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

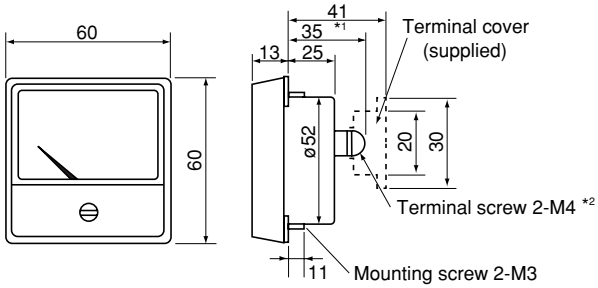
Front frame
60: 60mm square
80: 80mm square

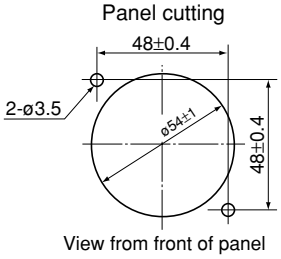
■ Ordering information

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

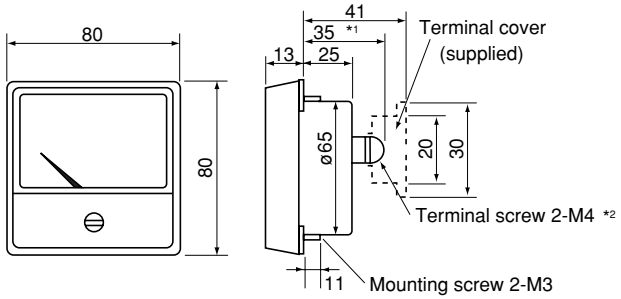


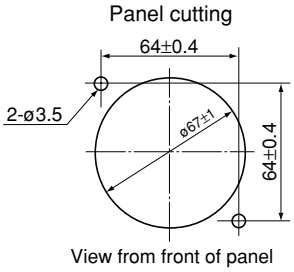


Note: AC ammeter and DC ammeter of 30A direct connection type
*1: 37mm
*2: M5

Mass: 130g

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



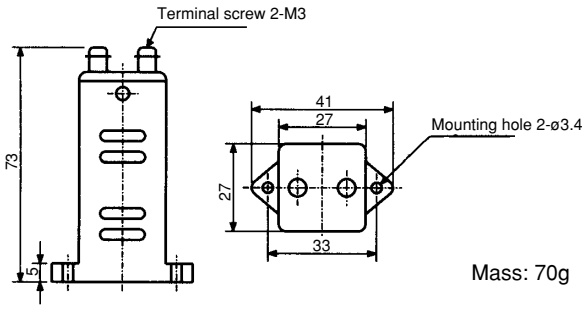


Note: AC ammeter and DC ammeter of 30A direct connection type
*1: 37mm
*2: M5

Mass: 170g

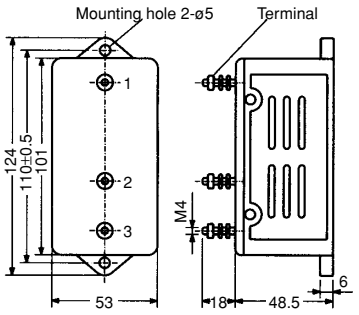
• Series resistor

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



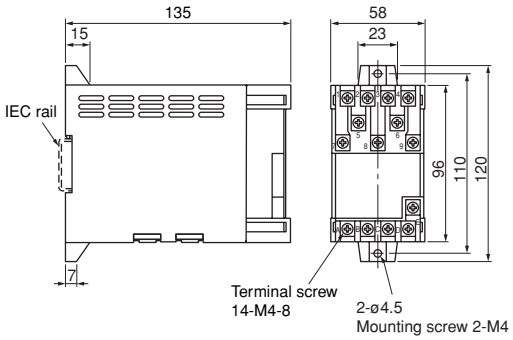
Mass: 70g

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



Mass: 250g

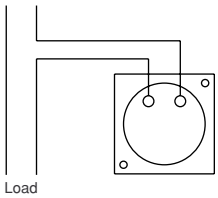
• DC converter



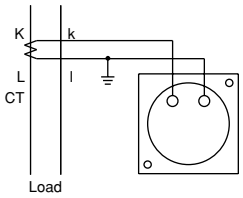
Used with	Mass (g)
FR-□W1, W3	580
FR-□V3, PF3	650

■ Wiring diagrams

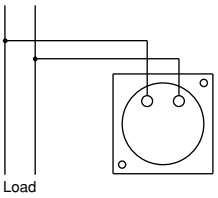
AC ammeter FS-60, 80
(For direct connection)



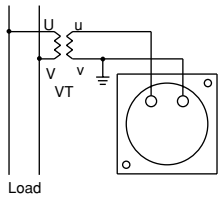
AC ammeter FS-60, 80
(For connection to CT)



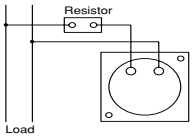
AC voltmeter FS-60, 80
FR-60, 80
(For direct connection)



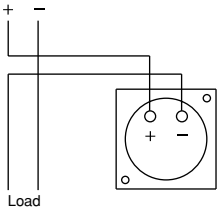
AC voltmeter FS-60, 80
FR-60, 80
(For connection to VT)



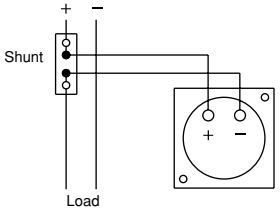
AC voltmeter FS-60, 80
(For connection to series resistor)



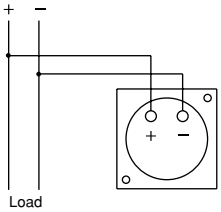
DC ammeter FM-60, 80
(For direct connection)



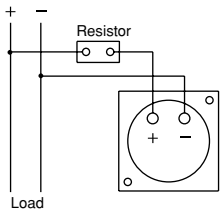
DC ammeter FM-60, 80
(For connection to shunt)



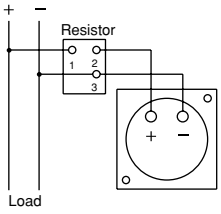
DC voltmeter FM-60, 80
(For direct connection)



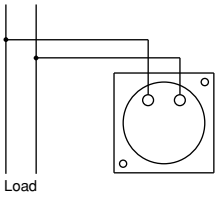
DC voltmeter FM-60, 80
(For connection to series resistor/
2-terminal)



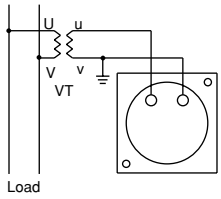
DC voltmeter FM-60, 80
(For connection to series resistor/
3-terminal)



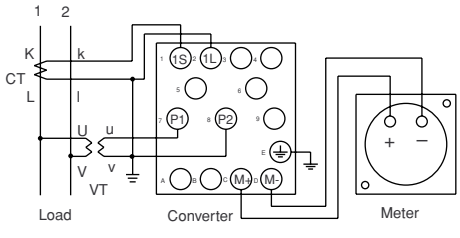
Frequency meter FR-60F, 80F
(For direct connection)



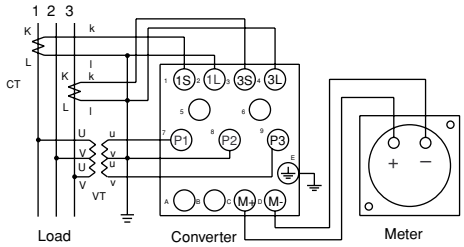
Frequency meter FR-60F, 80F
(For connection to VT)



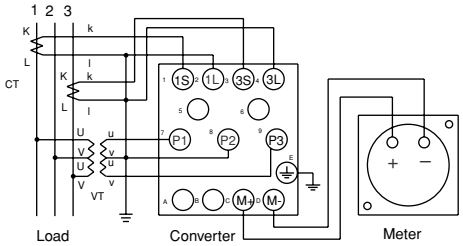
Wattmeter (Single-phase, 2-wire) **FR-□W1**



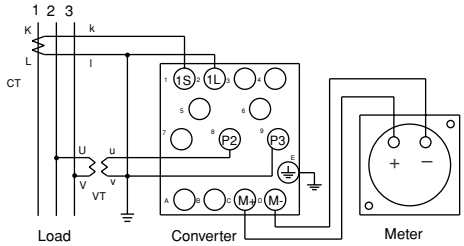
Wattmeter (3-phase, 3-wire) **FR-□W3**



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

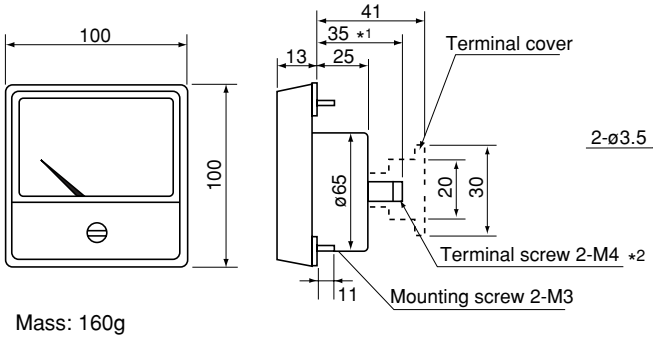
Specify the following:
1. Type number (Ordering code)
2. Measuring range
3. VT or CT ratio
4. Input voltage (for power factor meter and frequency meter)

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

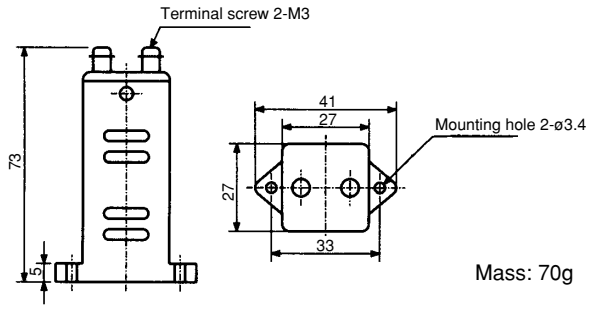


Mass: 160g

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

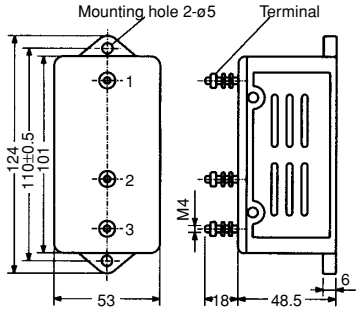
Series resistors

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



Mass: 70g

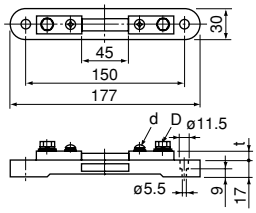
For FM-100A
3-terminal 1500-2000V



Mass: 250g

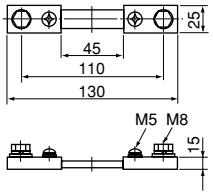
Shunts

With base 1 to 75A, 100A

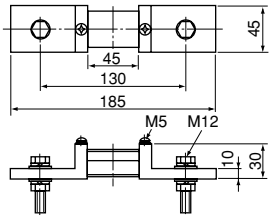


	D	d	t
1 to 75A	M6	M5	8
100A	M8	M5	10

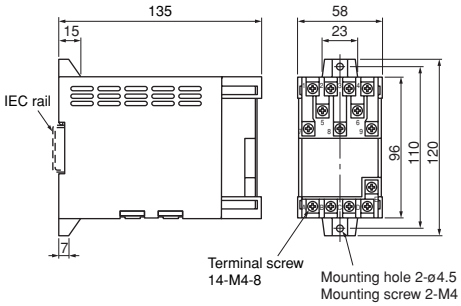
Without base 150A, 200A



Without base 250 to 500A



DC Converter



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

Rating of shunts

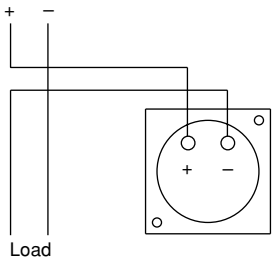
Ratings:	60mV 1A	60mV 7.5A	60mV 40A	60mV 150A	60mV 500A
	60mV 1.5A	60mV 10A	60mV 50A	60mV 200A	
	60mV 2A	60mV 15A	60mV 60A	60mV 250A	
	60mV 3A	60mV 20A	60mV 75A	60mV 300A	
	60mV 5A	60mV 30A	60mV 100A	60mV 400A	

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.

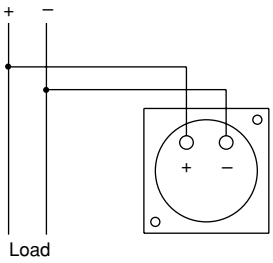
Length (m)	2	3	5.5	9	12.5	22	35
Cross sectional area (mm^2)	1.25	2	3.5	5.5	8	14	22
Resistance (Ω)	0.06						

■ Wiring diagrams

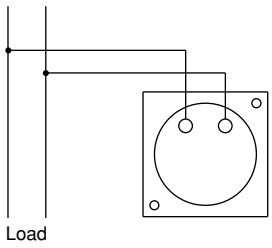
DC ammeter (Direct connection)
FM-100A



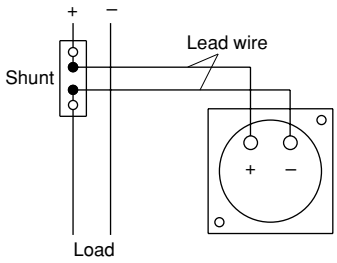
DC voltmeter (Direct connection)
FM-100A



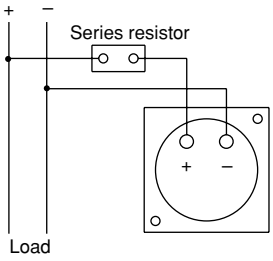
AC voltmeter (Direct connection)
FS-100A



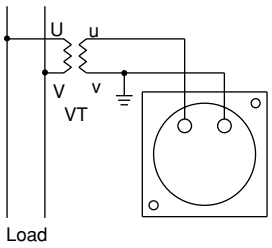
DC ammeter (Connection to shunt)
FM-100A



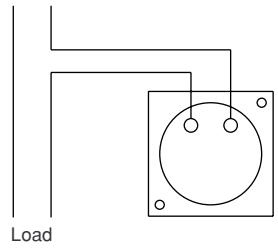
DC voltmeter
(Connection to 2-terminal series resistor)
FM-100A



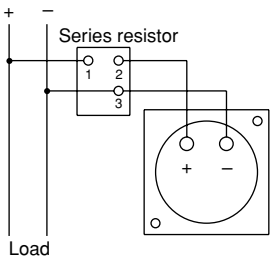
AC voltmeter (Connection to VT)
FS-100A



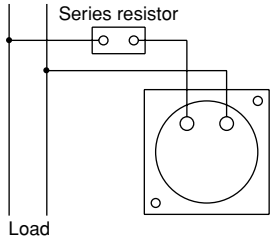
AC ammeter (Direct connection)
FS-100A



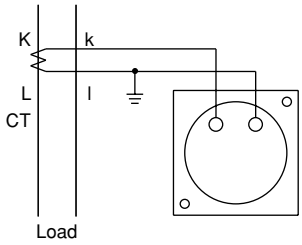
DC voltmeter
(Connection to 3-terminal series resistor)
FM-100A



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

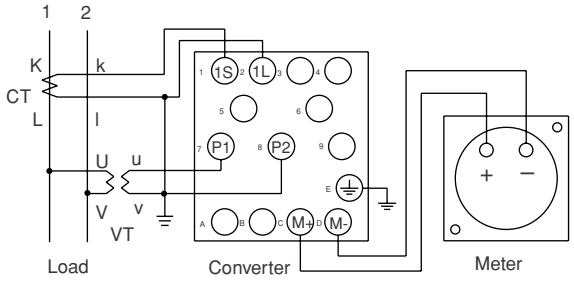


AC ammeter (Connection to CT)
FS-100A

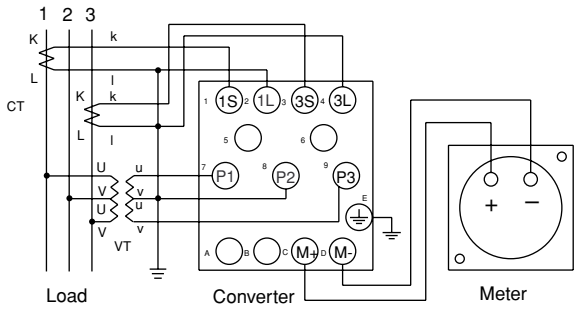


■ Wiring diagrams

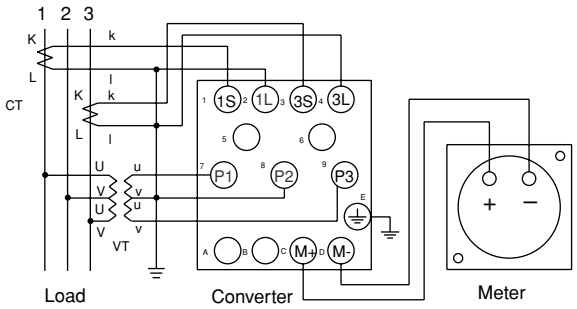
Single-phase, 2-wire wattmeter FR-100AW1



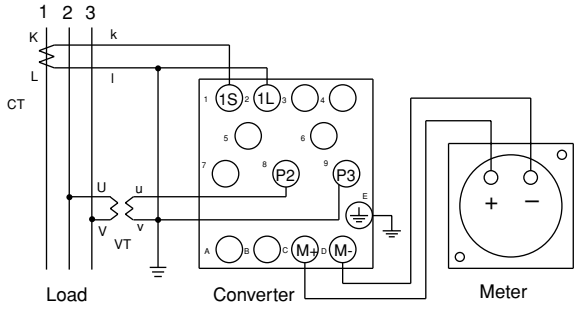
3-phase, 3-wire wattmeter FR-100AW3



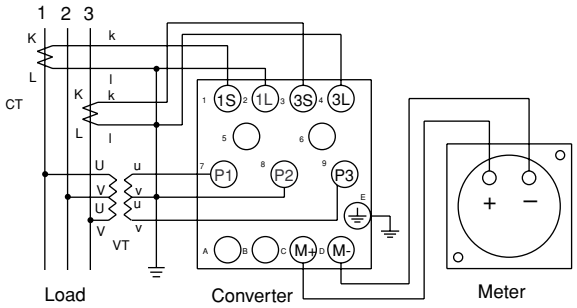
3-phase, 3-wire varmeter FR-100AV3



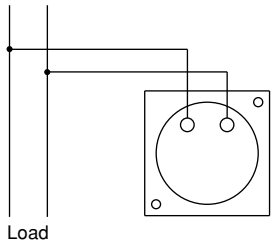
3-phase, 3-wire power factor meter (for balanced circuit) FR-100APF3



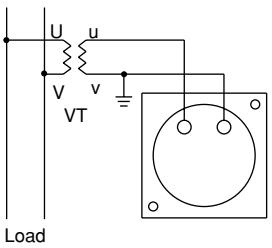
3-phase power factor meter (for unbalanced circuit) FR-100APFU



Frequency meter (Direct connection) FR-100AF



Frequency meter (Connection to VT) FR-100AF



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