A and secondary current is 5A.
400 ÷ 5 = 80 CT ratio = 80

■ Determining capacitances and number of capacitor banks to improve the power factor by switching-on capacitors

The capacitances and the number of capacitor banks are determined as follows:

• For capacitors having the same capacitances

When load variation (increase and decrease of load) is frequent.

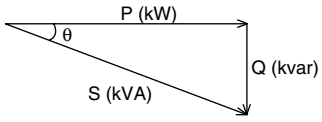
1. Determining the target power factor

Consider how far the power factor can be improved from the current value by automatic control.

Example

Current power factor (before improvement): 0.8
Target power factor (after improvement): 0.98
Maximum demand power: 1000kW

Power factor: Cosθ
P: Active power
Q: Reactive power
S: Max. demand power



2. Calculating the capacitances needed to improve the power factor

See the capacitor selection chart (*Page 09/101*) to calculate the necessary capacitance.

Example

To improve the power factor from 0.8 to 0.98, the factor K_1 should be 0.54. Therefore, the necessary capacitance (Cm) is obtained as follows:
Cm = Maximum demand power × K_1 = 1000kW × 0.54 = 540kvar
The necessary capacitance is 540kvar.

3. Calculating the target reactive power

Calculate the target reactive power from the target power factor (after improvement) and the maximum demand power.

Example

The target value is calculated using the factor K_2 selection table. (*Page 09/101*)
Target power factor: 0.98
K_2=0.2
The target reactive power (Q_1):
Q_1 =Maximum demand power × K_2
=1000kW × 0.2
=200kvar

4. Determining the number of capacitor banks

Determine the number of capacitor banks from the necessary capacitance for power factor improvement and target reactive power.

Example

Determine the number of capacitor banks as follows:

$$n = \frac{\text{Necessary capacitance for power factor improvement (Cm)}}{\text{Target reactive power } (Q_1)}$$

(1) If n 6, the number of banks should be six.
(2) If n < 6, the number of banks should be n.
(Round up any fraction)
In this example,

$$n = \frac{540\text{kvar}}{200\text{kvar}} = 2.7 < 6$$

If the fraction is rounded up, the number of necessary banks is 3.

Note: The necessary capacitance for power factor improvement (Cm) means the total capacitance to be controlled by this unit.

5. Calculating the capacitance per capacitor bank

If each bank should have the same capacitance, the capacitance needed to improve the power factor must be divided by the number of banks calculated at step 4.

Example

Capacitance per capacitor bank:

$$Co = \frac{\text{Capacitance needed to improve the power factor (Cm)}}{\text{Number of capacitor banks (n)}}$$

In this example,

$$Co = \frac{Cm}{n} = \frac{540\text{kvar}}{3\text{ (banks)}} = 180\text{kvar}$$

Since there are no 180kvar capacitors, a 200kvar-capacitor can be used.

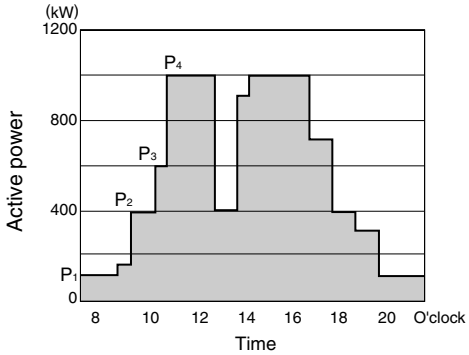
• For capacitors having unequal-capacitances

When load variation is a slight and stable all the year round. Target power factor and the necessary capacitance for power factor improvement are calculated using step 1 and 2.

Current power factor (before improvement): 0.8
Target power factor (after inprovement): 0.98
Necessary capacitance for power factor improvement (Cm): 540kvar
For load variation as shown below, calculate the reactive power variation using K_1.

Example

- When P_1 is 150kW, $Q_1 = P_1 \times K_1 = 150 \times 0.54 = 81$kvar
  Capacitor C_1 = 100kvar
- When P_2 is 400kW, Q_2 = 216kvar
  Capacitor $C_2 = Q_2 - C_1$ = 116kvar, C_2 = 150kvar
- When P_3 is 600kW, Q_3 = 324kvar
  Capacitor $C_3 = Q_3 - (C_1 + C_2)$ = 74kvar, C_3 = 100kvar
- When P_4 is 1000kW, Q_4 = 540kvar
  Capacitor $C_4 = Q_4 - (C_1 + C_2 + C_3)$ = 190kvar, C_4 = 200kvar



■ Capacitor selection / Factor K_1

Obtain the value of the capacitor required for improving the power factor by referring to the following list:

Power factor before being improved = cosθ_0	Power factor after being improved = cosθ_1																														
	1.00	0.99	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.91	0.9	0.875	0.85	0.825	0.8	0.775	0.75	0.725	0.7	0.675	0.65	0.625	0.6	0.575	0.55	0.525	0.5	0.475	0.45	0.425
0.4	2.30	2.16	2.10	2.05	2.01	1.97	1.94	1.90	1.87	1.84	1.82	1.75	1.68	1.61	1.55	1.49	1.42	1.35	1.28	1.21	1.13	1.05	0.96	0.88	0.78	0.68	0.57	0.45	0.32	0.17
0.425	2.13	1.98	1.92	1.88	1.84	1.80	1.76	1.73	1.70	1.67	1.64	1.57	1.51	1.44	1.38	1.31	1.24	1.18	1.11	1.04	0.96	0.88	0.79	0.71	0.61	0.51	0.40	0.27	0.15	
0.45	1.98	1.83	1.77	1.73	1.68	1.65	1.61	1.58	1.55	1.52	1.49	1.42	1.36	1.29	1.23	1.16	1.10	1.03	0.96	0.89	0.81	0.73	0.64	0.56	0.46	0.36	0.24	0.12		
0.475	1.85	1.71	1.65	1.61	1.56	1.53	1.49	1.46	1.43	1.40	1.37	1.30	1.23	1.16	1.10	1.04	0.98	0.91	0.84	0.76	0.68	0.60	0.52	0.44	0.33	0.23	0.12			
0.5	1.73	1.59	1.53	1.48	1.44	1.40	1.37	1.34	1.30	1.28	1.25	1.18	1.11	1.04	0.98	0.92	0.85	0.78	0.71	0.64	0.56	0.48	0.40	0.31	0.21	0.11				
0.525	1.62	1.48	1.42	1.37	1.33	1.29	1.26	1.22	1.19	1.17	1.14	1.07	1.00	0.93	0.87	0.81	0.74	0.67	0.60	0.53	0.45	0.37	0.29	0.20	0.10					
0.55	1.52	1.38	1.32	1.27	1.23	1.19	1.16	1.12	1.09	1.06	1.04	0.97	0.90	0.83	0.77	0.71	0.64	0.57	0.50	0.43	0.35	0.27	0.19	0.10						
0.575	1.42	1.28	1.22	1.17	1.14	1.10	1.06	1.03	0.99	0.96	0.94	0.87	0.80	0.74	0.67	0.60	0.54	0.47	0.40	0.33	0.25	0.17	0.08							
0.6	1.33	1.19	1.13	1.08	1.04	1.01	0.97	0.94	0.91	0.88	0.85	0.78	0.71	0.65	0.58	0.52	0.46	0.39	0.32	0.24	0.16	0.085								
0.625	1.25	1.11	1.05	1.90	0.96	0.92	0.89	0.85	0.82	0.79	0.77	0.70	0.63	0.56	0.50	0.44	0.37	0.30	0.23	0.16	0.08									
0.65	1.17	1.03	0.97	0.82	0.88	0.84	0.81	0.77	0.74	0.71	0.69	0.62	0.55	0.48	0.42	0.36	0.29	0.22	0.15	0.08										
0.675	1.09	0.95	0.89	0.84	0.80	0.76	0.73	0.70	0.66	0.64	0.61	0.54	0.47	0.40	0.34	0.28	0.21	0.14	0.07											
0.7	1.02	0.88	0.81	0.77	0.73	0.69	0.66	0.62	0.59	0.56	0.54	0.46	0.40	0.33	0.27	0.20	0.14	0.07												
0.725	0.95	0.81	0.75	0.70	0.66	0.62	0.59	0.55	0.52	0.49	0.46	0.39	0.33	0.26	0.20	0.13	0.07													
0.75	0.88	0.74	0.67	0.63	0.58	0.55	0.52	0.49	0.45	0.43	0.40	0.33	0.26	0.19	0.13	0.065														
0.775	0.81	0.67	0.61	0.57	0.52	0.49	0.45	0.42	0.39	0.36	0.33	0.26	0.19	0.12	0.065															
0.8	0.75	0.61	0.54	0.50	0.46	0.42	0.39	0.35	0.32	0.29	0.27	0.19	0.13	0.06																
0.825	0.69	0.54	0.48	0.44	0.40	0.36	0.33	0.29	0.26	0.23	0.21	0.14	0.07																	
0.85	0.62	0.48	0.42	0.37	0.33	0.29	0.26	0.22	0.19	0.16	0.14	0.07																		
0.875	0.55	0.41	0.35	0.30	0.26	0.23	0.19	0.16	0.13	0.10	0.07																			
0.9	0.48	0.34	0.28	0.23	0.19	0.16	0.12	0.09	0.06	0.028																				
0.91	0.45	0.31	0.25	0.21	0.16	0.13	0.09	0.06	0.028																					
0.92	0.43	0.28	0.22	0.18	0.13	0.10	0.06	0.031																						
0.93	0.40	0.25	0.19	0.15	0.10	0.07	0.033																							
0.94	0.36	0.22	0.16	0.11	0.07	0.036																								
0.95	0.33	0.18	0.12	0.08	0.035																									
0.96	0.29	0.15	0.09	0.04																										
0.97	0.25	0.11	0.05																											
0.98	0.20	0.06																												
0.99	0.14																													

k: Figures obtained by cosθ_0 and cosθ_1

■ Factor K_2 selection

Power factor (cosθ_2)	0.7	0.75	0.8	0.85	0.875	0.9	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99
$K_2 = \sqrt{\frac{1}{\cos^2\theta_2} - 1}$	1.02	0.88	0.75	0.62	0.55	0.48	0.45	0.43	0.40	0.36	0.33	0.29	0.25	0.20	0.14

K_2: Figures obtained by cos θ_2

09

Power monitoring equipment (F-MPC)
F-MPC60B, F-MPC30, F-MPC04 series

KK02-050

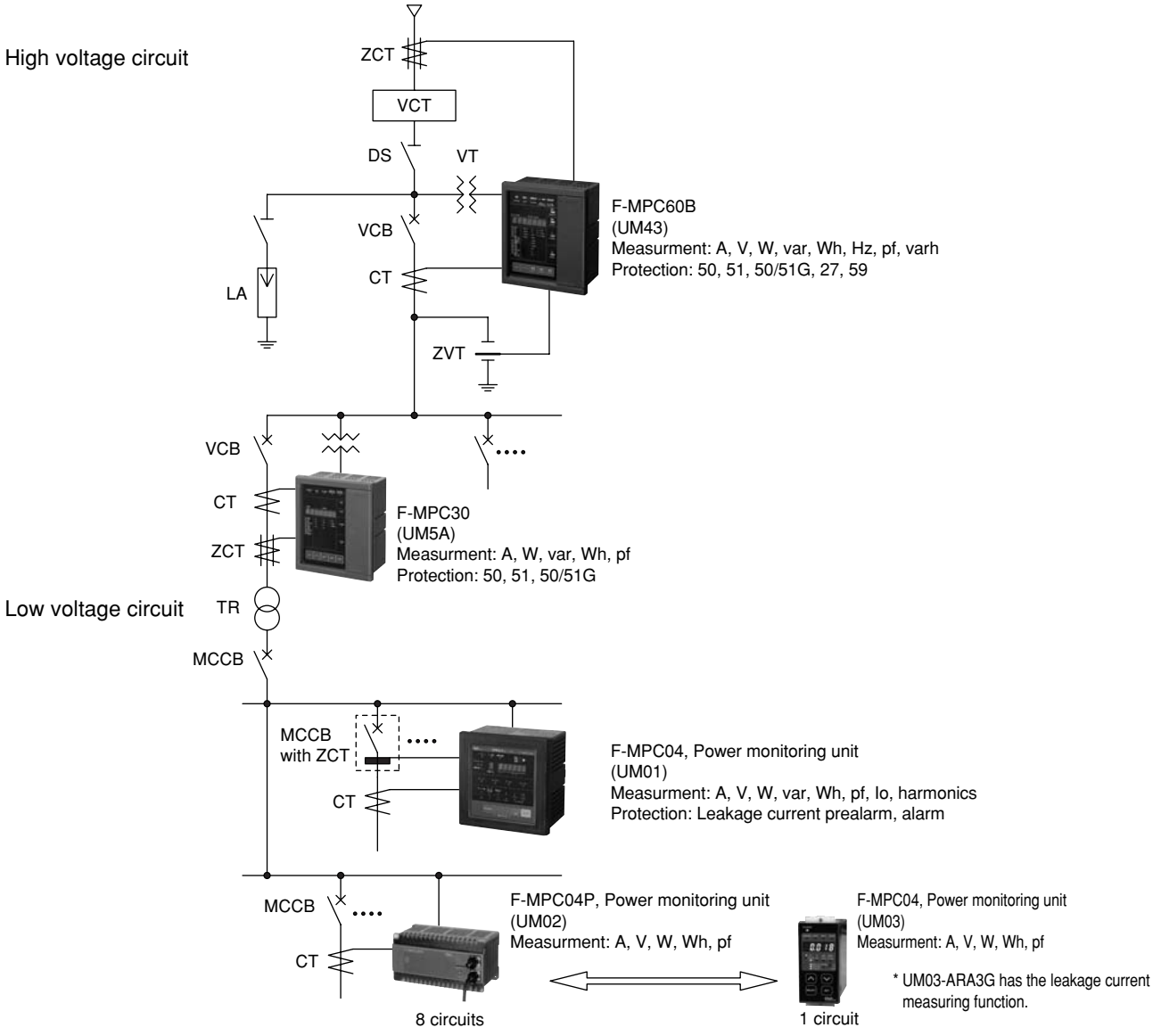
F-MPC60B (UM43FG-E5AK)

F-MPC04 (UM03)

■ Description

- FUJI power monitoring equipment (F-MPC) realizes fine power management to contribute to energy-saving.
- We can offer you various F-MPC equipment such as F-MPC04 series power monitoring unit that measures electric power of one to multi-circuits, and compact size F-MPC60B, F-MPC30 series multifunctional digital relay that protects, controls, and measures high-voltage distribution facilities.
- As support tool, a power monitoring system software, F-MPC-Net is also available, which collects and analyzes data measured by F-MPC.
- As related products of F-MPC, molded case circuit breaker with ZCT and split type current transformer are introduced.

■ Power monitoring equipment used in power distribution system



* UM03-ARA3G has the leakage current measuring function.

Multiple function protectors and controllers F-MPC60B, F-MPC30 series

■ Description

- FUJI multiple function protector and controller (F-MPC) performs energy control to contribute to energy-saving. The F-MPC60B and F-MPC30 are a kind of multifunctional digital relays.
- Although these series are very compact, they integrate multiple functions in a compact body, such as protection, measurement, operation, and monitoring of high-voltage power distribution and switching facilities. They can also transmit data obtained from these functions to upper level controllers.

KK02-050

F-MPC60B (UM43FG-E5AK)

KK02-042

F-MPC30 (UM5ACG-H5R)

■ Functions

The functions of F-MPC60B and F-MPC30 series are listed below.

Series		F-MPC60B	F-MPC30
Type		**UM43FG-E5AK**	**UM5ACG-H5R**
Installation location		Receiving or feeder	Feeder
Application (phase: line)		3:3, 3:4	3:3, 3:4
VT voltage	Input	2VT/3VT star	—
	Voltage indication	Between phases, between lines	—
Ground fault system	System type	Direct/resistance	Direct/resistance
IO detection	①Residual (3XCT)	○	○
	②Tertiary winding (100/5A)	○	○
	③ZCT (5 to 100/5A)	○	○
	④ZCT (5 to 400/5A)	—	○
	⑤ZCT (200/1.5mA)	—	—
	⑥ZCT (100/1A) or (70/1A) or secondary I input (0.002 to 0.4A)	—	—
E0 detection * Feeder: Depending on MN signal.	EVT (3Ry= 110V)	—	—
	EVT (3Ry= 190V)	—	—
	ZPD-1 (FUJI-made)	—	—
	MN signal output	—	—
	MN signal input	—	—
Protective characteristic (current)	SI, VI, LT, EI, I^2t	○	○ (without I^2t)
	DT1 (short-time)	○	○
	DT2 (definite-time)	○	○
Control voltage	Rating	100V DC	100/200V DC
	Allowable range	80 to143V DC	80 to 286V DC
Transducer output selection	No. of output pole	6	—
	(Function and terminal)	Select	—
No. of DI/DO		8 : 8	1 : 3
No. of CPU		2	1
External plug		—	○
CB close/open	CB making slow-down monitoring function	○	—
	Harmonic voltage (3, 5, 7, Total)	—	—
	Harmonic current (3, 5, 7, Total)	○	—
	Demand current	○	—
Display mode	All or part: changeable	○	— (All only)

○ Available — Not available

09

■ **Functions (continued)**

Series			F-MPC60B	F-MPC30
Type			**UM43FG-E5AK**	**UM5ACG-H5R**
Installation location			Receiver or feeder	Feeder
Protection	Overcurrent Instantaneous	50	○	○
	Overcurrent Short-time	51DT1	○	○
	Overcurrent Definite-time	51DT2	○	○
	Overcurrent Inverse-time *1	51	○	○ *2
	Ground-fault Instantaneous	50G	○	○
	Overcurrent Inverse-time *2	51G	○	○
	Ground fault directional	67		
	Phase-loss	46	○ *3	
	Inverse-phase	47	○ *3	
	Voltage established	84		
	Undervoltage	27	○	
	Overvoltage	59	○	
	Ground-fault overvoltage	64		
	Current prealarm	OCA	○	○
	Ground-fault current prealarm	OCGA	○	○
Measurement	Current (r, s, t)	A	○	○
	Voltage (line)	V	○	
	Voltage (phase)		○	
	Active power (±)	W	○	
	Reactive power (±)	Var	○	
	Power-factor (±)	PF	○	
	Frequency	Hz	○	
	Active electric energy (+)	WHM	○	
	Active electric energy (–)	WHM	○	
	Reactive electric energy (+)	VarH	○	
	Reactive electric energy (–)	VarH	○	
	Ground fault (zero-phase) voltage	V0		
	Ground fault (zero-phase) current	A0	○	○
	Harmonic current (3, 5, 7, Total)	HA	○	
	Harmonic voltage (3, 5, 7, Total)	HV		
	Demand current (r, s, t)	DA	○	
	Demand active power	DW	○	
	Max. zero-phase current value		○	○
	Max. zero-phase voltage value			
	Max. demand current value (r, s, t)		○	
	Max. demand power		○	
	Total electric energy (+)		○	
	Total electric energy (–)		○	
	Min. voltage value (between lines)		○	
Preventive maintenance	50(INST)	number of operation	○	○
	51DT1	number of operation	○	○
	51DT2	number of operation	○	○
	51	number of operation	○	○
	67DG	number of operation		
	50G	number of operation	○	○
	51G	number of operation	○	○
	OCA	number of operation	○	○
	OCGA	number of operation	○	○
	Phase loss	number of operation		
	Inverse phase	number of operation		
	27	number of operation	○	
	59	number of operation	○	
	64	number of operation		
	84 (VR)	number of operation		
	84 (VR)	operating time	○	○
	84 (VR)	No. of making/breaking	○	○

*1 with SI, VI, LT, EI, and I^2t characteristics
*2 with SI, VI, LT, and EI characteristics
*3 Available for version 1 or later.

○ Available — Not available

Multiple function protectors and controllers F-MPC60B series, UN43FG-E5AK

■ Description

Although the F-MPC60B series is very compact, it integrates multiple functions in one body, such as protection, measurement, operation, and monitoring of high-voltage power distribution and switching facilities. It can also transmit the data obtained with these functions to upper level controllers.

■ Features

Flexibility

In accordence with changes in circuit conditions such as CT ratio, the setting of the F-MPC60B can be easily changed.

Improved maintainability

Preventive maintenance and fault analysis can be easily made with the functions that display operation history and fault data.

High reliability

To prevent operation errors such as circuit disconnection, the F-MPC60B series has dual CPUs that check with each other for confirmation and dual output circuits from which output signals are always checked.

UM43FG-E5AK KK02-050

RS-485 communication interface

Two protocol types are available: MPC-Net protocol and MODBUS protocol.*

Note: * MODBUS protocol is available for version 1 or later.

■ Specifications

• General specifications

Type		**UM43FG-E5AK**
Control power supply Control power consumption		100V DC (80 to 143V)/ 100V AC (85 to 132V) common use Max. 15W
Power consumption of CT, VT		Max. 1.0VA
Rated current (CT secondary current)		5A AC ("1A AC" model is also available (non-standard).)
Rated voltage	Line voltage	Select "110V AC" or " 110×$\sqrt{3}$ AC" (VT secondary voltage)
	Phase voltage	Select "110V /$\sqrt{3}$ AC" or "110V AC" (VT secondary voltage)
Zero-phase current		5A AC
Insulation resistance Vibration resistance Shock resistance Dielectric strength Noise immunity Overload resistance Lightning impulse noise resistance		10MΩ (min.) between ground and electric circuits connected together 16.7Hz 1.96m/s^2, 0.4mm double amplitude, 10 minutes each in X, Y, and Z directions 300m/s^2, three times each in X, Y, and Z directions 2kV AC 1 minute. between ground and electric circuits connected together, excluding, RS-485 signal, MN signal, and kWh-pulse output signal cables JEC2500 (conforming to ANSI), square wave, 1.5kV, 1ns/1μs, for 10 minutes. CT circuit: 40 × rated value, for 1s, 2 times VT circuit: 1.25 × rated value, for 10s 5.0kV (between ground and electrical circuits connected together)
Dropout tolerance		20ms (Operation continues, however, display goes out.)
Electrostatic discharge		Contact discharge: ±8kV Aerial discharge: ±15kV
Ambient temperature Humidity Atmosphere Grounding		Operating: -10 to + 60˚C (operation guaranteed) 0 to + 40˚C (characteristics guaranteed) (no icing) *1 Storage: - 20 to + 70˚C (no icing) 20 to 90% RH (no condensation) Free from corrosive gases and excessive dusts or particles Class D grounding (100Ω or less)
Applicable standard		JEC2500 (Protective relays for electric power systems), JEC-2510 (Overcurrent relays), JEC-2511 (Voltage relays), JIS C4602 (Overcurrent relays for 6.6kV receiving), JIS C1102-1 to -9 (Direct acting analogue electrical instrument and their accessories), IEC255-3 (1989), -5, -6
Mass		1.4kg

*1: The operation guaranteed temperature is a temperature at which operation is guaranteed within two times of the guaranteed accuracy value at JEC characteristics guaranteed temperature, or within the accuracy of influence of JIS temperature.

■ Specifications

• Input/output specifications

Input circuit		Applicable to both 100V DC (max. 143V) and 100V AC (max. 132V) Pick up voltage: 40 to 70V DC/40 to 70V AC
Output circuit	Circuit breaker ON/OFF/trip	Making current: 15A (110V DC), allowable continuous current: 4A
	Other than above	Making/breaking current: 0.2A (110V DC, inductive load L/R = 15ms or less), allowable continuous current: 1A

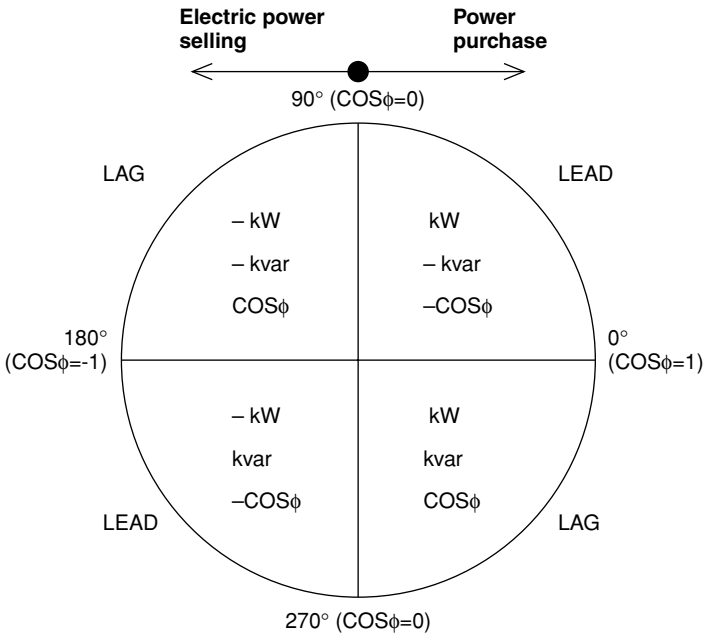
• Measurement and display specifications

	Effective measuring and display range	Accuracy *2
Current/Demand current/ Max. demand current	0, 0.8% to CT rating to 8 × CT rating *1	±1.5% (0, 0.8 to 100%), ±5% (100 to 800%)
Zero-phase current/Max. zero-phase current	CT: 0, 2% to CT rating to 8 × CT rating	±1.5%: 0, 2% to CT rating, ±5%: others
Active power Demmand/active power/ Reactive power	±0.015 to ±1kW at VT secondary circuit (The value is converted into the VT rated voltage	±1.5% : 0, ±0.015 to ±1kW See the figure below. 110V AC.)
Power factor	Lead 0% - 100% - Lag 0%	±5% (Lagging: no sign, leading: - sign) See the figure below.
Active electric energy *3 Reactive electric energy	0 to 99999, multiplying factor: 1, 10, 100, 1000	Equivalent to ordinary instruments shown in Table 4 specified in JIS C 1216 (instrument with a transformer)
Line voltage Phase voltage	9.5 to 260V on VT secondary side 5.5 to 150V on VT secondary side	±1.5% ±1.5%
Frequency Max. demand value Harmonics current	45 to 55Hz (50Hz), 55 to 65Hz (60Hz) Same as the above range 3rd, 5th, 7th, overall harmonics	±0.5% – –

*1 The fault current up to 2000% (accuracy: ±5%) can be displayed.
*2 "0, a to n%" means that "0" is indicated if a value is less than a%.
*3 There are two indications in the electric energy indication; total electric energy indication (zero clear disable) and periodic electric energy indication (zero clear is enable).

The sign "±" in electric measuring

The sign "±" is used to display "LEAD/LAG" in power-factor. measuring and "electric power selling/purchase" in electric power measuring. No signs are used if a value is "+". The sign "±" has the following meanings depending on the measured items.



- Active power: kW
  +: Power purchase (Consumed electric power)
  –: Electric power selling (Inverse electric power flow)
- Reactive power: kvar
  +: Lagging current by reactive volt-ampere meter method
  –: Leading current by reactive volt-ampere meter method
  * "LEAD/LAG" reverses with electric power selling/purchase.
- Power factor: COSϕ
  +:LEAD –: LAG

■ Specifications

• History data

Item	Display range	Display code
50 (INST) detection count	0 to 9999	H0
51DT1 detection count	0 to 9999	H1
51 (OC) detection count	0 to 9999	H2
51G detection count	0 to 9999	H3
50G detection count	0 to 9999	H4
59 (OV) detection count	0 to 9999	H6
27 (UV) detection count	0 to 9999	H7

* Other history display: Fault value display (on occurrence of a fault), history maximum values of zero-phase current/voltage, maximum demand value (A, W), and minimum instantaneous voltage

Item	Display range	Display code
46 detection count	0 to 9999	H9
47 detection count	0 to 9999	HA
OCA detection count	0 to 9999	Hb
Running time	0 to 9999 × 100 (h)	Hc
ON/OFF operation	0 to 9999 × 10 (times)	Hd
OCGA operation count	0 to 9999	Hn
51DT2 opeartion count	0 to 9999	HP

* The display codes are the codes to be displayed on this F-MPC60B (UM43FG-E5AK).

• Specifications of protective relays

Item	Setting range of current/ voltage operate value	Setting range of operate time (timer)	Characteristics	
			Operate value	Operate time
50 (Instant trip)	(1 to 20) × CT rated current (in 0.2 times step), Lock	Fixed	±5%	40ms or less
51DT1 (Definite time)	(1 to 20) × CT rated current (in 0.2 times step), Lock	0 to 5s (in 0.05 step)	±5%	Less than 1s ±50ms More than 1s ±5%
51DT2 (Definte time)	(20 to 240%) × CT rated current (2% step), Lock	0 to 10s (0.1s step)	±5%	Less than 1s ±50ms More than 1s ±5%
51 (Inverse time) SI, EI, VI, LT, I^2t	(20 to 240%) × CT rated current (2% step), Lock	Time multiplication: 0.5 to 20 times, (in 0.1 times step) (Minimum operation time: 150ms)	±5%	Setting = 300%: ±12% 500, 1000%: ±7% (lower limit ± 100ms)
50G, 50N (Instant, definite time)	(0.2 to 8) × CT rated current (in 0.1 times step), Lock	0.0 to 10s to 180s *1	±5%	±5% (lower limit ±50ms)
51G , 51N SI, EI, VI, LT	(2 to 100%) × CT rated current (1% step), Lock	Time multiplication: 0.5 to 20 times (in 0.1 times step) (Minimum operation time: 150ms) *1	±5% (min. ± 100mA)	Setting = 300%: ±12% 500, 1000%: ±7% (lower limit ± 100ms)
59V (0V)	VT secondary voltage: 60 to 150V (1V step), lock	0.0 to 5.0s to 60s (in 0.5s step) (in 1s step)	±5%	±5% (min. ±50ms)
27V (UV)	VT secondary voltage: 10 to 100V (1V step), lock	0.0 to 5.0s to 60s (in 0.5s step) (in 1s step)	±5%	±5% (min. ±50ms)
46 (Open-phase)	–	–	Unbalanced rate 50 - 80%	2s (fined)
47 (Phase sequence relay)	–	–	–	0.5s on less
OCA (Overcurrent pre-alarm)	(10 to 100%) x CT rated current (in 5% step), Lock	10 to 200s (in 10s step)	±10%	±5%
OCGA (Leakage current pre-alarm)	50, 60, 70, 80% of the setting value of "51G operating current", Lock	10 to 200s (in 10s step)	±10% (min±100mA)	±5%

*1 When a current exceeds 15% of the rated fundamental wave current, the malfunction preventive function against the exciting inrush current activates. (When the contents of the second higher harmonics are about 15% or higher, the feature will lock outputs.) Note that with the 50G relay, the malfunction preventive function against the exciting inrush current will not activate if you set the operate time at 0s.

• Communications specifications

Protocol	MODBUS protocol mode	MPC-Net mode
Standard	EIA RS-485	EIA RS-485
Data exchange method	polling/selecting system	1: N polling/selecting system
Transmission distance	1000m (total length)	1000m (total length)
No. of connectable units	Up to 32 units (including master unit)	Up to 32 units (including master unit)
Station number address	01 to 99	01 to 99
Transmission speed	4800/9600/19200 bps (selectable)	4800/9600/19200 bps (selectable)
Data format	Number of start bits: 1 (fixed) Data length: 8 bits (fixed) Parity bit: None/even/odd (selectable) Number of stop bits: 1/2 bit (depends on Pority bit)	Number of start bits: 1 (fixed) Data length: 7/8 bits (selectable) Parity bit: None/even/odd (selectable) Number of stop bits: 1 (fixed)

■ Specifications

• Specifications of transducer outputs

Transducer output signal		4 to 20mA DC (external load resistance: 270Ω or less)	
Signal type	Current (Ia, Ib, Ic)	4 to 20mA for 0 to CT rated Ω current	Accuracy ±1.5%
	Line voltage (Vab, Vbc, Vca)*1	For VT secondary 0 to150V, 4 to 20mA *1 0 to 150V ×√3, 4 to 20mA *2	
		For VT secondary 0 to 150V/√3, 4 to 20mA *1 0 to150V, 4 to 20mA *2	
	Active power (W)	For 0 to 1kW (CT5A, VT110V AC conversion), 4 to 20mA	
	Reactive power (var)	For –1 to 0 to1kvar (CT5A, VT110V AC conversion), 4 to 12 to 20mA	
	Frequency (Hz)	For 45 to 55Hz or 55 to 65Hz, 4 to 20mA	
	Power factor	For LEAD 0.5 to 1 to 0.5 LAG, 4 to 12 to 20mA	

Note: • Output signals are connected to a common terminal (minus side).
• An upper or lower limiter operates when the output signal is about to exceed the upper or lower limit.
The upper limit is fixed at 20mA, and the lower limit is fixed at 20mA.
*1: Applied line voltage: 100V/110V/120V AC.
*2: Applied line voltage: 100V/110V/120V AC ×√3, AC.

• Specifications of kWh pulse output

Type of output	Transistor, open collector
Ratings	Max. 150V DC, 100mA
Pulse width	200 ± 20ms
Pulse rate	10^n kWh per pulse (n=-2 to 4) (integer), or 2000 pulses per kWh

■ Type number nomenclature

UM43 F G - E 5 A K

Basic type
UM43: F-MPC60B series
(3ø3W/3ø4W use)

Type of unit
F: Receiving unit

Ground fault protection
G: 50G/51G (resister grounding)

External interface
A: "4-20mA output" and "RS-485 interface"

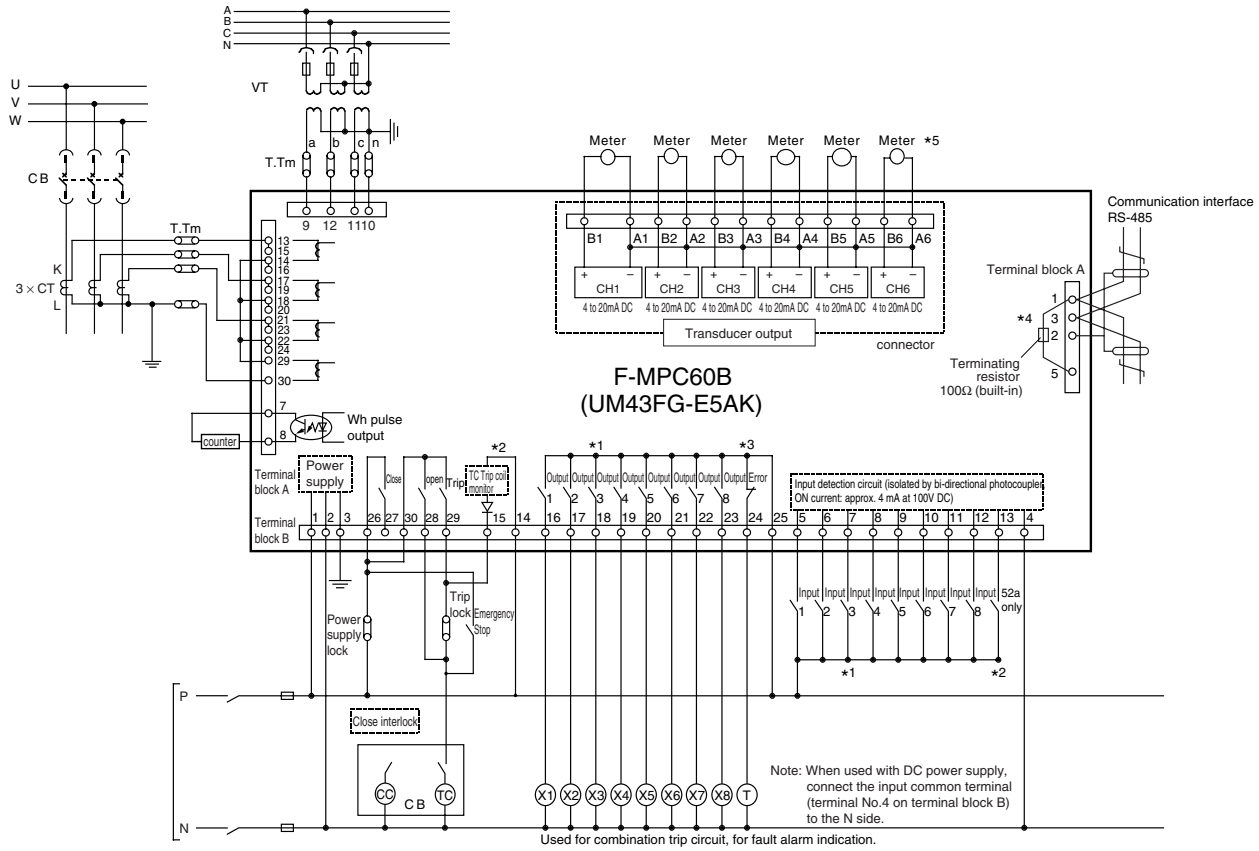
CT secondary current
5: 5A

Control power supply
E: 100V AC/DC common use

■ Ordering information

Specify the following:
1. Type number

■ Example of etxternal wiring diagrams

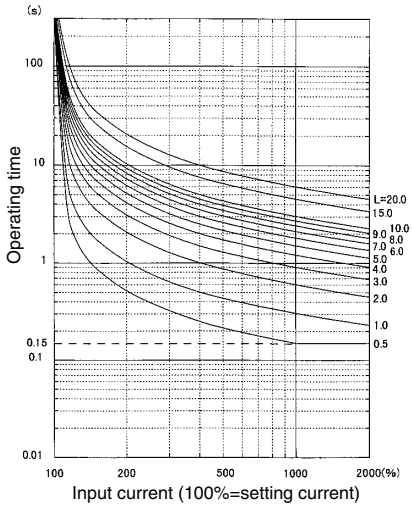


Note: *1 Use selective input 1 to 8 and selective output 1 to 8 by selecting the function type by setup.
*2 Outputs of “ON, OFF, TRIP and equipment error” are used exclusively. Inputs of "52a: the answer back signal of CB ON" and "the monitoring of TC coil" are used exclusively.
*3 Equipment error output is a normally closed contact (normally excited, and if an error occurs, excitation terminates and contact opens). Therefore, a time delay of about 100ms occurs before the contact opens, since the power has been on (in operation). Consider the use of a timer, if necessary, if you create an external sequence.
*4 If this unit, being provided with RS-485 communication function, is located at the termination of a communication line, connect terminals No.3 and 5. With this, the 100Ω terminating resistor is connected across the RS-485 bus.
*5 Use twisted wires (cables) as the output cable of transducer.
• If you have to connect a heavy load exceeding relay’s contact rating, be sure to use it in combination with FUJI’s miniature power relay HH6□.
See page 09/106 “Input/output specifications.”

09

■ Time-current characteristic

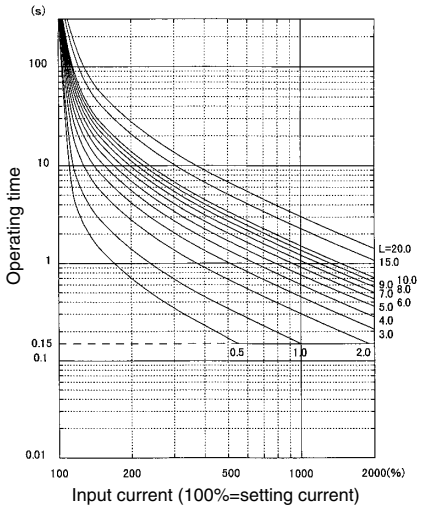
Standard inverse (SI) characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{0.14}{I^{0.02} - 1} \times \frac{L}{10}$$ (L: time magnification)

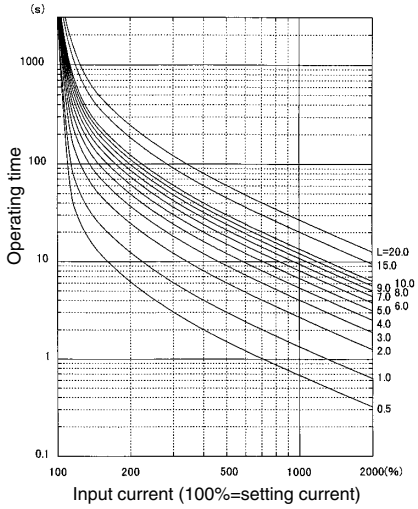
Very inverse (VI) characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{13.5}{I - 1} \times \frac{L}{10}$$ (L: time magnification)

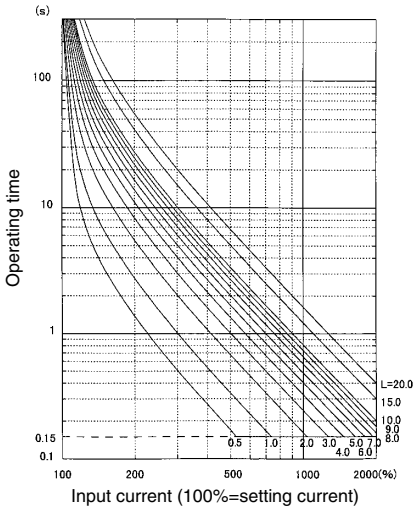
Very inverse (LT) characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{120}{I - 1} \times \frac{L}{10}$$ (L: time magnification)

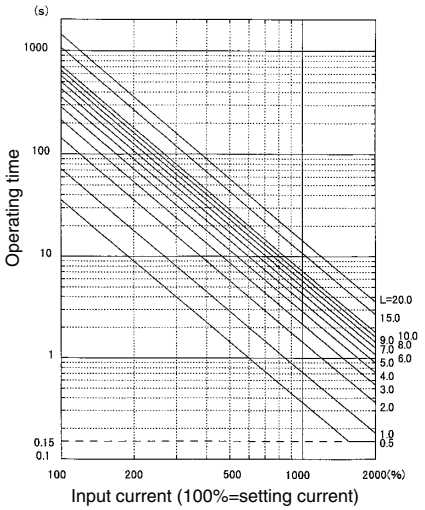
Exremely inverse (EI) characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{80}{I^2 - 1} \times \frac{L}{10}$$ (L: time magnification)

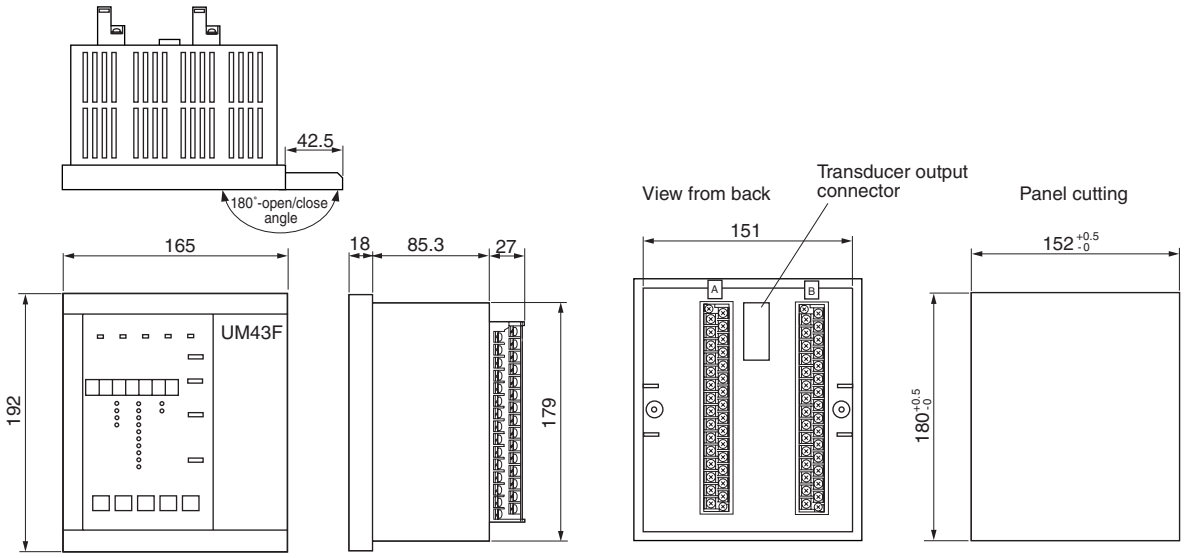
I^2t characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{720}{I^2} \times \frac{L}{10}$$ (L: time magnification)

■ Dimensions, mm



Minimum clearance from adjacent upper and lower devices or panel plate: 100mm

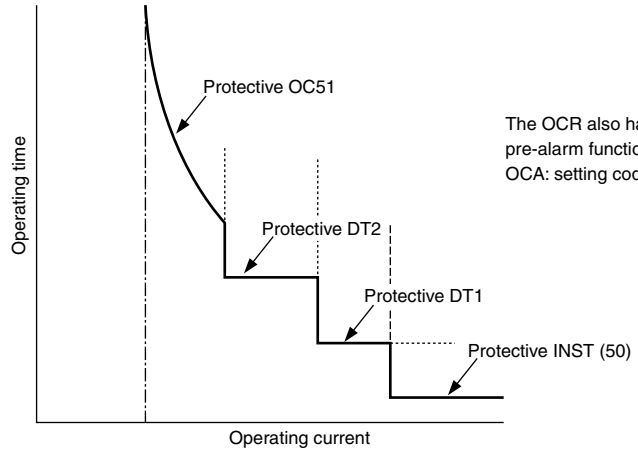
■ Characteristics of overcurrent relay (OCR)

The characteristics of overcurrent relays (OCR) are, in general, divided into the protective INST (50) (setting code 10, 11), the protective DT1 (setting code 12 to 14), protective DT2 (setting code 1c, 1d, 1E) and the protective OC 51 (setting code 15 to18). The characteristics of protective OC 51 consist of 5 kinds of inverse characteristic curves, such as standard inverse (SI) characteristics, very inverse (VI) characteristics, long time inverse (LT) characteristics, extremely inverse (EI) characteristics and I^2t characteristics). Combination of the protective INST (50), protective DT1, protective DT2 and OC 51 carries out coordinative protection.

Outline of characteristic of overcurrent relay

Item	Operating current	Operating time
Protective INST (50)	1 to16 times of CT rated current 5A (0.2 times step)	Fixed (40ms or less)
Protective DT1		0 to 5s (0.05s step)
Protective DT2	20 to 240% of CT rated current 5A	0 to 10s (0.1s step)
Protective OC (51)	(2% step) *1	Select from 5 characteristic curves. Time magnification: 0.5 to 20 times (0.1 times step)

*1: The operating time of protective OC51 is saturated at about 150ms.
The operating time will be saturated at 20 times of CT rated current when the setting exceeds 200%.
For example, the operating time becomes 833% (= 2000%/(240%×100)) of the CT rated current in 240% setting.



The OCR also has the pre-alarm function (protective OCA: setting code 19-1b).

Multiple fuction protectors and controllers F-MPC30

Multiple function protectors and controllers F-MPC30 series, UM5ACG-H5R

■ Description

The F-MPC30 series is a multiple function protectors and controllers in the power monitoring equipment, which integrates protective, measurement, and transfer functions for power feeder facilities. Versatile functions such as preventive maintenance and history data and abnormal value recording can be achieved with excellent economy and reliability. These works have been very complicated as you must have used individual power monitoring devices in combination.

UM5ACG-H5R KK02-042

■ Features

Economical system configuration

Includes measurement and protective functions limited to the current ranges most frequently used, thus allowing the construction of economical systems.

Improved operating reliability

Includes an automatic monitor function, an automatic diagnostic function supported by continuous monitoring and automatic inspection, and a fail-safe function, thus ensuring high operating reliability while minimizing daily and regular inspection tasks.

Easily designed coordination protection

Provided with 51DT1 and 51DT2 definite time trip characteristics that simplify the designing of coordination protection between overcurrent relays.

RS-485 communications interface

Two protocol types are available:
MPC-Net protocol and MODBUS protocol.

■ Specifications

• General specifications

Type	**UM5ACG-H5R**
Control power supply Control power consumption	100/200V DC (80 to 286V DC) common use Max. 15W
Power consumption of CT, VT	Max. 1.0VA
Rated current (CT secondary current) Zero-phase current	5A AC ("1A model" is also available (non-standard)) 5A AC
Insulation resistance Vibration resistance Shock resistance Dielectric strength Noise immunity Overload resistance Lightning impulse noise resistance	10MΩ min. between ground and electric circuits connected together 16.7Hz, 0.4mm double amplitude, 1.96m/s^2, 10 minutes each in X, Y, and Z directions 300m/s^2, three times each in X, Y, and Z directions 2kV AC 1 minute between ground and electric circuits connected together, excluding RS-485 signal lines JEC 2500 (conforming to ANSI), square wave, 1.5kV, 1ns/1μs, for 10 minutes CT circuit: 40 × rated value, for 1s, 2 times 5kV (between ground and electrical circuits connected together)
Dropout tolerance	20ms (Operation continues, however, display goes out.)
Electrostatic discharge	Contact discharge: ±8kV, Aerial discharge: ±15kV
Ambient temperature Humidity Atmosphere Grounding	Operating: –10 to +60˚C (operation guaranteed), 0 to +40˚C (characteristic guaranteed) (no icing) *1 Storage: –25 to +70˚C (no icing) 20 to 90%RH (no condensation) Free from corrosive gases and excessive dusts or particles Class D grounding (100Ω or less)
Applicable standard	JEC2500 (Protective relays for electric power systems), JEC-2510 (Overcurrent relays), JIS C4602 (Overcurrent relays for 6.6kV receiving), JIS C1102-1 to -9 (Direct acting analogue electrical instrument and their accessories), IEC255-3 (1989) -5, -6.
Mass	1.4kg

*1: The operation guaranteed temperature is a temperature at which operation is guaranteed within two times of the guaranteed accuracy value at JEC characteristics guaranteed temperature, or within the accuracy of influence of JIS temperature.

• Input/output specifications

Input circuit		100/200V DC (286V DC or less) common use Pick-up voltage: 40 to 70V DC (Input current; 1.2mA at 100V DC, 2.4mA at 200V DC)
Output circuit	Circuit breaker trip	Making current: 15A (110V DC), 10A (220V DC), allowable continuous current: 4A
	Other than above	Making current: 0.2A (110V DC, inductive load L/R = 15ms or less) Allowable continuous current: 1A
		Making current: 0.1A (220V DC, inductive load L/R = 15ms or less) Allowable continuous current: 1A

• Measurement and display specifications

	Effective measuring and display range	Accuracy *2
Current	0, 0.8% to CT rating to 8 × CT rating *1	±1.5% (0, 0.8 to 100%), ±5% (100 to 800%)
Zero-phase current	CT: 0, 2% to CT rating to 8 × CT rating	±1.5% (0, 2% to CT rating), ±5% (more than CT rating)

*1 The fault current up to 2000% (accuracy: ±5%) can be displayed.
*2 "0, a to n%" means that "0" is indicated if a value is less than a%.

• History data and display ranges

Item	Display range	Display code
50 (INST) detection count	0 to 9999	H0
51DT1 detection count	0 to 9999	H1
51 (OC) detection count	0 to 9999	H2
51G detection count	0 to 9999	H3
50G detection count	0 to 9999	H4

Item	Display range	Display code
OCA detection count	0 to 9999	Hb
Running time	0 to 9999 × 100 (h)	Hc
Close operation count	0 to 9999 × 10 (times)	Hd
OCGA operation count	0 to 9999	Hn
51DT2 operation count	0 to 9999	HP

* Other history display: Fault value display (on occurrence of a fault), history maximum values of zero-phase current/voltage, maximum demand value (A, W), and minimum instantaneous voltage

* The display codes are the codes to be displayed on this F-MPC30 (UM5ACG-H5R).

• Specifications of protective relays

	Setting range of current/voltage operatel value	Setting range of operate time (timer)	Characteristics (accuracy)	
			Operate value	Operate time
50 (Instant trip)	(1 to 16) × CT rated current (in 0.2 times step), Lock	Fixed	±5%	40ms or less
51DT1 (Definite time trip)	(1 to 16) × CT rated current (in 0.2 times step), Lock	0 to 5s (in 0.05s step)	±5%	Less than 1s ±50ms More than 1s ±5%
51DT2 (Definite time trip)	(20 to 240%) × CT rated current (in 2% step), Lock	0 to 10s (in 0.1s step)	±5%	Less than 1s ±50ms More than 1s ±5%
51 (Inverse time trip) SI, EI, VI, LT	(20 to 240%) × CT rated current (in 2% step), Lock	Time multiplication: 0.5 to 20 times (in 0.1 times step) (Min. operation time: 150ms)	±5%	Setting value 300%: ±12% 500, 1000%: ±7% (lower limit ±100ms)
50G, 50N (Instant/definite time trip)	(0.1 to 8) × CT rated current (in 0.1 times step), Lock	0.0 to10s to 180s (in 0.1s step.) (in 1s step.) *1 *2	±5%	±5% (lower limit ±50ms)
51G, 51N SI, EI, VI, LT	(2 to 100%) × CT rated current (in 1% step), Lock	Time multiplication: 0.5 to 20 times (in 0.1 times step) (Min. operation time: 150ms)*1	±5% (min. ±100mA)	Setting value 300%: ±12% 500, 1000%: ±7% (lower limit ±100ms)
OCA (Pre-alarm of overcurrent)	(10 to 100%) × CT rated current (in 5% step), Lock	10 to 200s (in 10s step)	±10%	±5%
OCGA (Pre-alarm of leakage current)	50, 60, 70, 80% of the setting value of "51G operating current", Lock	10 to 200s (in 10s step)	±10% (min. ± 100mA)	±5%

Notes: *1 When a current exceeds 15% of the rated fundamental wave current, the malfunction preventive function against the exciting inrush current activates. (When the contents of the second higher harmonics are about 15% or higher, the feature will lock outputs.) Note that with the 50G relay, the malfunction preventive function against the exciting inrush current will not activate if you set the operate time at 0s.

• Communications specifications

Protocol	MODBUS protocol mode	MPC-Net mode
Standard	EIA RS-485	EIA RS-485
Data exchange method	Polling/selecting system	1: N polling/selecting system
Transmission distance	1000m (total length)	1000m (total length)
No. of connectable units	Up to 32 units (including master unit)	Up to 32 units (including master unit)
Station number address	01 to 99	01 to 99
Transmission speed	4800/9600/19200 bps (selectable)	4800/9600/19200 bps (selectable)
Data format	Number of start bits: 1 (fixed) Data length: 8 bits (fixed) Parity bit: None/even/odd (selectable) Number of stop bits: 1/2 bit (depends on Pority bit)	Number of start bits: 1 (fixed) Data length: 7/8 bits (selectable) Parity bit: None/even/odd (selectable) Number of stop bits: 1 (fixed)

■ Type number nomenclature

UM5AC G - H 5 R

Basic type
UM5AC: F-MPC30 series
Feeder unit
(3ø3W/3ø4W use)

Ground fault protection
G: 50G/51G (rated current: 5A)

Control power supply
H: 100/200V DC

CT secondary current
5: 5A

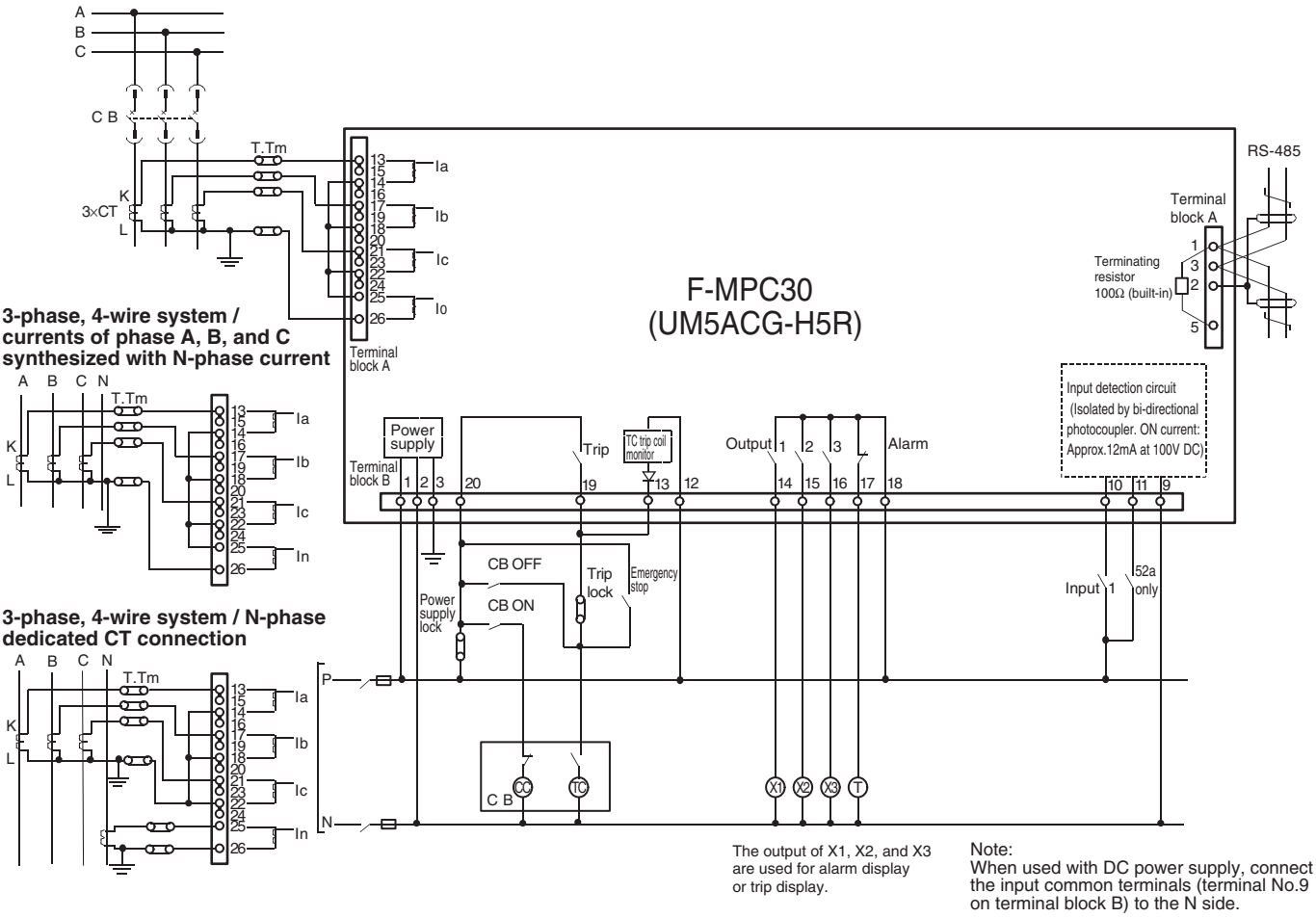
External interface
R: RS-485 communications interface

■ Ordering information

Specify the following:
1. Type number

■ Example of external wiring diagram (External 3 CTs)

3-phase, 4-wire system / zero-phase current



3-phase, 4-wire system / currents of phase A, B, and C synthesized with N-phase current

3-phase, 4-wire system / N-phase dedicated CT connection

The output of X1, X2, and X3 are used for alarm display or trip display.

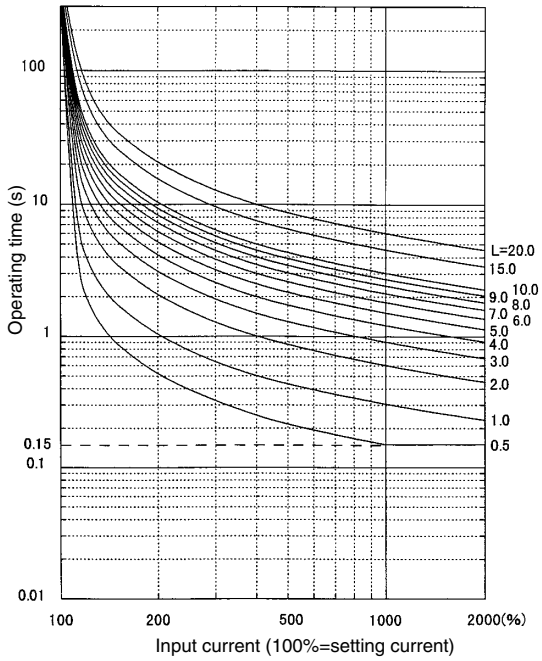
Note:
When used with DC power supply, connect the input common terminals (terminal No.9 on terminal block B) to the N side.

Note:
- Use selective input 1 and selective output 1 to 3 by selecting the function type by setup. *See page 09/113 for details.*
- Outputs of “TRIP and equipment error” are used exclusively. Inputs of "52a: the answer back signal of CB ON" and "the monitoring of TC coil" are used exclusively.
- Equipment error output is a normally closed contact (normally excited, and if an error occurs, excitation terminates and contact opens). Therefore, a time delay of about 100ms occurs before the contact opens, since the power has been on (in operation). Consider the use of a timer, if necessary, if you create an external sequence.
- If you have to connect a heavy load exceeding relay’s contact rating, be sure to use it in combination with FUJI’s miniature power relay HH6□. *See page 09/113* “Input/output specifications.”
- If this unit, being provided with RS-485 communication function, is located at the termination of a communication line, connect terminals No.3 and 5. With this, the 100Ω terminating resistor is connected across the RS-485 bus.

09

■ Time-current characteristics of an overcurrent relay

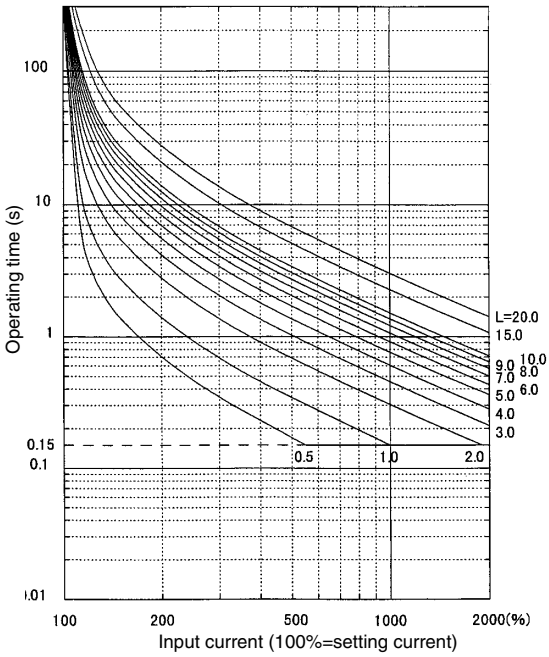
Stnadard inverse (SI) characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{0.14}{I^{0.02} - 1} \times \frac{L}{10}$$ (L: Time magnification)

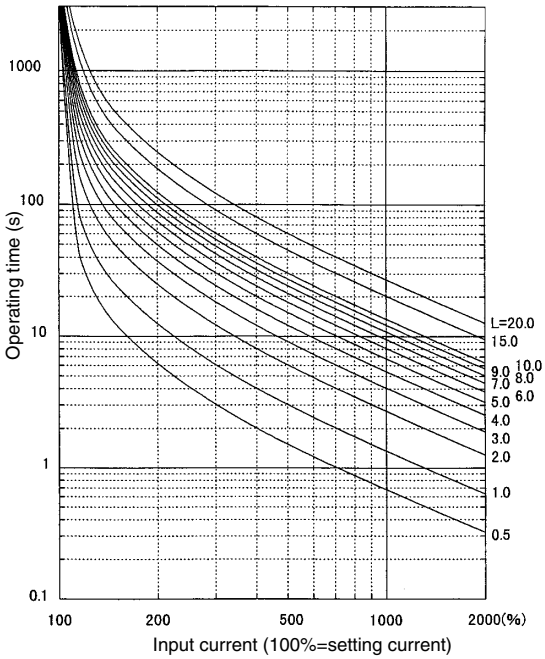
Very inverse (VI) characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{13.5}{I - 1} \times \frac{L}{10}$$ (L: Time magnification)

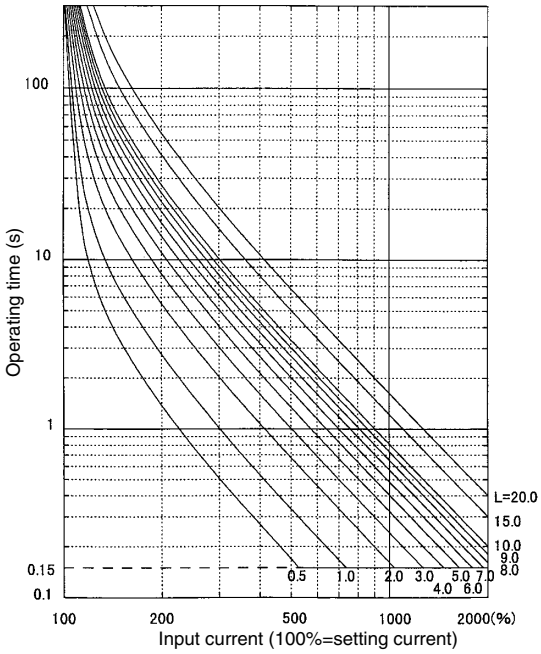
Long time inverse (LT) characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{120}{I - 1} \times \frac{L}{10}$$ (L: Time maginification)

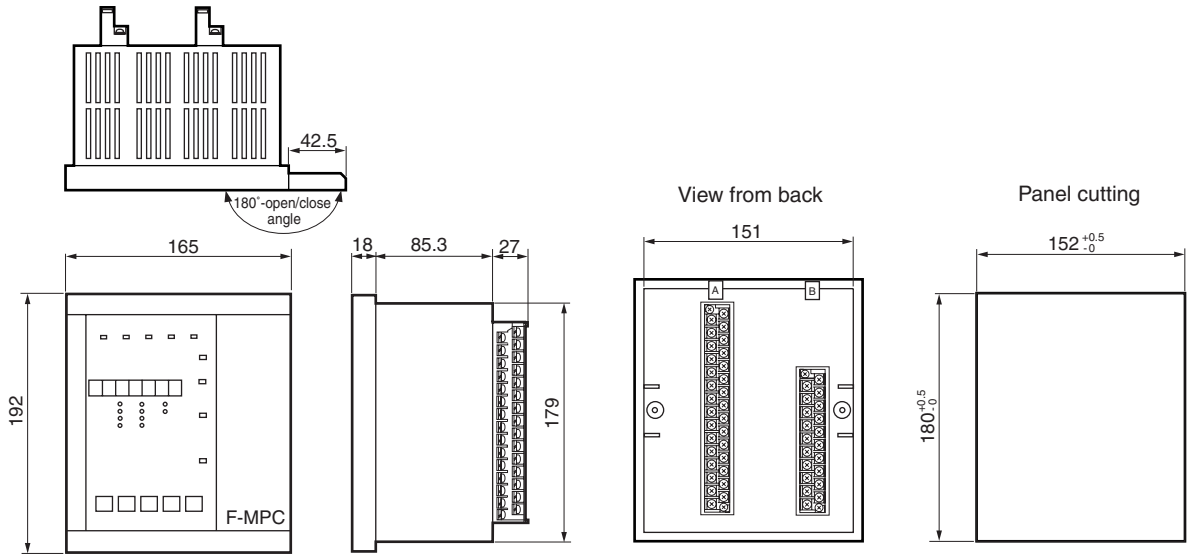
Extremely inverse (EI) characteristics



Note:
Time setting (lever) is of 0.1 times step (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{80}{I^2 - 1} \times \frac{L}{10}$$ (L: Time maginification)

■ Dimensions, mm



Minimum clearance from adjacent upper and lower devices or panel plate: 100mm

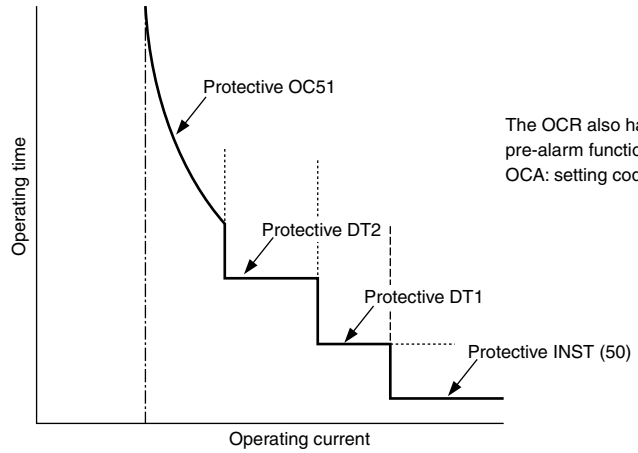
■ Characteristics of overcurrent relay (OCR)

The characteristics of overcurrent relays (OCR) are, in general, divided into the protective INST (50) (setting code 10, 11), the protective DT1 (setting code 12 to 14), protective DT2 (setting code 1c, 1d, 1E) and the protective OC 51 (setting code 15 to18). The characteristics of protective OC 51 consist of 4 kinds of inverse characteristic curves, such as standard inverse (SI) characteristics, very inverse (VI) characteristics, long time inverse (LT) characteristics, extremely inverse (EI) characteristics. Combination of the protective INST (50), protective DT1, protective DT2 and OC 51 carries out coordinative protection.

Outline of characteristic of overcurrent relay.

Item	Operating current	Operating time
Protective INST (50)	1 to16 times of CT rated current 5A (0.2 times step)	Fixed (40ms or less)
Protective DT1		0 to 5s (0.05s step)
Protective DT2	20 to 240% of CT rated current 5A	0 to 10s (0.1s step)
Protective OC (51)	(2% step) *1	Select from 4 characteristic curves. Time magnification: 0.5 to 20 times (0.1 times step)

*1: The operating time of protective OC 51 is saturated at about 150ms.
The operating time will be saturated at 20 times of CT rated current when the setting exceeds 200%.
For example, the operating time becomes 833% (= 2000%/(240%×100)) of the CT rated current in 240% setting.



The OCR also has the pre-alarm function (protective OCA: setting code 19-1b).

09

Power monitoring unit
F-MPC04, F-MPC04P, F-MPC04S

Power monitoring unit F-MPC04 series

■ Description

- F-MPC04 series power monitoring equipment, designed for used in low voltage circuits, can perform electric power management and monitoring from high to low voltage circuit efficiently and economically, used together with F-MPC60B and F-MPC30 series.
- F-MPC04 series consists of 3 types: type UM01 integrated power monitoring unit that can monitors up to 10 feeders, type UM02 multi-circuit power monitoring unit that is space-saving and can monitor up to 8 feeders in three-phase three-wire system, and type UM03 single circuit power monitoring unit, being compact, that has optimum output functions for preventive maintenance, and is best suited for installation in a unit of facility, section, and floor.
- RS-485 communications interface is standard except (UM01-ATA4E). With our application software of F-MPC-Net power monitoring system, you can automatically display, print, and save the data measured by F-MPC 04 on your PC.

F-MPC04 (UM01)

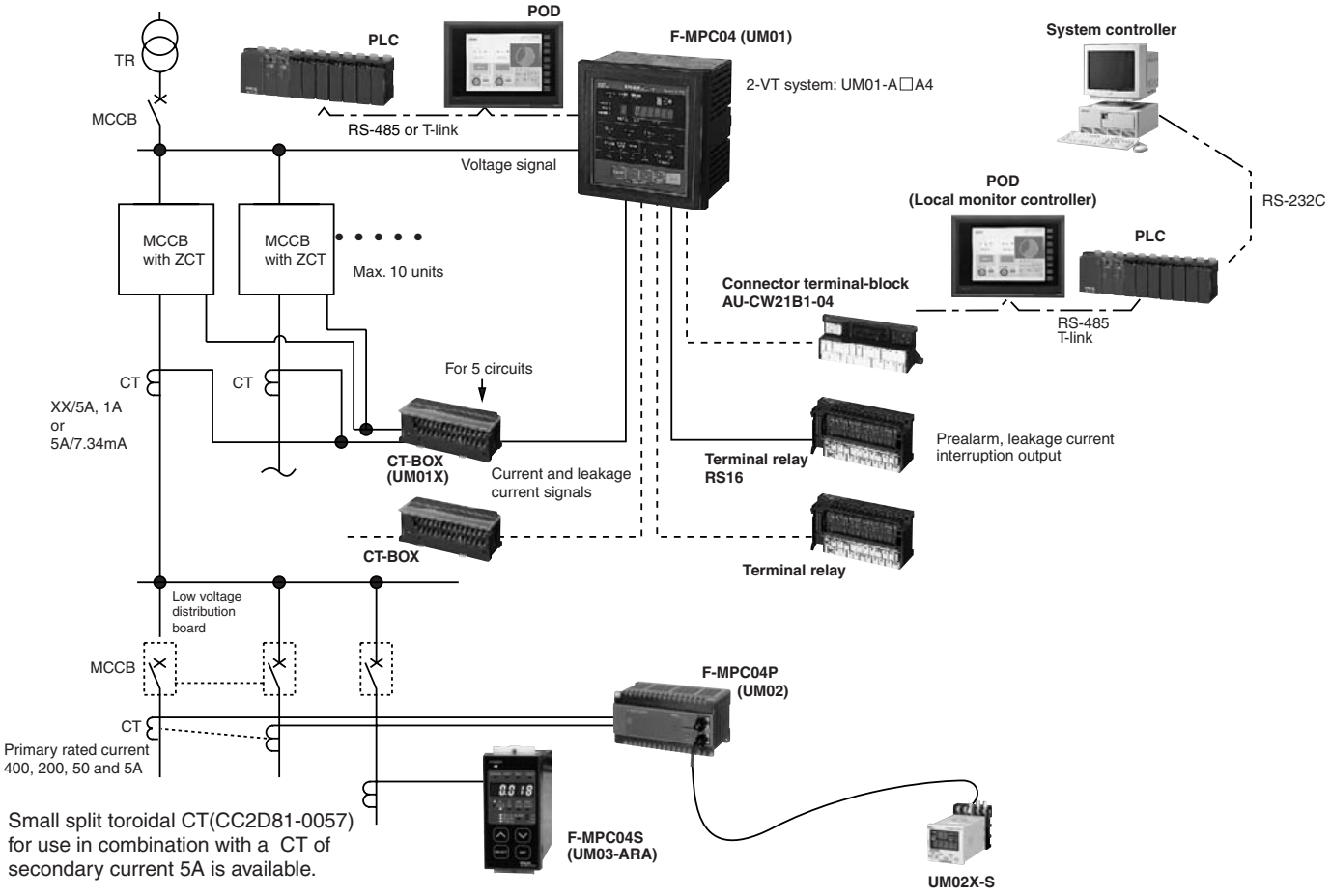
F-MPC04P (UM02)

F-MPC04S (UM03)

Type				F-MPC04	F-MPC04P			F-MPC04S	
				UM01-A□A4E	**UM02-AR2**	**UM02-AR3**	**UM02-AR4**	**UM03-ARA3G**	**UM03-ARA3**
				Integrated power monitoring unit	Multi-circuit power monitoring unit			Single-circuit power monitoring unit	
Measuring function	No. of phase and wire	1-phase 2-wire		10 circuits	12 circuits	—	—	1 circuit	1 circuit
		1-phase 3-wire 3-phase 3-wire		10 circuits	—	8 circuits	—		
		3-phase 4-wire		6 circuits	—	—	4 circuits	—	—
	No. of voltage circuit			2	1			1	1
	Measuring item	Voltage	[V]	○	○			○	○
		Current	[A]	○	○			○	○
		Power	[W]	○	○			○	○
		Active power	[Wh]	○	○			○	○
		Reactive power	[var]	○	○			○	○
		Reactive energy	[varh]	○	–			○	○
		Power-factor		○	○			○	○
		Leakage current	[Io]	○	–			○	–
		Basic component of leakage current	[Iob]	–	–			○	–
	Maintenance item	Demand	Current	○	–			○	○
			Power	○	–			○	○
			Max. current	○	–			○	○
			Max. power	○	○			○	○
		Max. voltage value		○	○			–	–
		Min. voltage value		○	○			–	–
	Harmonic current			○	–			○ (Demand only)	
Protection	Current prealarm (OCA)			○	–			○	○
	Leakage current prealarm (OCGA)			○	–			○	–
	Leakage current trip (OCG)			○	–			○	–
Communications interface				RS-485, T-link	RS-485			RS-485	RS-485
Display and setting				○	Display and setting unit UM02S			○	○
Devices to be connected	Current sensor (Current Transformer:CT)			○ *1	CT: 5, 50, 200, 400A				
	ZCT (separately installed)			○	–			○	–
	MCCB with ZCT			○	–			○	–

Note *1: FMPC 04 (UM01) is connected to CT via CT-BOX. For combination of F-MPC04 (UM01), CT-BOX and CT, *See page 09/120* and *09/136*; "Applicable CT."

■ System configuration example
Low voltage



Small split toroidal CT(CC2D81-0057) for use in combination with a CT of secondary current 5A is available.

09

Power monitoring unit
F-MPC04

Integrated power monitoring unit, UM01-A

■ Description

Integrating complete functions required for power distribution and power line data management in a single unit (up to 10 circuits for 3-phase 3-wire system)

- Supports multiple power distribution lines
  UM01-A allows economical management of each facility and installation by means of communications interface.
- Easy mounting to existing switchboards
  Split-through type CTs enables UM01-A's easy mounting to existing boards.
- Flexible energy management
  UM01-A manages power line data such as measurement, preventive maintenance, maintenance and electricity quality, and transmit those data to upper level controller, thus promises energy and labor-saving.
- Harmonics current measurement
  The third, fifth, seventh, and total harmonic current can be measured.

UM01-A□A4E

CT-BOX

- Related Equipment
  Molded case circuit breakers with ZCT and split type current transformers are also introduced as related products, RS16 Terminal Relay which outputs leakage current prealarm and the connector terminal-block which outputs kWh pulse, are also explained (UM01 use only).

■ Type number nomenclature

Integrated power monitoring unit

UM01-A T A 4 E □

Basic type
UM01-A□A: F-MPC04 series integrated power monitoring unit (with kWh pulse output)

Communications interface
T: T-link
R: RS-485

Special version
H0: CT direct input
No mark: CT secondary current 5A, 1A

Nameplate language
E: English

VT input type
4: 2VT conformed
Up to 10 feeders: 3∅3W, 1∅2W, 1∅3W
Up to 6 feeders: 3∅4W

■ Ordering information

Specify the following:
1. Type number

■ Types

Description	Specification	Type	Page
Integrated power monitoring unit	RS-485, 2VT-conformed	**UM01-ARA4E**	
	T-link, 2VT-conformed	**UM01-ATA4E**	
CT-BOX	For CT secondary current 5A	**UM01X-5**	
	For CT secondary current 1A	**UM01X-1**	
	For CT secondary current 7.34mA	**UM01X-0**	
Related product			
Terminal Relay		**RS16-DE04H**	*See page 09/139.*
Connector terminal block		**AU-CW21B1**	*See page 09/140.*
Connector cable		**AX014**	

■ Applicable CT

Current transformer (CT)	CT secondary current	Applicable CT-BOX	Applicable integrated power monitoring unit
Small CT Type CC2D81-0057	7.34mA	UM01X-0	UM01-A□A4EH0
Split CT Type CC2N□□-□□□□ Type CC2D□□-□□□□	1A	UM01X-1	UM01-A□A4E
General-purpose CT XX/1A	1A		
General-purpose CT XX/5A	5A	UM01X-5	

■ Specifications

• General specifications

Item		Specification
Rating	Rated frequency	50 or 60Hz (Select at initial setting.)
	Rated voltage	Applicable to both 110V and 220V AC, 110V AC for use with a VT secondary circuit
	Rated current	Depends on CT-BOX specifications (5A, 1A, 7.34mA in a CT secondary circuit, power consumption: 0.1VA max., excluding power loss in the external cable resistance)
	Zero-phase CT	EW type or MCCB output with a ZCT (zero-phase current transformer) (FUJI model)
Control power supply		85 to 242V AC (Connects to dedicated control power supply terminals)
Inrush current		18A max., 3ms max. (100V AC 50Hz) 36A max., 3ms max. (200V AC 50Hz)
Control power consumption *1		25VA max. (Power monitoring unit + two CT-BOXes + two Terminal Relays with all contacts ON)
Ambient temperature		Operating: -10 to + 55˚C (no icing or no condensation) Storage: -20 to +70˚C (no icing on no condensation)
Humidity		20 to 90% RH (no condensation)
Atmosphere		Free from corrosive gases and excessive dusts or particles
Alarm and shutdown outputs		Continuous output current: 1A max. (with output of terminal relay, RS16-DE04H) Make and break current: 250V AC 5A, 30V DC 5A max.
Insulation resistance		10MΩ min.: between ground and electric circuits connected together 5MΩ min.: between electric circuits, between contacts
Dielectric strength		2000V AC, 1 minute between ground and electric circuits connected together, excluding T-link and RS-485 signal circuits
Impulse		4.5kV (1.2 × 50μs) between ground and electric circuits connected together, excluding T-link and RS-485 signal circuits
Momentary overload capability		20 times rated current, nine times for 0.5s, once for 2s
Shock resistance		Approx. 300m/s^2, three times in each of X, Y, and Z axes
Noise immunity		1 to 1.5MHz damped oscillation noise having 2.5 to 3kV peak voltage for 2s 1.5kV square wave (rise time: 1ns, pulse width: 1μs) for 10 minutes continuously
Vibration resistance		JIS C 0040, crossover frequency: 57Hz, 9.8m/s^2
Electrostatic noise resistance		Mounting steel panel surface: ± 8kV F-MPC04 (UM01-A) front panel surface: ± 15kV
Permissible momentary power failure		20ms, continuous operation (excluding display)
Mass		Power monitoring unit UM01: 1000g, CT-BOX: 300g Terminal relay: 200g

Note *1 The control power consumption on the table applies to where CT-BOXes and Terminal relays are connected to the power monitoring unit UM01.

Power monitoring unit
F-MPC04

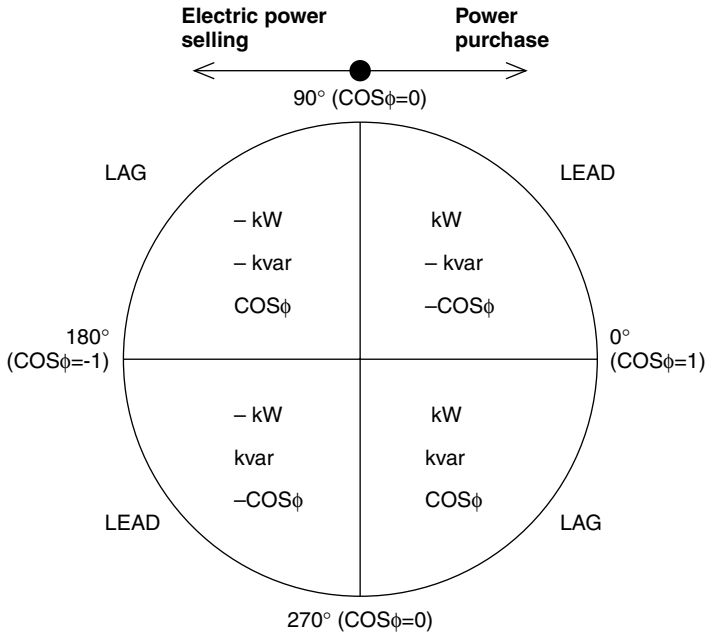
• Measurement and display specifications

Measurement	Display	Effective measurement range	Accuracy (%)	Remarks
Current: I(r), I(s), I(t)	4 digits	0, 2.5 to 150% of CT secondary current	±2.5%	Approx. 2.5% or less is displayed as 0.00.
Voltage: $V_{(uv)}$, $V_{(vw)}$, $V_{(wu)}$		85 to 242V AC at VT secondary voltage	±2.5%	3φ3W: 264V max. 3φ4W (phase voltage): 264V max. 3φ4W (line voltage): $\sqrt{3}$ x 264V
Zero-phase current (Io)		0, 50 to 1200mA	±20%	Approx. 50mA or less is displayed as 0.
Active power		0 to 2kW, at transformer secondary circuit conversion	±2.5%	
Reactive power		0 to 2kvar, at transformer secondary circuit conversion	±2.5%	
Power-factor	□, □□	Lead 0% to 100% to log 0%	±5%	90° phase-angle conversion
Active electric energy	5 digits	+0 to 99999 –0 to 99999	JIS ordinary class or equivalent	
Reactive electric energy	4 digits (communications data only)	+0 to 9999 –0 to 9999	JIS ordinary class or equivalent	No inidication available on the UM01
Minimum voltage	4 digits	85 to 264V AC at each phase VT secondary voltage	±2.5%	
Maximum voltage		85 to 264V AC at each phase VT secondary voltage at maximum voltage phase	±2.5%	
Higher harmonics current		0, 2.5 to 150%: 3rd, 5th harmonics 0, 5.0 to 150%: 7th harmonics	±2.5% (± 5%: 7th harmonics)	

Note : * The accuracy includes the errors of CT-BOXes and ZCTs connected to the UM01-A. The errors of integrated VTs and CTs are not included.
The current, voltage, and electric power measurement characteristics conform to JIS C 1102 (Electrical Measurement Instrument).
The displayed values are moving averages calculated for four seconds for current and one second for voltage.

The sign "±" in electric measuring

The sign “±" is used to display "LEAD/LAG" in power-factor. measuring and “electric power selling/purchase” in electric power measuring. No signs are used if a value is "+". The sign “±" has the following meanings depending on the measured items.



- Active power: kW
  +: Power purchase (Consumed electric power)
  –: Electric power selling (Inverse electric power flow)
- Reactive power: kvar
  +: Lagging current by reactive volt-ampere meter method
  –: Leading current by reactive volt-ampere meter method
  * “LEAD/LAG” reverses with electric power selling/purchase.
- Power factor: COSφ
  +:LEAD –: LAG

• Demand measurement

Item	Specification
Current (I(r), I(s), I(t)) Effective power Zero-phase current (Io) Harmonics currents, voltage	Time: Select one from 0, 1, 5, 10, 15, and 30 minutes it at the initial setting (common to all 10 circuits). Display item: 1. Demand values 2. Maximum demands (maximum values recorded before the last reset operation)

● **Specifications of a leakage current relay**

Sensitive current

Setting value	200/500/1000mA on Lock
Operating Level	50 to 100% of setting value (Operate at less than 50%, no opearate at 100%)

Operation time characteristics

Setting time	Inertia non-operating time	Operating time
0.1s	–	0.1s max.
0.3s	0.1s min.	0.3s max.
0.5s	0.3s min.	0.5s max.
1.0s	0.5s min.	1.0s max.

Note: • Sensitive current and operation time can be set by an arbitrary combination.
• The values on the table is for a trip relay's specifications. The pre-alarm relay operates at half the operating level on the table, and its operation time is 10s fixed. The pre-alarm relay can be used as an alarm against leakage current increase in case of cable insulation deterioration or flood.

● **Data display at fault occurrence**
Pre-alarm of load current, pre-alarm of leakage current relay (auto-reset), maximum current indication at circuit interruption (indication reset by resetting)

● **kWh-pulse-output specifications** (for products with a kWh-pulse-output feature)
Transistor open collector output: 35V DC, 50mA max., (residual voltage at ON state: 2.5V max.)
Output pulse width: 200ms ±20ms
Output pulse rate: 10^n kWh/pulse, n =-2, -1, 0, 1, 2, or 3 (selected from VT and CT ratio.)

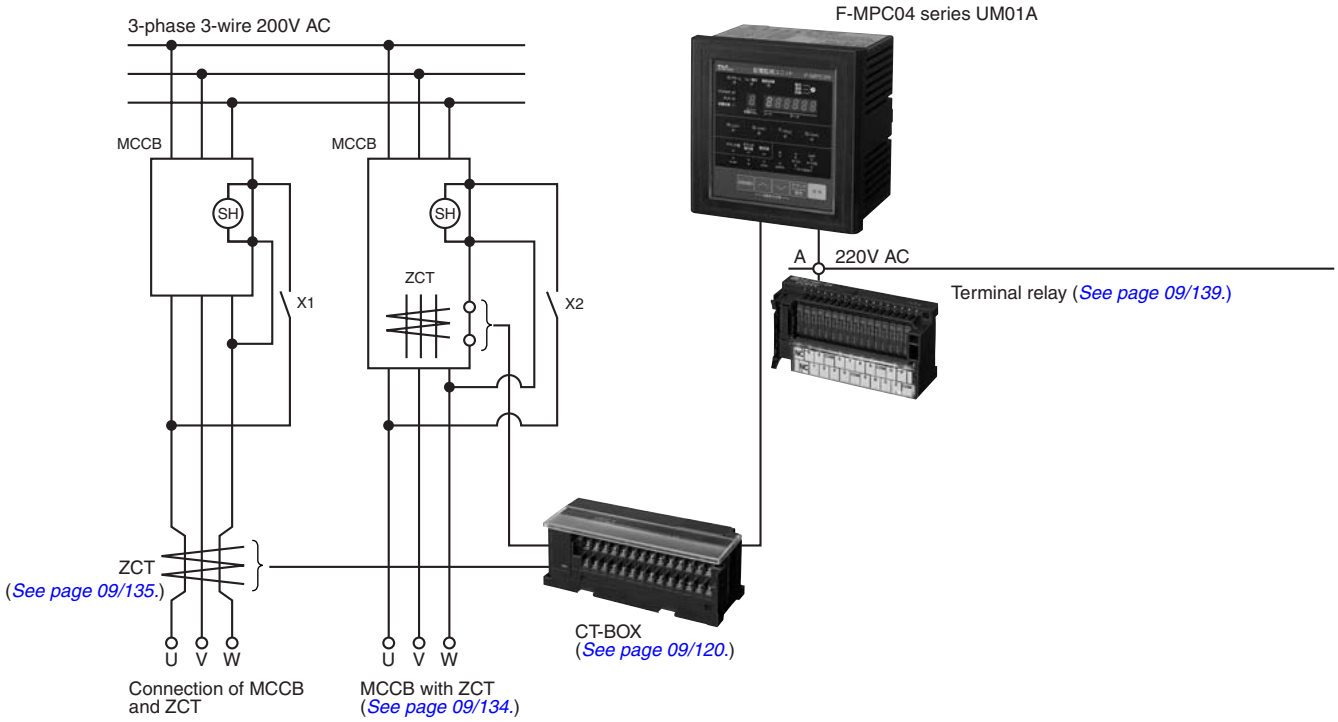
■ **Communications specifications**

Description	T-link	RS-485
Standard	—	EIA RS-485
Data exchange	1:N (UM01) Polling/selecting	
Transmission distance	700m	1000m
No. of stations	Max. 32 (excluding master)	Max. 32 (including master)
Address setting	00 to 99	01 to 99
Transmission speed	500kbps	4800/9600/19200bps
Data format	Dedicated	Start bit: 1 bit (fixed)
		Data length: 7/8 bits (selectable)
		Parity bit: None/even/odd (selectable)
		Stop bit: 1 bit (fixed)

Power monitoring unit
F-MPC04

■ System configuration

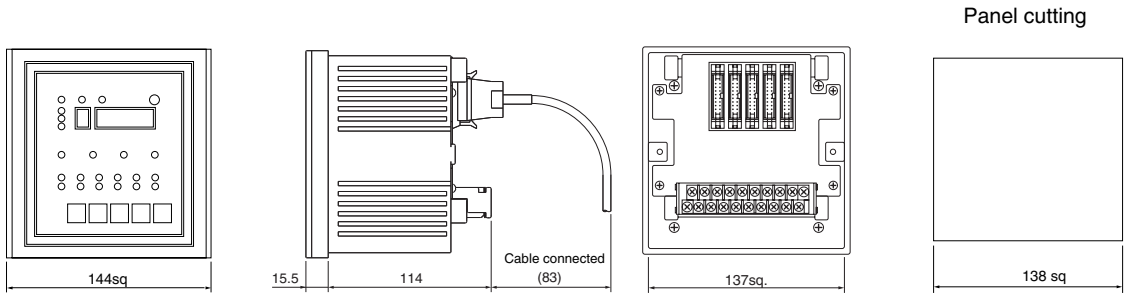
With an integrated power monitoring unit UM01-A, you can easily construct a low-voltage power distribution system equipped with leakage current measuring, leakage current pre-alarm, and earth leakage circuit shutdown.



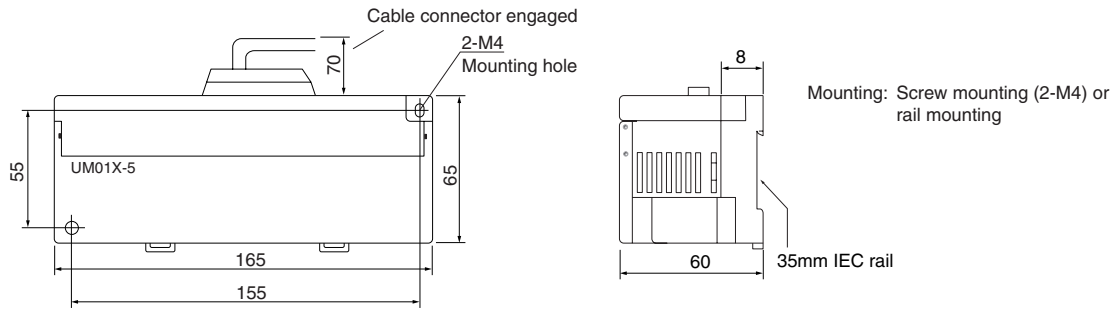
(SH) : Shunt trip device

■ Dimensions, mm

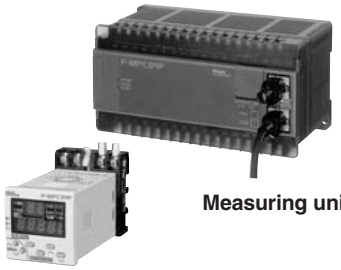
• Integrated power monitoring unit, UM01



• CT-BOX, UM01X



Multi-circuit power monitoring unit, UM02



Measuring unit UM02

Display and setting unit

■ Description

Integrating measuring functions required for power monitoring in one unit

- A single unit measures multiple circuits
  A single UM02 can measure up to 8 feeders in 3-phase 3-wire, 12 feeders in 1-phase 2-wires and up to 4 feeders in 3-phase 4-wire circuit.
- Easy installation into existing switchboards
  Compact UM02 can be easily installed into on-site power distribution or lighting panel, irrespective of new panel or existing panel, to create power monitoring system economically.
- On-site measuring instrument
  UM02 can be used an on-site measuring instrument by combining with an optional display and setting unit UM02X-S.
- Communication interface
  As UM02 has an RS-485 communications interface as standard, it can communicate with other power monitoring equipment with RS-485

■ Type number nomenclature

Multi-circuit power monitoring unit (Measuring unit)

UM02-AR 3

Basic type
UM02-AR: Measuring unit

Applicable circuit
2: 1-phase 2-wire, up to 12 feeders
3: 3-phase 3-wire, 1-phase 3-wire, up to 8 feeders
4: 3-phase 4-wire, up to 4 feeders

■ Type and applicable circuit

Description	Applicable circuit	**Type**
Measuring unit	1-phase 2-wire, up to 12 feeders	**UM02-AR2**
	3-phase 3-wire, 1-phase 3-wire, up to 8 feeders	**UM02-AR3**
	3-phase 4-wire, up to 4 feeders	**UM02-AR4**

Sold separately

Display and setting unit	—	**UM02X-S**
Cable for UM02-AR connection	0.5m	**UM02X-C005**
	5m	**UM02X-C050**

09

■ Ordering information

Specify the following:
1. Type number

Power monitoring unit
F-MPC04P

■ Specifications F-MPC04P (UM02)

• General specifications

Item		Specification
Ratings	Voltage	Direct input: 100 or 200V AC, 400V AC (AR4 only) VT primary/ secondary: 220, 440V AC, 3.3k, 6.6kV AC/110V AC, 440/220V AC *1
	Current	Split CT: 50, 200, 400A AC Small split current sensor CT: 5A AC (primary rated set range 10 to 7500A) *1
Control power supply		100/200V AC common use (85 to 264V AC) AR2: between terminals P1-N, AR3: between terminals U-V, AR4: between terminals P1-P2
Inrush current		15A max., 3ms max. (100V AC 50Hz) 30A max., 3ms max. (200V AC 50Hz)
Control power consumption		20VA or less (or approx. 15VA at 200V AC, 10VA at 100V AC)
Ambient temperature Humidity Atmosphere		Operating: -10 to 55˚C (no icing or no condensation) Storage: -20 to 70˚C (no icing or no condensation) 20 to 90% RH (no condensation) Free from corrosive gases and excessive dusts or particles
Insulation resistance Dielectric strength		10MΩ min. between electric circuits and ground 2000V AC, 1 minute (2500V AC, 1 minute for AR4) between control power circuits and ground
Lightning impulse noise resistance		4.5kV (1.2 × 50μs) between control power circuits and ground (6.0kV for AR4)
Momentary overload capability Vibration resistance Shock resistance Noise immunity Permissible momentary power failure		20 times rated current, 9 times for 0.5s. JIS C 0040, crossover frequency 57Hz, 9.8m/s^2 Approx. 300m/s^2, 3 times in each of X, Y. and Z axes 1.5kV square wave (rise time: 1ns, pulse width: 1μs) for 10 minutes continuously 20ms (continuous operation) except RS-485 communications
Mass		Measuring unit: Approx. 500g, Display and setting unit: Approx. 200g

Note *1 Make VT and CT ratio settings through the display and seting unit UM02X-S or from the host controller.

• Measurement specifications

Item	Effective measurement range		Display	Accuracy *1
Current (N-phase current measured in AR4) Active power Reactive power *2	With split CT (200A and 400A AC) combined 0, 0.4% of In to 500A With small split current sensor (50A AC) combined 0, 0.4% of In to 50A with small split current sensor (5A) combined *4 0 to n times CT rating		4 digits	±1.5% ±2.5% for S-phase current of AR3 and N-phase current of AR4
Power-factor			□. □□	±5% (converted into a phase angle of 90˚)
Active electric energy *2			5 digits	Equivalent to JIS ordinary class *4
Max. active power *3	Same as above. (with a demand time set to 0, 1, 5, 10, 15, or 30min.)		4 digits	±1.5%
Min. voltage each phase *2	AR2, R3 85 to 264V (directly or VT secondary voltage conversion) The minimum and maximum voltage are average values for 0.3s.	AR4 Phase voltage 50 to 288V (directly or VT secondary voltage conversion) Line voltage 86 to 498V The minimum and maximum voltage are average values for 0.3s.	4 digits	±1.5%
Max. voltage each phase *2			4 digits	±1.5%

Notes *1 Measurement accuracy does not include CT and current sensor.
*2 In measurement mode display is the number of digits of RS-485 communications data. The display and setting unit does not display communications data on reactive power, minimum voltage, and maximum voltage values.
*3 Max active power and active electric energy values can be reset by the display and setting unit and host controller. And, when VT ratio or CT ratio is changed, these are autamalically reset.
*4 With 1-turn or 3-turn primary winding selected for the 5A small split current sensor, the lower limit of minute current measurement is selected as specified below.

Classfication	Measurement and display range	Measurement lower limit (Electric energy starting current)	Accuracy Current and power	Electric energy
1 turn	0 or 2% to rating × 10	2% of rating	0 to rating: ±1.5% of rating Exceeding rating: ±1.5% (FS) *	±2.5% (5% to 100% of rating, load power factor -0.8 to 1.0 to +0.8)
3 turns	0 or 0.7% to rating × 3	0.7% of rating		

Note: * The range of the measuring unit UM02-AR is automatically changed internally depending on the load current.

• Sampling interval and display value

Type	Sampling interval/display value of current and power (Communication)	Sampling and cumlative interval of power
UM02-AR2	Approx. 0.2s / Average voltage for aprox. 1.5s	Approx. 0.2s
UM02-AR3	Approx. 0.2s / Average voltage for aprox. 1.5s	Approx. 0.2s
UM02-AR4	Approx. 0.1s / Average voltage for aprox. 0.4s	Approx. 0.1s

■ Display and setting unit UM02X-S, specifications

Item	Specification	Remarks
Control power supply	Supplied from the measuring unit UM02-AR	
Measuring unit UM02-AR communications specifications	EIA RS-485 (always 19200bps fixed)	
Number of connectable measuring unit UM02-AR	5 max.	UM02-AR2, AR3, AR4
Max. cable length between UM02-AR and UM02X-S	23m	Total length between UM02X-S and all UM02-ARs
Display item	Operating status, measurement value VT, CT setting value, fault	Selective indication by a switch
Setting	Voltage, current (CT), demand time, pulse multiplication rate, No. of turns of CT secondary winding, host controller communications mode (different communications interface)	UM02-AR incorporates a different RS-485 interface to communicate with a host controller.

Note : The display and setting unit UM02X-S provides a function to start inital communications to recognize the UM02-AR automatically when UM02X-S is turned on. If on-site indication is not necessary once the setting to the measuring unit UM02-AR is complete, UM02-AR fully operates even without UM02X-S.

■ Communications specifications

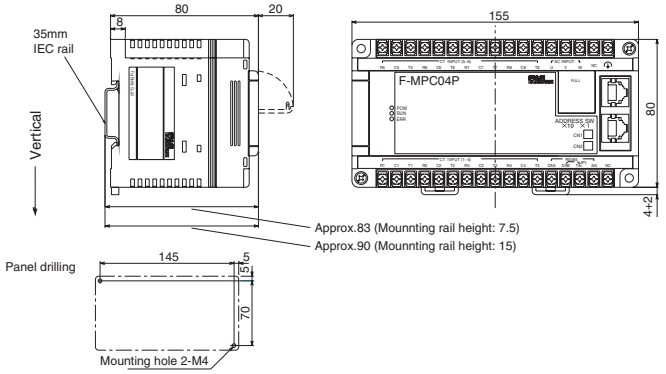
Item		Specification
Standard		EIA RS-485
Transmission system		2-wire half duplex
Data exchange		1: N (F-MPC04P, UM02-AR) polling/selecting
Transmission distance		1000m (total length)
No. of connectable units		Up to 31 units per system
Station number setting		01 to 99 (set with digital switch)
Transmission characters		ASCII
Transmission speed		4800, 9600, or 19200 bps (selectable)
Data format	Number of start bits	1 (fixed)
	Data length	7 or 8 bits (selectable)
	Parity bit	None, even, or odd (selectable)
	Number of stop bits	1 (fixed)
	BCC	Horizontal parity: Even

Note : Use the display and set unit to change the transmission setting.
The communications specifications cannot be changed through the host controller.

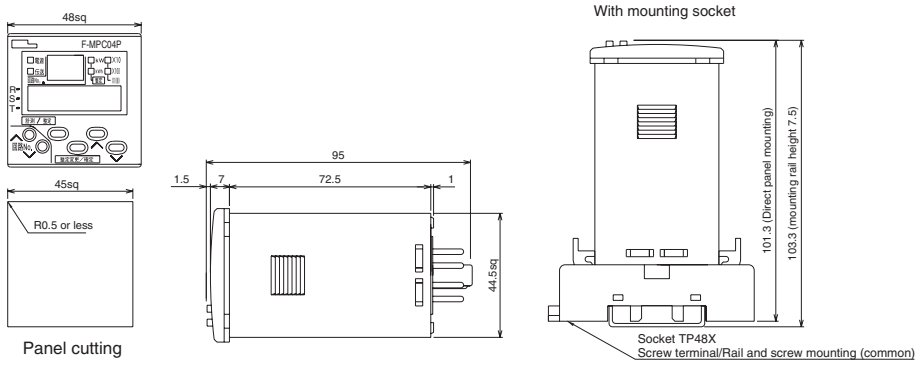
Power monitoring unit
F-MPC04P

■ Dimensions, mm

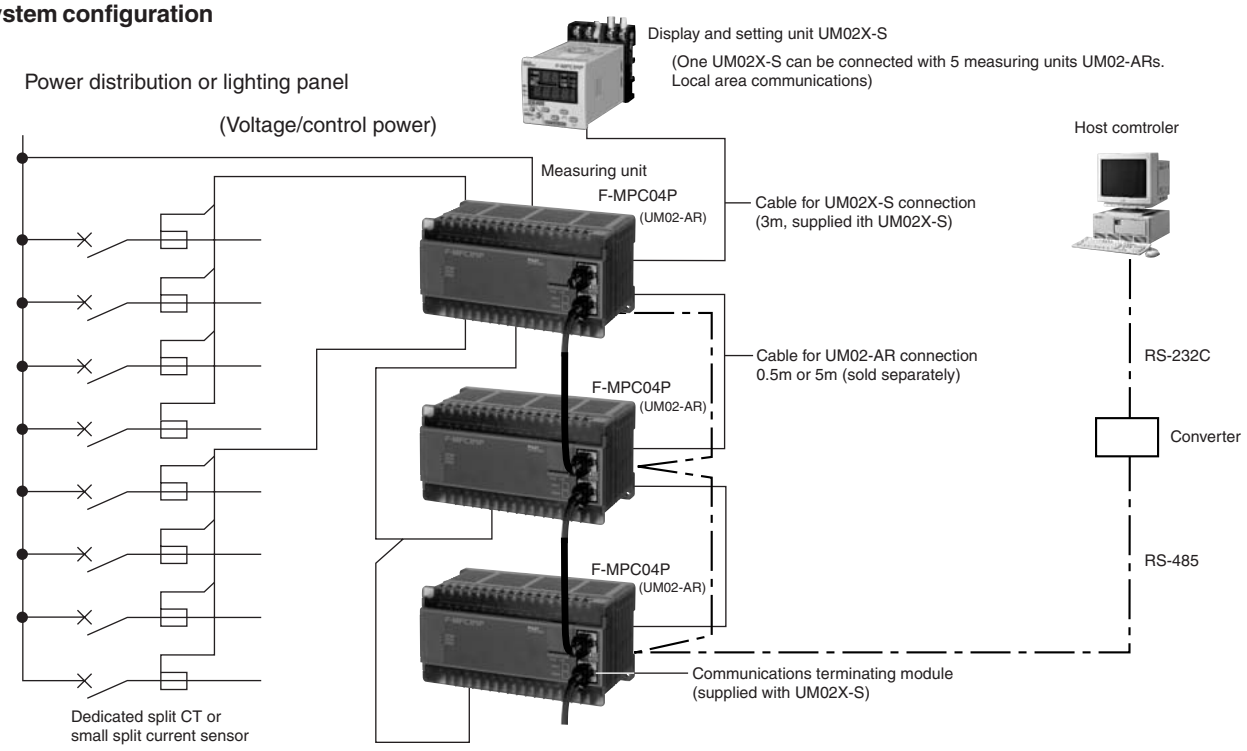
● Measuring unit UM02-AR



● Display and setting unit UM02X-S



■ System configuration



Note: * The display and setting unit UM02X-S is a local area communications master and can monitor and be able to set maximum five measuring units, UM02-ARs.

** Station address setting of measuring unit UM02-AR
Use a digital switch on the measuring unit to set a different station address (communication address to host controller).
In local area communication of the display and setting unit UM02X-S, the UM02X-S will automatically read out the address of the measuring units connected with cables for unit connection, and communicate with hem.,

Single circuit power monitoring unit, UM03

■ Description

Integrating measuring functions required for power monitoring in one unit

● Output functions for preventive maintenance selectable
- Power alarm/current prealarm
- kWh pulse output
- Leakage current alarm, leakage current prealarm output (model with leakage current measuring function) only

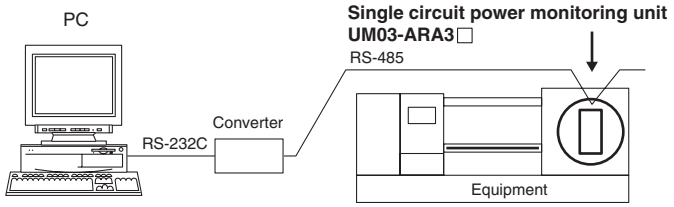
● Capable of measuring inrush current of welders
- High-speed sampling and calculation of voltage and current

● Compact design allows installation almost anywhere.
- Space-saving construction simplifies installation.
- Suited for monitoring individual equipment, section, and floor

● Networking capability
- RS-485 interface.
- Can be connected to power distribution system same way as the power monitoring equipment F-MPC 60B, 30, 04 (UM01, UM02) series products

UM03-ARA3

■ System configuration



■ Types numbers

Single circuit power monitoring unit		Type
Leakage current measuring function	Not provided	**UM03-ARA3**
	Provided	**UM03-ARA3G**

■ Ordering information

Specify the following:
1. Type number

■ Specifications

• General specifications

Applicable circuit		Single circuit 3-phase 3-wire: 2-CT, single-phase 3-wire: 2-CT, single-phase 2-wire: 1-CT
Control power supply		100 to 200V AC (85 to 264V AC) 50/60Hz (45 to 66Hz)
Inrush current		15A, 3ms or less (at 110V AC, 50Hz) 30A, 3ms or less (at 220V AC, 50Hz)
Control power consumption		Approx. 7VA (at 220V AC) Approx. 5VA (at 110V AC)
VT consumed burden		Approx. 0.2VA
Continuous overload capability	Current input circuit	110% of maximum setting value (150% of rated current), 2 hours
	Voltage input circuit	291V AC (1.1×264V AC), 2 hours
Short-time overload capability	Current input circuit	2000% of max. setting value (150% of rated current), 9 times for 0.5s
	Voltage input circuit	200% of max. setting value (264V AC), 9 times for 0.5s
Vibration		10 to 58Hz 0.075mm (one-way amplitude) 58 to 150Hz: constant acceleration 10m/s^2, 10 cycles for 8 min in each X, Y, and Z directions
Shock		300m/s^2, in each X, Y, and Z directions, 2 times
Withstand voltage / Insulation resistance (500V DC megger)		2kV /10MΩ Between power supply terminals connected together and other terminals connected together 2kV /10MΩ Between measurement input terminals connected together and other terminals connected together 2kV /10MΩ Between alarm output terminals connected together and other terminals connected together 500V /10MΩ Between watthour pulse output terminals connected together and other terminals connected together
Ambient temperature		Operating: -10 to +55˚C Storage: -20 to +70˚C
Humidity		20 to 90%RH (no condensation)
Atmosphere		Free from corrosive gases and excessive of dusts
Grounding		Grounding resistance of 100Ω or less
Allowable momentary power failure time		20ms (operation will continue)
Altitude		Less than 2,000m
Mass		Approx. 400g (actual unit only, CT excluded)

09

Power monitoring unit
F-MPC04S (UM03)

• Measurement specifications

Item	Effective measurement range	Display	Accuracy *1
Current (R/S/T), demand current Max. demand current value	• With CT (200A AC) 0, 0.4% of In (0.8A) to 300A	4-digit	±1.5%: R- and T-phase ±2.5%: S-phase
Demand value and max. demand value of total harmonic current	• With CT (400A AC) 0, 0.4% of In (1.6A) to 600A	4-digit	± 2.5%
Active power (±) Demand power Max. active demand power value	• With CT (5A) 0, 0.4% of In (0.2A) to 50A 0, to 1.5 times CT rating (for 5A)	4-digit	±1.5%
Reactive power (±)	(converted into CT secondary: 7.5A)	4-digit	±3%
Power factor (±)	(Max. display range: up to 9,999A)	3-digit	±5% (Converted into a phase angle of 90˚)
Active electric energy (+only)	• Demand time setting: 0, 1 to 15min	5-digit	Equivalent to JIS ordinary class (pf: 0.5-1.0- –0.5)
Reactive electric energy (±absolute value addition)	(by 1min step) 30min setting: Available	5-digit	±5%
Voltage	Converted into an input voltage 60 to 264 V AC	4-digit	±1.5% ±2.5%: Vv-w
Frequency	45 to 66Hz *2	3-digit	±0.5%
Leakage current (Io/Iob) *3 Max. demand value	0, 10 to 1000mA	4-digit	±2.5%

Note: *1 Measurement accuracy does not include that of combined CT and small current sensor.
*2 When the measured frequency is out of the effective measurement range, 0.0Hz iz displayed.
*3 Only UM03-ARA3G can measure the leakage current.
Io: Leakage current including harmonics Iob: Leakage current comprissing fandamental wave only.

• Output specifications

Item		UM03-ARA3	UM03-ARA3G	Specification
Watthour pulse output		Provided	Provided	Transistor open collector output 35V DC 100mA
Alarm output	Current prealarm (OCA), power alarm *	Provided	Provided	Replay output 250V AC 1A
	Leakage current prealarm (OCGA) Leakage current alarm (OCG)	Not provided	Provided	

Note: * Choose the current prealarm (OCA) output or power alarm by change of setting.

Watthour pulse output details

Output specifications	35V DC 100mA (residual 2.5V or less at ON)
Output pulse width	100ms±20ms
Output cycle	200ms or more
Pulse multiplication rate	10^nkWh/pulse (n=–3 to 2 setting)

Alarm output details

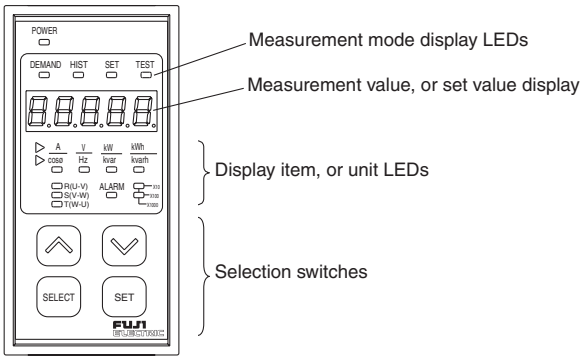
	Setting range		Accuracy	
	Operate value	Time	Operate value	Time
Current prealarm (OCA) *1	I: 20 to 120% of rated value, Lock (5% step)	Depending on the demand time setting	±5% (rated min ±1.5%)	±10%
Power alarm *1	0 to 9999kW (1kW step)			
Leakage current alarm (OCG) (Io operation)	Operate current 100, 200, 500mA, Lock	0.1, 0.3, 0.5, 1.0s	75%±5% of setting value	75%±5% of setting value (min±25ms)
Leakage current prealarm (OCGA)	50±5mA 100 to 500mA (50mA step), Lock	0.1, 0.3, 0.5, 1.0, 10s or demand time *2	±5%	±5%

Note: *1 Choose the current prealarm (OCA) output or power alarm by change of setting.
*2 If you select the demand time, the prealarm operate only with Iob (leakage current of fundamental wave only)

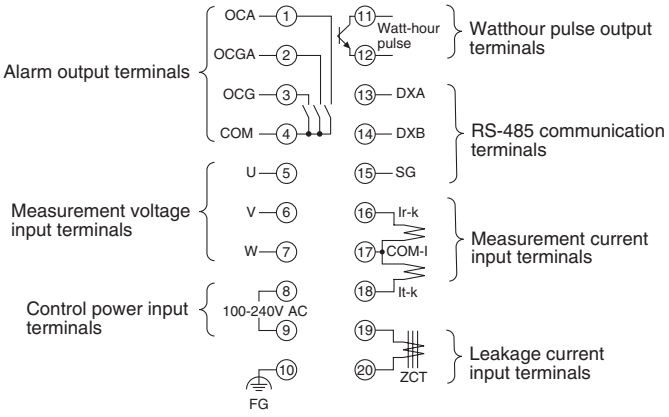
■ Communications specifications

Item		Specification	Factory setting
Standard		EIA RS-485	–
Transmission system		2-wire half duplex	–
Data exchange		1: N polling/selecting	–
Transmission distance		1000m (total length)	–
No. of connectable units		Up to 31units per system	–
Station number setting		1 to 99	(no setting)
Transmission characters		ASCII	–
Transmission speed		4800, 9600, or 19200 bps (selectable)	19200 bps
Data format	Number of start bits	1 (fixed)	–
	Data length	7 or 8 bits (selectable)	7 bits
	Parity bit	None, even,or odd (selectable)	Odd
	Number of stop bits	1 (fixed)	–
	BCC	Horizontal parity: Even (fixed)	–

■ Front panel

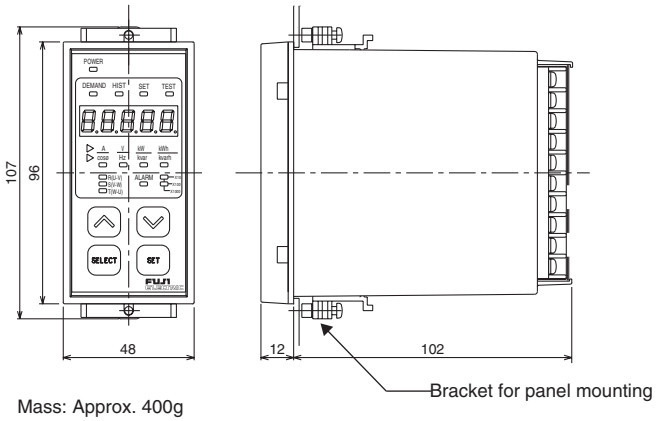


• Terminal layout



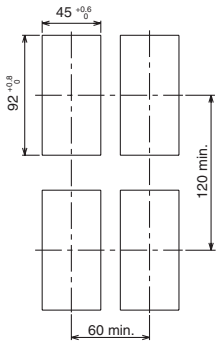
Note: Alarm output terminal ② ③ and ZCT input terminal ⑲ ⑳ of the UM03-ARA3 (without leakage current measuring function) are NC terminals. Do not connect anything to these terminals.

■ Dimensions, mm



Mass: Approx. 400g

Panel cutting



09

Power monitoring system software F-MPC-Net

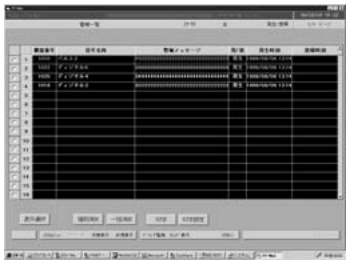
Power monitoring system software F-MPC-Net

■ Description

You can display various data that have been measured and collected by power monitoring equipments on your PC (Windows NT, 2000, XP) that the application software F-MPC-Net was installed. With your PC, you can see a demand monitor display, trend display, alarm display, and also print documents.

■ Features

- Measurement display
  Analog value like current can be measured and displayed (measured value display). Cumulative value like cumulative electric energy can be measured and displayed (measured value display). The measured data can be calculated (arithmetic operation)
- Demand monitoring
  2-channel demand monitor can be made for 30 minutes. (excessive power forecast, alarm output to excessive power available)
- Trend display
  Trend sampling can be made: up to 40 points of analog value's trends like current, up to 80 points of electric energy trends.



Alarm list screen

Trend data can be saved in CSV format which can be read by Excel.

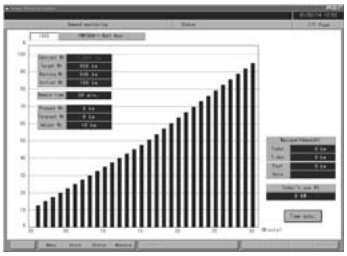
- Alarm display up to 512 points
  Outputs an alarm to the devices that you have added alarm function to. The alarm level is classified into three; light, medium, and heavy. The alarm data can be printed and saved.
- Print document
  Daily report, monthly report, and yearly report can be made, printed, and saved.

■ Example screen

Measurement value display screen

Displays a horizontal bar graph of the data on measurement signals. The above is an identification zone graph of upper and lower limits monitored.

Demand monitor screen



A screen for the 30-minute demand monitoring of accumulative power. A screen for one signal is provided.

Daily and monthly report in Excel

■ Software specifications

- Data display (Ver. 1.2 or later)

Screen name		Max. display per screen	Max. No. of management points
Alarm status indication		16 points	512 points
Status indication		16 points	2000 points *
Measured value indication		8 points	2000 points *
Demand monitor		1 system	512 points
Trend indication	Analog	8 points	512 points
	Electric energy	10 points	512 points
Document printing		16 points	512 points
Data setting screen	Basic setting	16 points	512 points
	Monitor setting	16 points	512 points
	Composing setting	16 points	512 points
	Spreadsheet	16 points	512 points

Note: * Use these two items at the total points of less than 3000 points.

- No. of operable data

Total	Description		
3000-amount	Input data	MPC	Numerical value
			Bit
		Analog (max. 32 points) *	
		Bit (max. 32 points) *	
	Internal composed data (max. 999 values)		

Note: * DIP is necessary.

■ System requirement

PC	DOS/V (PC-AT compatible)
CPU	Pentium 233MHz or higher
HDD	1GB or more
Memory	128MB or more

Monitor	17-inch or more CRT (1024 X 768 pixels)
Auxiliary storage device	MO drive
Printer	

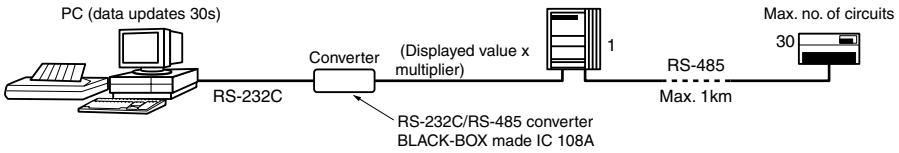
OS	Windows NT4.0, Windows 2000, Windows XP
Application software	Power monitoring system software F-MPC-Net
	Microsoft Excel 97 or later

Note: Windows NT4.0, Windows 2000, Windows XP are either registered trademarks or trademarks of Microsoft Corporation in the U.S. and/or other countries. Microsoft Excel 97/98/2000 are registered trademarks of Microsoft Corporation in the U.S. and/or other countries. All other product and company names mentioned herein are either registered trademarks or trademarks of their respective companies.

■ System configuration

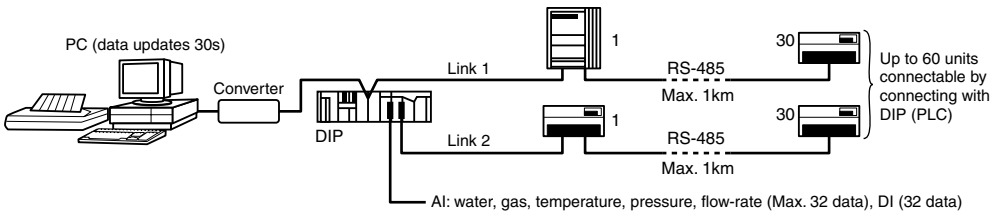
● Small system (RS-485)

F-MPC-Net (max. 3000 data)
Demand monitoring
Status display
Measured data display
Alarm display
Document printing and save



● Middle-sized system (RS-485)

Demand monitoring
Status display
Measured data display
Alarm display
Document printing and save



■ Communications specifications

● Standard transmission data with PC (default)

Monitoring unit	UM01	UM02	UM03
Present data amount	13	11	8
Current (R,S,T)	○×3	○×3	○×2
Z-phase current	○	–	△
Active power	○	○	○
Reactive power	–	○	○
Electric energy	○	○	○
Max. demand power	○	○	–
Line voltage UV,VW,WU (1VT)	○×3 *1	○×3 *1	○×2
Line voltage UV,VW,WU (2VT)	○×3 *1	–	–
Z-phase voltage	–	–	–
Power-factor	– *2	○	○

Monitoring unit	UM01	UM02	UM03
Fault data amount	–	–	–
Fault current (R,S,T)	–	–	–
Z-phase fault current	–	–	–
Fault current UV (59)	–	–	–
Fault voltage UV, VW, WU (27)	–	–	–
Zero-phase fault voltage	–	–	–
Alarm signal amount	3	1	0
Current alarm	○	–	△
Leakage current alarm	○	–	△
Device faulty	○ *1	○ *1	–
No. of circuits	10	8	1
Total of data	97	68	8

Note: *1: Data transmission: one data per UM unit
*2: Power-factor can be read by setting change depending on the version of UM01.

○ Available, — Not available, △ Available by setting

● Maximum number of data by each unit

	Number of data	
UM01	97 per 1 unit (10 circuits) × 30 units	2910
UM02	68 per 1 unit (8 circuits) × 30 units	2040
UM03	8 per 1 unit × 30 units	240

Molded case circuit breakers with ZCT, SA□-FZ

■ Description

By combining one of the following models with the F-MPC04 series (UM01 and UM03-ARA3G), a leakage current monitor and breaking system can be easily constructed.

■ Type number nomenclature

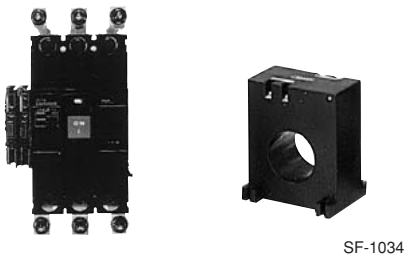
SA103C - FZ/100 X F

Basic type
SA□3-FZ:
MCCB with ZCT

Rated current

Mounting and connection

Shunt trip device



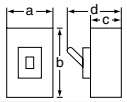
SF-1034

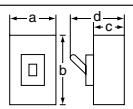
MCCB with ZCT **ZCT**

■ Ordering information

Specify the following:
1. Type number

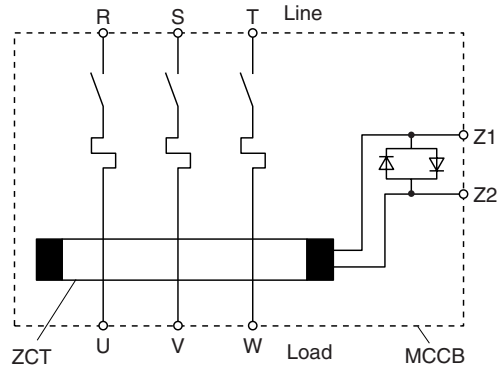
■ Specifications, MCCB with ZCT for line protection

Frame			100A		225A	
Type (Instantaneous trip)			**SA103C-FZ**	**SA103RC-FZ**	**SA203C-FZ**	**SA203RC-FZ**
Pole			3	3	3	3
Rated current (A) Ambient temp.: 40˚C for general use			15, 20, 30, 40, 50 60, 75, 100	15, 20, 30, 40, 50 60, 75, 100	125, 150, 175 200, 225	125, 150, 175 200, 225
Rated insulation voltage Ui (V)		AC	690	690	690	690
Rated breaking capacity (kA)	JIS C 8201-2-1 AC IEC60947-2 (Icu/Ics)	500V 440V 230V	15/4 25/7 50/25	30/8 50/13 100/50	15/4 25/7 50/25	30/8 50/13 100/50
Dimensions (mm)		a b c d	90 155 60 82	90 155 60 82	105 165 60 84	105 165 60 84
Front mounting, front connection		No-mark	●	●	●	●
Front mounting, rear connection		X	● Bar stud	● Bar stud	● Bar stud	● Bar stud
Flush mounting, rear connection		E	● Bar stud	● Bar stud	● Bar stud	● Bar stud
Supplied accessory			Mounting screw, interphase barrier			

Frame			400A		600A	800A
Type (Instantaneous trip)			**SA403C-FZ**	**SA403RC-FZ**	**SA603RC-FZ**	**SA803RC-FZ**
Pole			3	3	3	3
Rated current (A) Ambient temp.: 40˚C for general use			250, 300, 350 400	250, 300, 350 400	500, 600	700, 800
Rated insulation voltage Ui (V)		AC	690	690	690	690
Rated breaking capacity (kA)	JIS C 8201-2-1 AC IEC60947-2 (Icu/Ics)	500V 440V 230V	22/11 35/18 50/25	35/18 50/25 85/43	35/18 50/25 85/43	35/18 50/25 85/43
Dimensions (mm)		a b c d	140 257 103 146	140 257 103 146	210 275 103 146	210 275 103 146
Front mounting, front connection		No-mark	●	●	●	●
Front mounting, rear connection		X	● Bar stud	● Bar stud	● Bar stud	● Bar stud
Flush mounting, rear connection		E	● Bar stud	● Bar stud	● Bar stud	● Bar stud
Supplied accessory			Mounting screw, interphase barrier			

●: Available

■ Internal wiring



*S1, S2 : Shunt trip coil input terminal
*Z1, Z2 : ZCT output terminal
*T1, T2 : ZCT trip test current input terminal

■ EW series zero-phase current transformers (low-voltage circuit use)

Description	Type	Rated current (A)	Sensor hole diameter (mm)	Hole-through cable			Mass (kg)
				1φ2W	1φ3W, 3φ3W	3φ4W	
Round hole through-type	EW-ZB-30M05	50	30	IV 14mm²	IV 8mm²	IV 8mm²	0.22
	EW-ZB-30M1	100	30	IV 60mm²	IV 50mm²	IV 38mm²	0.32
	EW-ZB-58M2	200	58	IV 125mm²	IV 100mm²	IV 80mm²	0.6
	EW-Z70A4	400	70	IV 400mm²	IV 325mm²	IV 250mm²	1.1
	EW-Z70A6	600	70	IV 400mm²	IV 325mm²	IV 250mm²	1.1
	EW-Z90	800	90	IV 500mm²	IV 500mm²	IV 500mm²	3.1
	EW-Z115	1200	115	–	–	–	4.8
	EW-Z160	2000	160	–	–	–	10
	EW-Z250	3000	250	–	–	–	28.5
Split through-type	EW-ZD30	100	30	IV 60mm²	V 50mm²	IV 38mm²	0.55
	EW-ZD45	200	45	IV 125mm²	V 100mm²	IV 80mm²	0.89
	EW-ZD65	400	65	IV 325mm²	V 250mm²	IV 200mm²	1.15

Description	Type	Rated current (A)	Sensor hole diameter (mm)	Hole-through conductor		Mass (kg)
				3φ3W	3φ4W	
With conductors, 3-pole	EW-Z3B40	400	70	5×40mm	–	2.8
	EW-Z3B50	500	70	6×40mm	–	3.1
	EW-Z3B60	600	90	6×50mm	–	7.6
	EW-Z3B80	800	90	8×50mm	–	8.8
	EW-Z3B100	1000	90	12×50mm	–	11.5
	EW-Z3B120	1200	115	10×75mm	–	15.2
	EW-Z3B160	1600	160	12×100mm	–	30.5
	EW-Z3B200	2000	160	6×100mm×2	–	30.5
	EW-Z3B300	3000	250	8×150mm×2	–	68.6
With conductors, 4-pole	EW-Z4B40	400	90	–	5×40mm	6.4
	EW-Z4B50	500	90	–	6×40mm	6.9
	EW-Z4B60	600	90	–	6×50mm	11.5
	EW-Z4B80	800	90	–	8×50mm	14.1
	EW-Z4B100	1000	115	–	12×50mm	15.5
	EW-Z4B120	1200	115	–	10×75mm	24.9
	EW-Z4B160	1600	160	–	12×100mm	36.4
	EW-Z4B200	2000	160	–	6×100mm×2	36.4
	EW-Z4B300	3000	250	–	8×150mm×2	80.3

Note : Twist the ZCT secondary wires (normally once every 50mm) and separate the wires from power line.

Current transformers, CC2

■ Description

Designed for even easier handling. Line-up consists of two types; models exclusively used for FUJI power monitoring unit (F-MPC 04 series), and models for general-purpose instrumentation.

- Improved design enables easier mounting.
- Large K→L display allows easier identification of primary conductor direction.
- Hook attached makes it easier to secure the primary conductor with a cable-tie.
- Clamping diode built in CT will not burn out even with the secondary circuit open (except for the CC2D81).

CC2D

CC2B

■ Specifications

Description	Compact split		Square split		Toroidal	
Type	**CC2D81-0057**	**CC2D81-0506**	**CC2D65-2008**	**CC2D54-4009**	**CC2B65-2008**	**CC2B54-4009**
Used with	**F-MPC04 (UM01 type), F-MPC04S (UM03 type) F-MPC04P (UM02 type)**		**F-MPC04S (UM03 type) F-MPC04P (UM02 type)**			
Rated primary current: In	5A	50A	200A	400A	200A	400A
Linear output limit	Based on the instrumentation range					
Rated secondary current	7.34mA	73.4mA	66.67mA	133.33mA	66.67mA	133.33mA
Sensor hole diameter	ø10		ø24	ø36	ø24	ø36
Rated frequency	50-60Hz					
Overcurrent resistance	40 In/1.0s	10 In/1.0s	40 In/1.0s		40 In/1.0s	
Ratio error	±1%/In, ±1.5%/0.2In					
Phase difference	150' ±90' /In, 180' ±120' /0.2In		±60' /In, ±90' /0.2In		±60' /In, ±90' /0.2In	
Rated burden	0.2693mVA (load res. 5Ω)	26.93mVA (load res. 5Ω)	44.4mVA (load res. 10Ω)	0.18VA (load res. 10Ω)	44.4mVA (load res. 10Ω)	0.18VA (load res. 10Ω)
Insulation resistance	100MΩ or more at 500V DC megger, between sensor core and output					
Dielectric strength	2000V AC/1min, between sensor core and output				2500V AC/1min, between sensor core and output	
Output protection	—		±3Vp, built-in clamping diode		—	
Operating condition	–20 to 75°C 80%RH max. No condensation					
Split portion securing method	Clamp		Clamp		—	
Mounting	Hanger		Hanger			
Connection	Heat-resistant IV cable AWG22 1000mm supplied		Heat-resistant IV cable AWG18 x 1000mm supplied		PVC cable ø0.18mm 12-core 1000mm supplied	M3 screw terminal
Mass	45g		200g	300g	60g	180g

Note: If an existing general-purpose CT (***/5A) has been installed, connect the CC2D81-0057 to the secondary circuit of the existing one.

The combination CTs are CTs dedicated to F-MPC. The general-purpose CTs (rated secondary current 5A or 1A) can not be directly connected to F-MPC. Damage may result.
Combination CT for F-MPC04P (UM02 type) and F-MPC04S (UM03 type)

■ Ordering information

Specify the following:
1. Type number

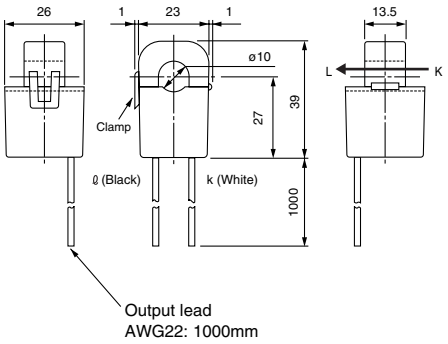
■ Specifications

Description	Square split			Toroidal split	
					
Type	**CC2D74-1001**	**CC2D74-2001**	**CC2D74-4001**	**CC2C76-8001**	**CC2C76-12X1**
Used with	**F-MPC04 (UM01 type)**				
Rated primary current: In	100A	200A	400A	800A	1200A
Linear output limit	Based on the instrumentation range				
Rated secondary current	1A				
Sensor hole diameter	ø36			ø60	
Rated frequency	50/60Hz				
Overcurrent resistance	40 In/1.0s				
Ratio error	+1% In +1.5%/0.2 In				
Phase difference	±80' /In ±100' /0.2 In				
Rated burden	0.5VA (load res. 0.5Ω)				
Insulation resistance	100MΩ min. (500V DC megger) between sensor core and output				
Dielectric strength	2000V AC/1min, between sensor core and output				
Output protection	±1.4Vp, built-in clamping diode				
Operating condition	–20 to 75°C 80%RH No condensation				
Split portion securing method	Clamp				
Mounting	Hanger				
Connection	Heat-resistant IV cable AWG18 1000mm supplied			IV cable 0.75mm^2 1000mm 2-core	
Mass	300g			500g	
CT-BOX	UM01X-1			UM0X-1	

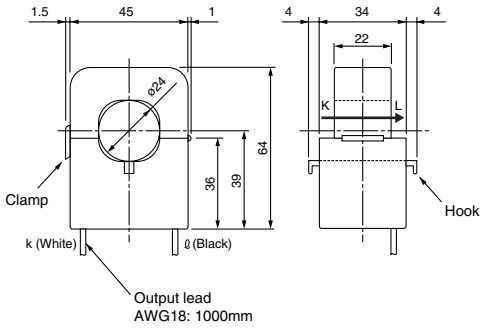
Combination CT for F-MPC04 (UM01 type)
Prepare an exclusive combination CT-BOX when you intend to use the CT in combination with F-MPC04 (UM01 type).
Beware that a different CT-BOX is required depending on the secondary current of the CT you use.

■ Dimensions, mm

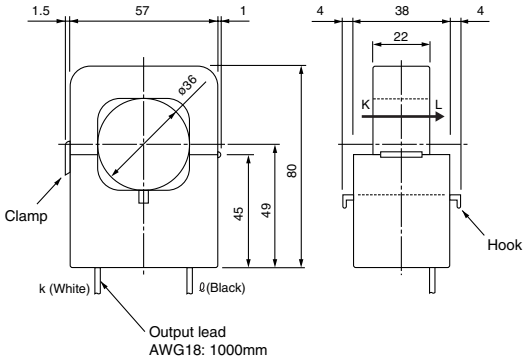
CC2D81



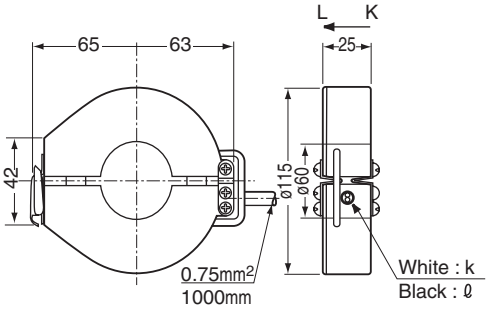
CC2D65



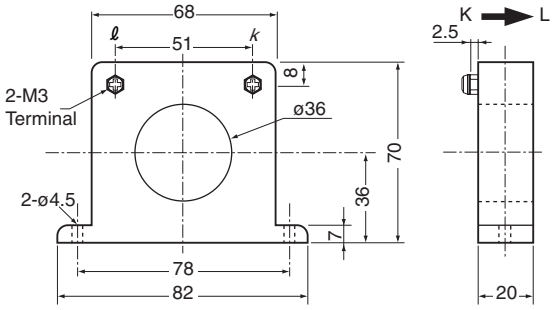
CC2D54, 74



CC2C76

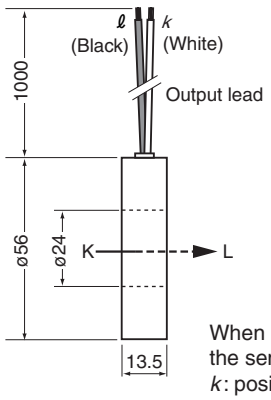


CC2B54



When current flows from K to L direction through the sensor hole, output terminal polarities are *k*: positive and *ℓ*: negative.

CC2B65



When current flows from K to L direction through the sensor hole, output terminal polarities are *k*: positive and *ℓ*: negative.

Terminal relay RS16

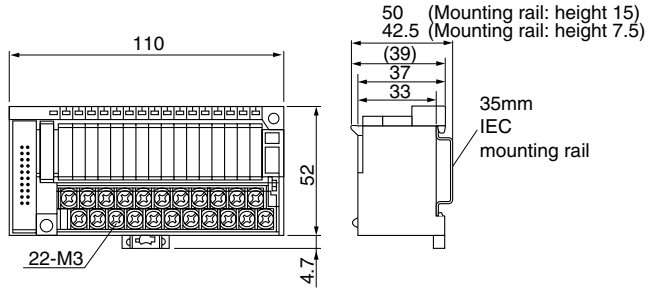
■ Description

The RS16 relay, in combination with F-MPC04 (type: UM01) power monitoring unit, outputs the current prealarm signal and leakage current pre alarm signal, and the signal to trip circuit breakers.

■ Specifications

Type		RS16-DE04H
No. of connectable circuits		5
Operate time		10ms or less
Release time		10ms or less
Vibration	Malfunctions durability	10–55Hz 1mm double amplitude (0.61N max.)
	Mechanical durability	10–55Hz 1mm double amplitude (0.61N max.) 3 times in each X, Y, Z direction, total 18 times
Shock	Malfunctions durability	100m/s²
	Mechanical durability	200m/s², 2 hours in each X, Y, Z direction, total 6 hours
Operating ambient temperature		-25 to 55°C(no icing or no condensation)
Operating ambient humidity		35 to 85%RH
Terminal screw size		M3
Tightening torque		0.5–0.7N • m
Mounting		Rail mounting (screw mounting also available)
Applicable crimp terminal		R1.25–3 (Max 6mm)
Applicable wire size		Max. 1.4mm dia.
LED color	Operation indication	Red
	Power source indication	Green
Coil surge suppressor		Diode
Max. No. of rely insertion		50
Insulation resistance (initial)		100MΩ (500V DC megger)
Dielectric strength	Between contact and coil	2000V AC, 1 minute
	Between same polarity contacts	1000V AC, 1 minute
	Between reverse polarity contacts	2000V AC, 1 minute
Mass		200g

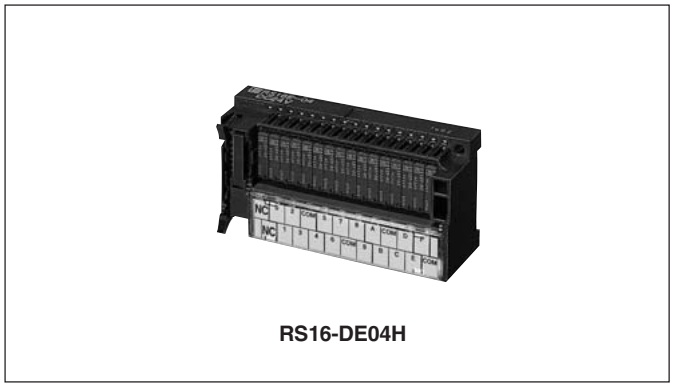
■ Dimensions, mm



■ Connector cable

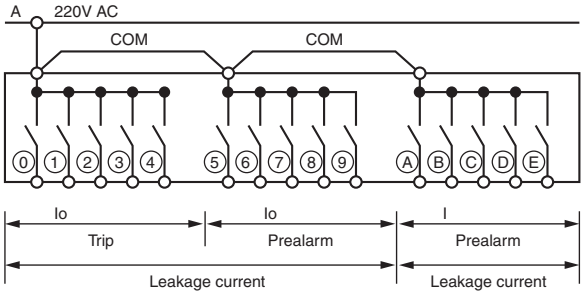
For connecting CT-BOX, Terminal relay RS16, and Connector terminal block AU-CW.

1m long	AUX014-201
2m long	AUX014-202
3m long	AUX014-203



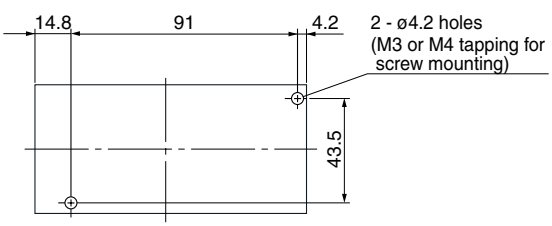
RS16-DE04H

■ Terminal arrangement



	3-phase 3-wire	3-phase 4-wire
⓪	:Io trip (No.1 or 6)	Io trip (No.1 or 4)
①	:Io trip (No.2 or 7)	Io trip (No.2 or 5)
②	:Io trip (No.3 or 8)	Io trip (No.3 or 6)
③	:Io trip (No.4 or 9)	Unused
④	:Io trip (No.5 or 0)	Unused
⑤	:Io prealarm (No.1 or 6)	Io prealarm (No.1 or 4)
⑥	:Io prealarm (No.2 or 7)	Io prealarm (No.2 or 5)
⑦	:Io prealarm (No.3 or 8)	Io prealarm (No.3 or 6)
⑧	:Io prealarm (No.4 or 9)	Unused
⑨	:Io prealarm (No.5 or 0)	Unused
Ⓐ	:I prealarm (No.1 or 6)	I prealarm (No.1 or 4)
Ⓑ	:I prealarm (No.2 or 7)	I prealarm (No.2 or 5)
Ⓒ	:I prealarm (No.3 or 8)	I prealarm (No.3 or 6)
Ⓓ	:I prealarm (No.4 or 9)	Unused
Ⓔ	:I prealarm (No.5 or 0)	Unused
Ⓕ	:Unused	Unused

Panel drilling



■ Ordering information

Specify the following:
1. Type number

09

Connector terminal-block AU-CW21B1

Connector terminal-block, AU-CW21B1

■ Description

The AU-CW21B connector terminal-block, in combination with the FMPC04 (type: UM01) power monitoring unit, can output a kWh pulse.

SB-277

AU-CW21B1

■ Specifications

Type	Front mounting	**AU-CW21B1-04**
	Rear mounting	**AU-CW21B1-04R**
Insulation voltage		60V AC/DC
Continuous current		1A (at 40˚C)
No. of terminals		21
No. of connectors		20
Terminal screw size		M3.5
Insulation resistance		100Ω or more
Dielectric strength		500V 1min
Allowable ambient temperature		–5 to +40˚C
Allowable ambient humidity		45 to 85%RH
Flame resistance		UL94-V1
Connection cable	Multi-core cable	AUX014-20□ *
	Flat cable	AUX024-20□ *

Note: * Specify cable length by replacing □ with 1: 1m, 2: 2m, or 3: 3m.

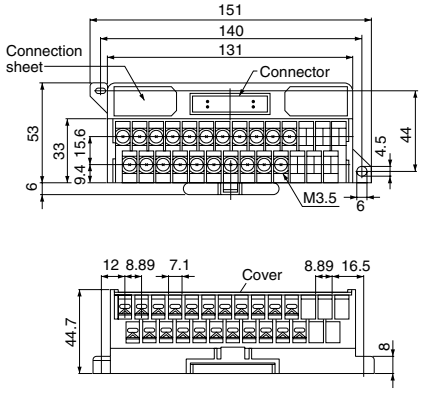
■ Ordering information

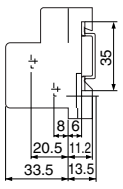
Specify the following:
1. Type number

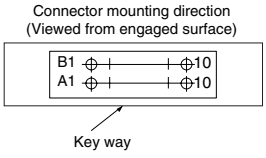
■ Terminal arrangement and output

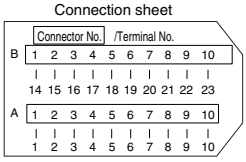
		Pulse output circuit No.	Remarks
Terminal No.	23	Circuit 1 pulse output	Circuit 1 to 6 pulse outputs are valid in 3-phase 4-wire system.
	22	Circuit 2 pulse output	
	21	Circuit 3 pulse output	
	20	Circuit 4 pulse output	
	19	Circuit 5 pulse output	
	18	Circuit 6 pulse output	
	17	Circuit 7 pulse output	
	16	Circuit 8 pulse output	
	10	Circuit 9 pulse output	
	9	Circuit 10 pulse output	
	15, 2	Common (–)	

■ Dimensions, mm









Mounting: Screw or 35mm IEC rail mounting

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- Follow the regulations of industrial wastes when the product is to be discarded.
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09 INDIVIDUAL CATALOG

from D&C CATALOG 19th Edition Revised

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