

# F-MPC series

**Multiple Function Protectors and Meters**



**Performs precise  
energy control  
at low cost**



This compact yet multifunctional unit will contribute to simplification of the power distribution panel.

# Digital Multifunctional Relay changes the image of high-voltage power distribution

The Fuji Multifunction Protector and Controller (F-MPC) is a digital multipurpose relay in a compact unit offering protection, operation, measurement, monitoring, and transmission functions for high-voltage power distribution facilities.

### F-MPC30, 60B series



Feeder unit  
Bus unit  
Motor feeder unit  
Crane power protective unit



Transformer protective unit  
Power receiving unit

The F-MPC series is categorized as power distribution equipment.

### Compact and lightweight

This compact all-in-one unit, integrating functions as diverse as protection, operation, measurement, monitoring, converter output, and transmission, is set to revolutionize the image of cubicle systems.

### Responds flexibly to circuit changes

Changing the current transformer (CT) ratio or suchlike is very straightforward.

### Network system

The network information system can be easily configured with host computers via Modbus.

### Self-monitoring function

Quickly responds to any emerging problems through constant monitoring of its internal operational status.

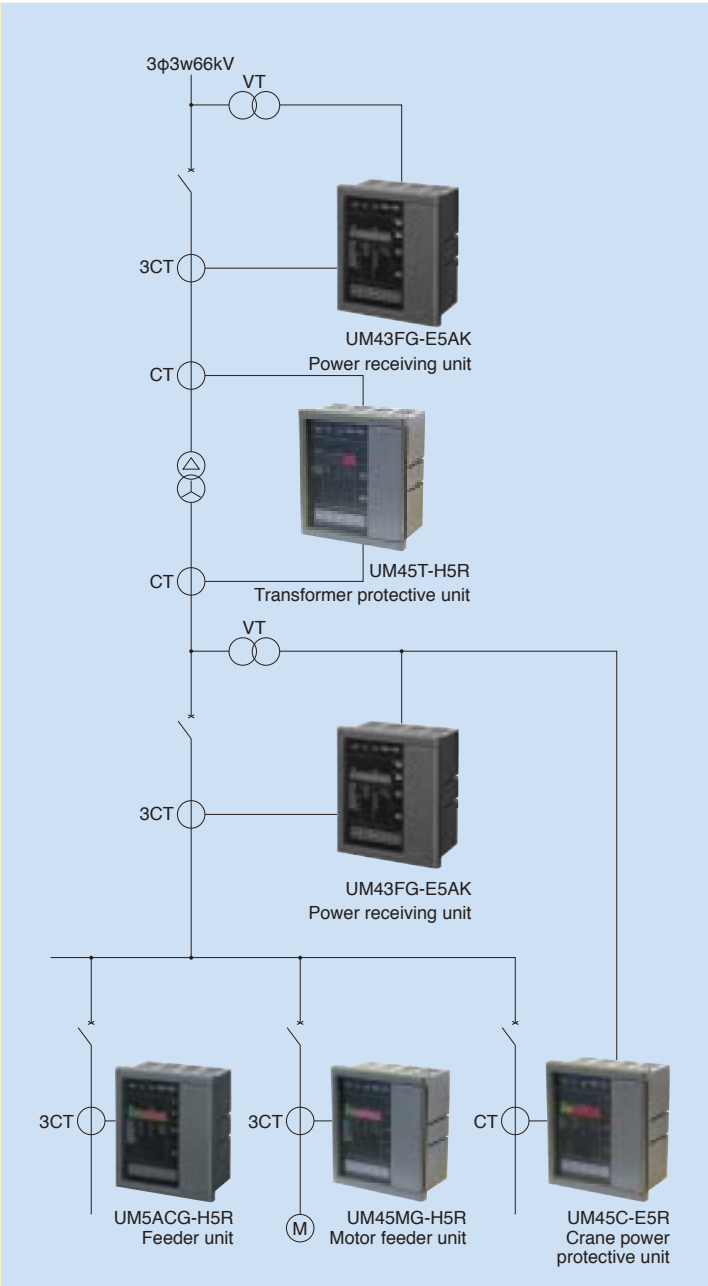
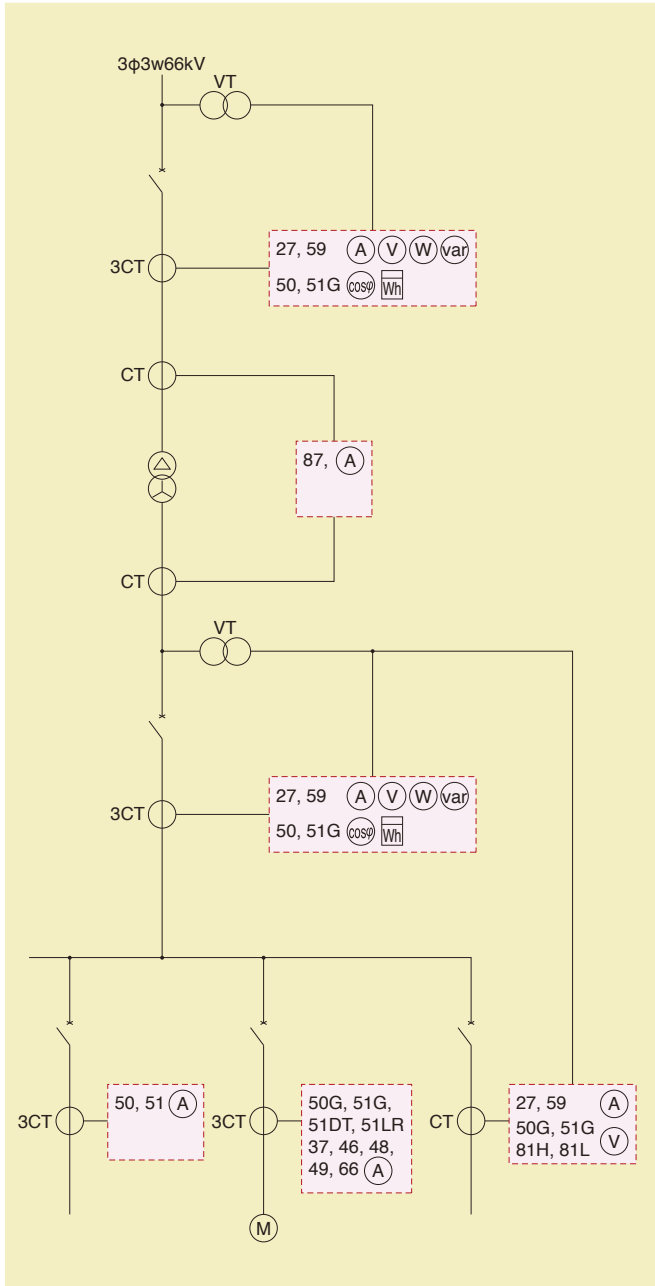
### Facilitates maintenance

Enables preventive maintenance by means of breaker monitoring and incident analysis by measuring incident information.

## Reduced Wiring Effect of Digital Multifunctional Relay





System diagram for conventional equipment

System diagram using the digital multifunctional relay



Each boxed functions can be covered by a single F-MPC.



## F-MPC30 series Digital Multi-function relays

Series	F-MPC30			
Name	Feeder unit	Bus unit	Motor feeder unit	Crane power protective unit
				
Type	UM5ACG-H5R	UM45B-HR	UM45MG-H5R	UM45C-E5R
Overview	Equipped with the current protective functions to protect loads	Equipped with the voltage protective functions to protect buses Adapted to 3-phase 3- or 4-wire circuit	Equipped with the protective functions to protect a high-voltage motor 49 (Accumulated heat), 46 (Phase loss) 51LR (Locked motor protection), 66 (Restart limit)	Equipped with the ground-fault, frequency or voltage protective functions to protect a crane
Protection	- - - - - 50 (Instantaneous trip) 51 (Inverse time trip) 51DT (Definite time trip) 50N/50G  51N/51G - - - - - - - - - -	27 (Undervoltage) - - - - - - - 59 (Overvoltage) RΦV (Reverse phase) - - - - - - -	- 37 (Undercurrent) 46 (Phase loss) 48 (Locked) 49 (Accumulated heat) - - 51DT 50G  51G 51LR (Locked) - 66 (Restart limit) - - - - -	27 (Undervoltage) - - - - - - 50G (Ground fault instantaneous trip) 51G (Ground fault inverse time trip) - 59 (Overvoltage trip) - - 81H (Over-frequency) 81L (Under-frequency) - -
Pre-alarm	OCA (Overcurrent pre-alarm) OCGA (Ground fault overcurrent pre-alarm)	- -	OCA (Overcurrent pre-alarm) OCGA (Ground fault overcurrent pre-alarm)	- -
Control	- Input (General-purpose: 1, 52a: 1) Output (General-purpose: 3, Fault: 1) Trip output -	- Input (General-purpose: 1, 52a: 1) Output (General-purpose: 3, Fault: 1) Trip output -	- Input (General-purpose: 1, 52a: 1) Output (General-purpose: 3, Fault: 1) Trip output -	- Input (General-purpose: 1, 52a: 1) Output (General-purpose: 3, Fault: 1) Trip output -
Measurement	A (Current) A <sub>0</sub> (Zero-phase current) A <sub>0,max</sub> (Maximum zero-phase current) - - - - - - - -	- - - V <sub>l</sub> (Line voltage) V <sub>l,min</sub> (Minimum line voltage) V <sub>p</sub> (Phase voltage) V <sub>p,min</sub> (Minimum phase voltage) Hz (Frequency) - - -	A (Current) A <sub>0</sub> (Zero-phase current) A <sub>0,max</sub> (Maximum zero-phase current) - - - - - - - -	A (Current) A <sub>0</sub> (Zero-phase current) - - V <sub>l</sub> (Line voltage) V <sub>l,min</sub> (Minimum line voltage) V <sub>p</sub> (Phase voltage) V <sub>p,min</sub> (Minimum phase voltage) Hz (Frequency) - - -
Communication	Modbus (RS-485)	Modbus (RS-485)	Modbus (RS-485)	Modbus (RS-485)

Conformity standard: JEC-2500 (Protective relays for electric power system), JEC-2510 (Over current relays), JEC-2511 (Voltage relays), JIS C 4602 (Overcurrent relays for 6.6kV receiving), JIS C 1102-1,2,7 (Direct acting indicating analogue electrical measuring instruments and their accessories), IEC255-3, 5, 6 (Electrical relays Part 3, 5, 6)



## F-MPC60B series Digital Multi-function relays

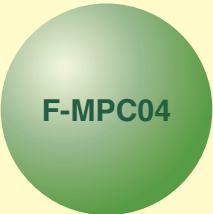
Series	F-MPC60B	
Name	Transformer protective unit 	Power receiving unit 
Type	UM45T-H5R	UM43FG-E5AK
Overview	Equipped with the protective functions to protect a transformer •3-phase ratio differential relay •3-phase differential circuit relay	Equipped with the voltage and current protective functions to protect loads
Protection	27 (Undervoltage) - - - - - - - - - - - - - - - 87RDF (Ratio differential) 87HOC (Differential circuit overcurrent)	27 (Undervoltage) - - - - 50 (Instantaneous trip) 51 (Inverse time trip) 51DT (Definite time trip) 50N/50G 51N/51G - 59 (Overvoltage) - - - - - - - 87RDF (Ratio differential) 87HOC (Differential circuit overcurrent)
Pre-alarm	- -	OCA (Overcurrent pre-alarm) OCGA (Ground fault overcurrent pre-alarm)
Control	- Input (General-purpose:3, 52a:1) Output (General-purpose:8, Fault:1) Trip output -	- Input (General-purpose:8, 52a:1) Output (General-purpose:8, Fault:1) Trip output Converter output (4-20mA) : 6ch
Measurement	- - - - - - - - - Differential circuit current - - -	A (Current) A <sub>0</sub> (Zero-phase current) - V <sub>L</sub> (Line voltage) V <sub>L,min</sub> (Minimum line voltage) V <sub>P</sub> (Phase voltage) V <sub>P,min</sub> (Minimum phase voltage) Hz (Frequency) - W (Power) Wh (Electric energy)
Communication	Modbus (RS-485)	Modbus (RS-485)

Conformity standard: JEC-2500 (Protective relays for electric power system), JEC-2510 (Over current relays), JEC-2511 (Voltage relays), Percentage differential relays, JIS C 1102-1,2,3,4,5,7 (Direct acting indicating analogue electrical measuring instruments and their accessories), JIS C 1111 (Electrical measuring transducers for converting a.c. electrical quantities to analogue or digital signals), JIS C 1216 (Electrical measuring transducers for converting a.c. electrical quantities to analogue or digital signals), JIS C 4602 (Overcurrent relays for 6.6kV receiving), IEC255-3, 5, 6 (Electrical relays Part 3, 5, 6).

# F-MPC04 series: Measurement Functions required for monitoring electrical facilities are Integrated in a single power monitoring unit.

The F-MPC04 series lineup ranges from compact single-circuit to multi-circuit measurement models allowing selection that best suits your application.

F-MPC04 series



UM01-ARA4



UM02-AR2  
UM02-AR3  
UM02-AR4



UM03-ARA3  
UM03-ARA3G

Integrated power monitoring unit F-MPC04

A single unit can be applied to multiple power distribution systems.  
Enables measurement of harmonic current and leakage current.



F-MPC04

Multi-circuit power monitoring unit F-MPC04P

Enables measurement of multiple circuits with a single unit.  
Easy to apply to existing switchboards.



F-MPC04P

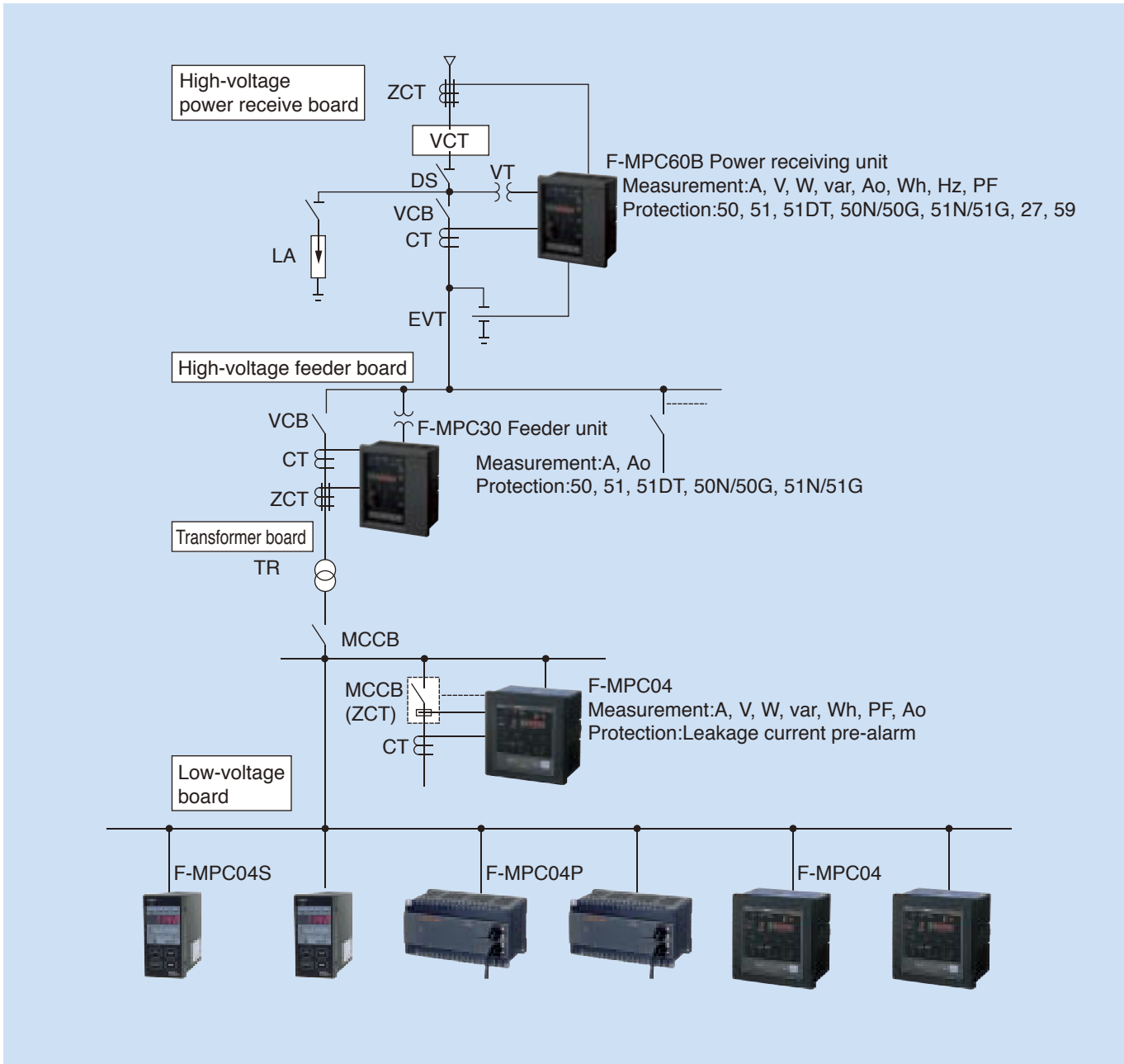
Single-circuit power monitoring unit F-MPC04S

Diverse output functions that best suits preventive maintenance can be selected.  
Compact design allows the unit to be installed almost anywhere.






F-MPC04S

System diagram using the F-MPC series



## Power monitoring unit F-MPC04 series

Series		F-MPC04 series	F-MPC04P series	F-MPC04S series	
Name		Integrated power monitoring unit	Multi-circuit power monitoring unit	Single-circuit power monitoring unit	
					
Type		UM01-ARA4E	UM02-AR2 UM02-AR3 UM02-AR4	UM03-ARA3	UM03-ARA3G
Applicable voltage, number of power rails		2VT	1VT	1VT	
Function	Measurement	A, V, W, var, PF, Wh	A, V, W, var, PF, Wh	A, V, W, var, PF, Wh	
		A <sub>0</sub> , A <sub>0,max</sub>	-	-	A <sub>0</sub> , A <sub>0,max</sub>
		varh	-	varh	
	Display	Measurement items above	Measurement items above (When UM02X-S is used)	Measurement items above	
	Preventive maintenance	A alarm A <sub>0</sub> alarm	-	A alarm A pre-alarm	A alarm A pre-alarm A <sub>0</sub> alarm A <sub>0</sub> pre-alarm
		Protection	Protection leakage current breaking output	-	
	Maintenance	DA, DW, HI	DW	DA, DW, HI	
Applicable circuit	1φ2W	-	○ (12 feeder)	○ (1 feeder)	
	3φ3W (1φ3W, 1φ2W)	○ (10 feeder)	○ (8 feeder)	○ (1 feeder)	
	3φ4W	○ (6 feeder)	○ (4 feeder)	-	
External interface	RS-485 (Modbus)	○	○	○	
	Wh pulse output	○	-	○	

DA:Demand current, DW:Demand active power, HI:Harmonic current

Conformity standard: JIS C 1102-1,2, 3, 4, 5, 7 (Direct acting indicating analogue electrical measuring instruments and their accessories), JIS C 1111 (Electrical measuring transducers for converting a.c. electrical quantities to analogue or digital signals), JIS C 1216 (Electrical measuring transducers for converting a.c. electrical quantities to analogue or digital signals)

## **CONTENTS**

### **F-MPC30/60B series**

#### **■ Feeder unit**

- Features, type numbers ..... 10
- Specifications ..... 10
- Time-current characteristics of overcurrent/51G relay ..... 13
- Basic wiring diagram, dimensions ..... 14

#### **■ Bus unit**

- Features, type numbers ..... 15
- Specifications ..... 15
- Basic wiring diagram, dimensions ..... 18

#### **■ Motor feeder unit**

- Features, type numbers ..... 19
- Specifications ..... 19
- Time-current characteristics of 51G relay ..... 22
- Protective characteristic curves ..... 23
- Protective characteristic curves of phase sequence relay ..... 24
- Basic wiring diagram, dimensions ..... 25

#### **■ Crane power protective unit**

- Features, type numbers ..... 26
- Specifications ..... 26
- Time-current characteristics of 51G relay ..... 30
- Basic wiring diagram, dimensions ..... 31

#### **■ Transformer protective unit**

- Features, type numbers ..... 32
- Specifications ..... 32
- Basic wiring diagram, dimensions ..... 35

#### **■ Power receiving unit**

- Features, type numbers ..... 36
- Specifications ..... 36
- Time-current characteristics of 51G relay ..... 40
- Basic wiring diagram, dimensions ..... 42

#### **■ Related products**

- AC power unit ..... 43
- Arrester for network circuit ..... 45

### **F-MPC04 series**

#### **■ F-MPC04**

- Features, type numbers ..... 46
- Specifications ..... 48
- Dimensions ..... 49

#### **■ F-MPC04P**

- Features, type numbers ..... 50
- Specifications ..... 52
- Dimensions ..... 53

#### **■ F-MPC04S**

- Features, type numbers ..... 54
- Specifications ..... 55
- Dimensions ..... 57

#### **■ Related products**

- Current transformers ..... 58
- Zero-phase current transformers ..... 60
- Terminal relay, cable with connector ..... 61
- Connector terminal-block ..... 62



# F-MPC30 series Feeder unit

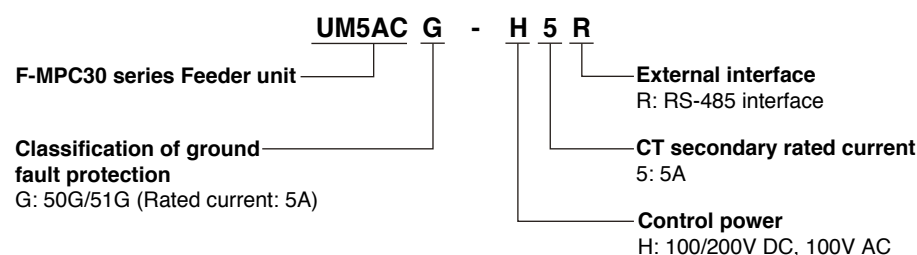
## F-MPC30 Feeder unit

### ■ Features

- This unit is equipped with current protective functions to protect loads, such as instantaneous, inverse time and definite time trips, as standard.
- The erroneous-breaking preventive function by adopting duplicated analog circuit and AND-output circuit.
- With its self-monitoring function, this unit quickly responds in case a fault occurs.
- The network system can be easily configured via Modbus (RTU).



### ■ Type numbers



### ■ Specifications

#### ● General specifications

Item	Specifications
Control power supply	100/200V DC (80 to 286V DC) 100V AC (85 to 132V) common use
Power consumption (main unit)	15W or less (100/200V DC) 25VA or less (100V AC)
Rated VA consumption of CT	Max. 1.0VA
Rated current (CT secondary side)	5A AC
Rated zero-phase current	5A AC
Insulation resistance	10MΩ or more between electric circuits and ground 5MΩ or more between circuits and between contact circuit terminals
Vibration resistance	16.7Hz, double amplitude 0.4mm, 1.96m/s <sup>2</sup> 10 minutes in each of 3 directions
Shock resistance	300m/s <sup>2</sup> , 3 times in each of 3 directions
Withstand voltage	2kV AC 1 minute between active parts and ground, excluding RS-485 signal lines.
Noise immunity	Vibratory surge JEC2500 (equivalent to ANSI), Square wave 1.5kV (1ns/1μs, 10 minutes)
Overload capacity	CT circuit: 40 times the rating, 1 second, twice
Ambient temperature	-10°C to 60°C: operation guaranteed.
Storage temperature	-25°C to 70°C
Relative humidity	20% to 90%RH (no condensation)
Atmosphere	No corrosive gas or excessive dust.
Grounding	Class D grounding (100Ω or less)
Mass	1.4kg
Instantaneous power failure time	20ms (operation continues) though the indication disappears
Electrostatic noise immunity	In contact with metal part: ±8kV Panel surface (no contact with nonmetal part): ±15kV
Lightning impulse withstand voltage	4.5kV between electric circuits and ground

Conformity standard: JEC-2500 (Protective relays for electric power system), JEC-2510 (Over current relays), JIS C 1102-1,2 (Direct acting indicating analogue electrical measuring instruments and their accessories), JIS C 4602 (Overcurrent relays for 6.6kV receiving), IEC255-3, 5, 6 (Electrical relays Part 3, 5, 6).



### ● External I/O specifications

Item	Specification	
Input circuit	100V DC/200V DC (286V DC or less) ON voltage: 40V DC to 70V DC (Current: approx. 1.2mA at 100V DC, approx. 2.4mA at 200V DC )	
Output circuit	CB trip	Making current: 15A(110V DC), 10A(220V 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
		Making/breaking current: 0.1A (220V DC, inductive load L/R=15ms or less) Allowable continuous current: 1A

### ● Measurement and display specifications

Item	Effective display range	Display range and accuracy <sup>*1</sup>
Current	0, 0.8% through CT rating to 8 times the CT rating	±1.5%: 0, 0.8% to 100% ±5%: 100 to 800%
Zero-phase current	CT: 0, 2% through CT rating to 8 times the CT rating	±1.5%: 0, 2% to CT rating ±5%: CT rating or more

Note: • “0, a% to n” means that “0” is indicated when the value is between “0 to a%”.

<sup>\*1</sup> For fault current, maximum 2000% can be indicated (accuracy: ±5%)

### ● History data specifications

Item	Display range	Code
50(INST) operation count	0-9,999 (times)	<b>H0</b>
51DT1 operation count	0-9,999 (times)	<b>H1</b>
51(OC) operation count	0-9,999 (times)	<b>H2</b>
51G operation count	0-9,999 (times)	<b>H3</b>
50G operation count	0-9,999 (times)	<b>H4</b>

Item	Display range	Code
OCA operation count	0-9,999 (times)	<b>Hb</b>
Running times	0-9,999 x 100(hr)	<b>Hc</b>
Making operation count	0-9,999 x 10 (times)	<b>Hd</b>
OCGA operation count	0-9,999 (times)	<b>Hn</b>
51DT2 operation count	0-9,999 (times)	<b>HP</b>

Note: • (Other indications) Fault value display: Display fault value in case of a fault.

<sup>\*1</sup> “Code” in the above table is the code that is displayed on this unit.

### ● Specification of protective relays

Item	Current/voltage operate value setting range	Operating time (timer) setting range	Characteristics	
			Operate value	Operating time
50 (Instantaneous)	1 to 20 times the CT rating (in 0.2 times steps), lock	(Fixed)	±5%	40ms or less
51DT1 (Definite-time)	1 to 20 times the CT rating (in 0.2 times steps), lock	0-5s (in 0.05s steps)	±5%	Less than 1s: ±50ms 1s or more: ±5%
51DT2 (Definite-time)	20% to 240% of CT rating (in 2% steps), lock	0-10s (in 0.1s steps)	±5%	Less than 1s: ±50ms 1s or more: ±5%
51 (Inverse time) SI, EI, VI, LT	20% to 240% of CT rating (in 2% steps), lock	0.5 to 20 times (in 0.1 times steps) (Operating time: min. 150ms)	±5%	Setting value 300%: ±12% 500,1000%: ±7% (Lower limit ±100ms)
50G, 50N (Instantaneous, definite-time)	0.1 to 8 times the CT rating (in 0.1 times steps), lock	0.0 through 10s to 180s (in 0.1s/1s steps) <sup>*1</sup>	±5%	±5% (Lower limit ±50ms)
51G, 51N SI, EI, VI, LT	2% to 100% of CT rating (in 1% steps), lock	0.5 to 20 times (in 0.1 times steps) (Operating time: min. 150ms) <sup>*1</sup>	±5% (min. ±100mA)	Equivalent to 51 above.
OCA (Overcurrent pre-alarm)	10% to 100% of CT rating (in 5% steps), lock	10 to 200s (in 10s steps)	±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 steps)	±10% (min. ±100mA)	±5%

Note: <sup>\*1</sup> The preventive function against malfunction due to exciting inrush current works when flowing exceeding 15% of the current rating for fundamental wave. (Locked if the content of second harmonics is approx. 15% or more.)

However, for 50G, the preventive function against malfunction due to exciting inrush current does not work if 0s is set for operating time.

# F-MPC30 series

## Feeder unit

### ● Communication specifications

#### • Modbus mode

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronization	
Connecting form	1 : N (N: UM5AC)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	8 (fixed)
	Parity bit	Odd, even, or none (selectable)
	Stop bit	1/2 (automatically selectable) 1/2: with or without parity
Transmission code	HEX value (Modbus RTU mode)	
Error detection	CRC-16	
Terminal symbol	D1(+): DXA, D0(-): DXB	

#### • F-MPC-Net mode

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronous transmission	
Connecting form	1 : N (N: UM5AC itself)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	7/8 (selectable)
	Parity bit	None, odd, or even (selectable)
	Stop bit	1 (fixed)
Transmission code	ASCII code	
Error detection	Horizontal parity: even parity	

Note: • Use KPEV-SB (0.5mm<sup>2</sup>), CPEV-SB (0.9mm dia.) or equivalent communication cable. Connect the shielding wire to the SG terminal (No. 2 of terminal block A).

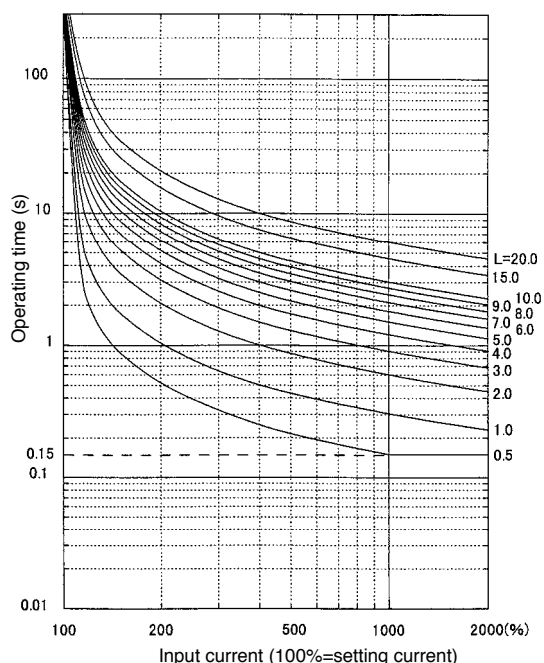
• Communication cable must not be branched. Connect terminating resistors at both ends of communication cable. If the UM5AC is located at the edge of communication line, short-circuit No. 3 and No. 5 of terminal block A. The UM5AC is equipped with a built-in terminating resistor of 100Ω.

• Use the communication cable such that its transmission distance becomes 1,000m or less.

Keep the wiring as far from high voltage equipment or power cables as possible.

## ■ Time-current characteristics of overcurrent/51G relay

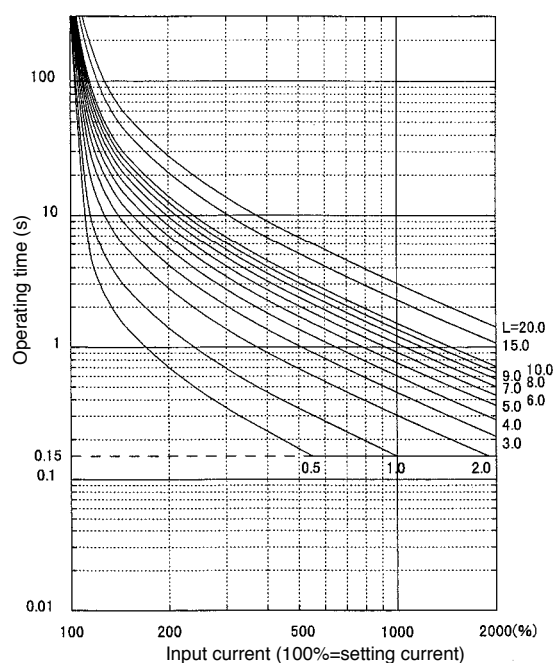
### Inverse (SI) characteristics



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

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

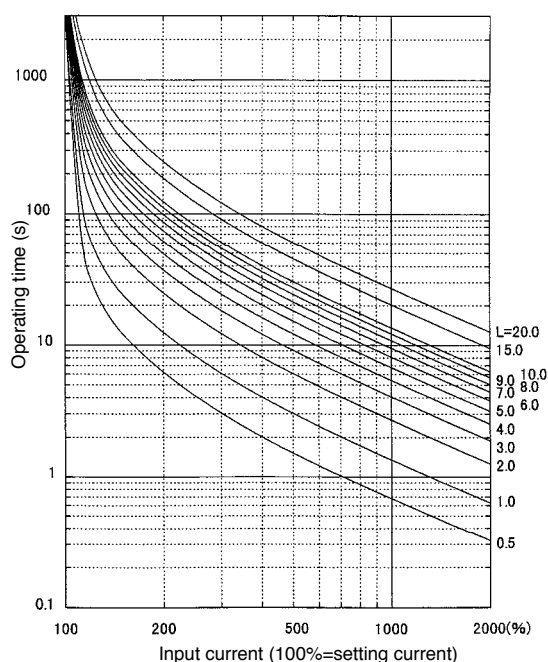
### Inverse (VI) characteristics



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

$$t = \frac{13.5}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

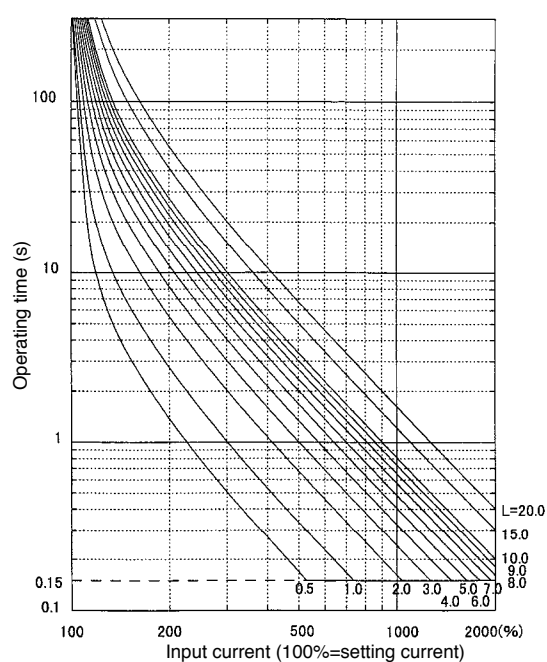
### Inverse (LT) characteristics



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

$$t = \frac{120}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

### Inverse (EI) characteristics



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

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

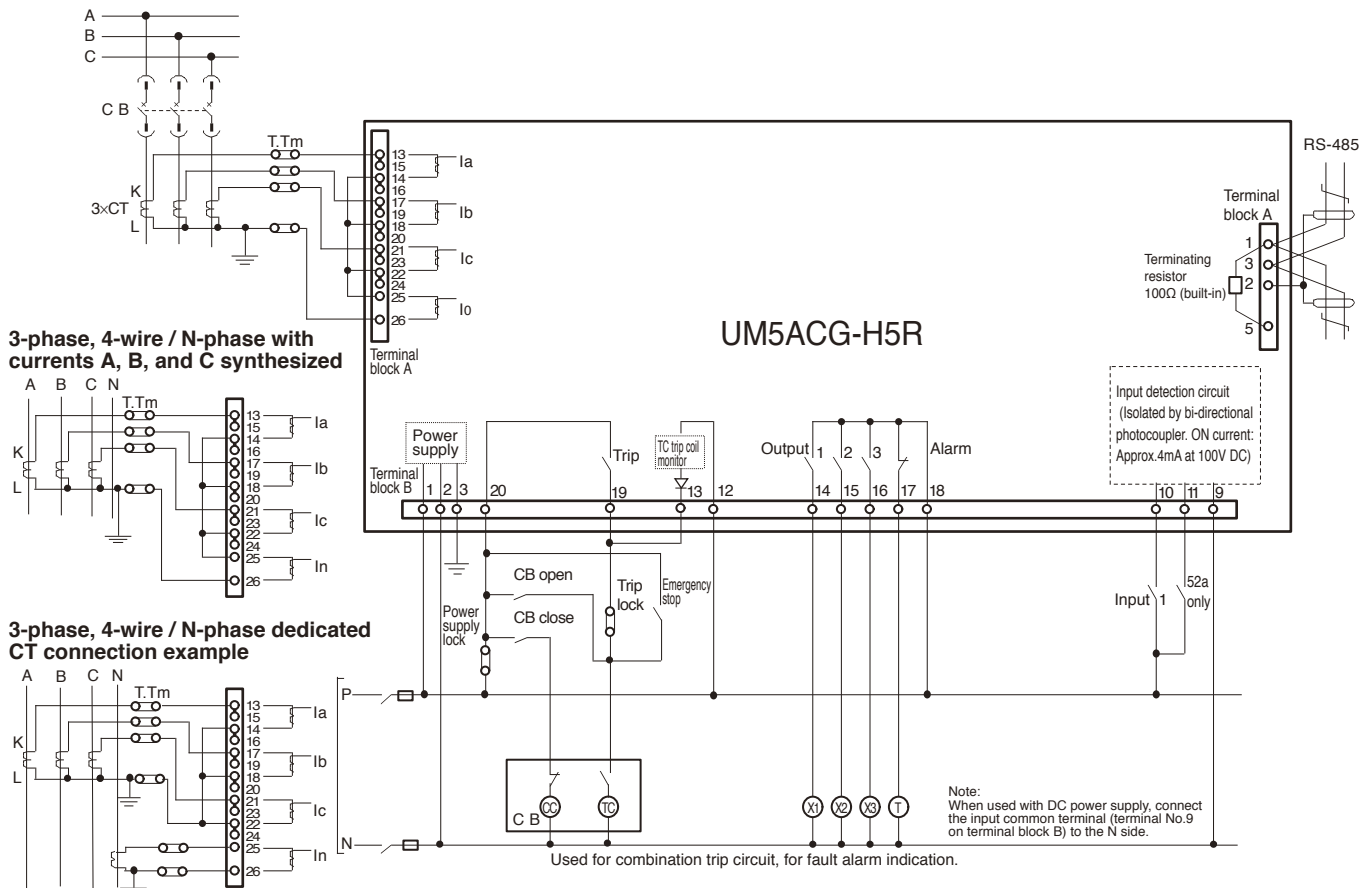


# F-MPC30 series Feeder unit

## ■ Basic wiring diagram

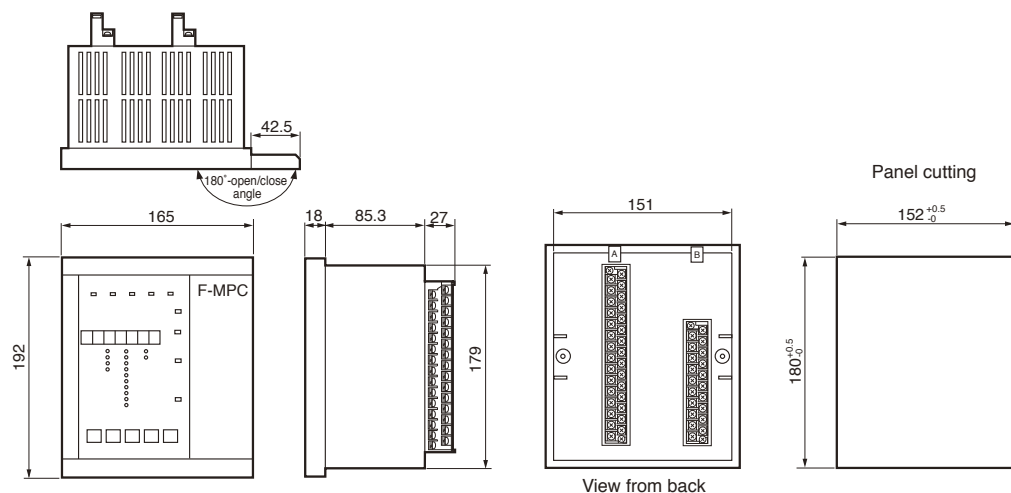
### Feeder unit / UM5ACG-H5R (external 3 CTs)

#### 3-phase, 3-wire / Zero-phase current detection (residual circuit)



1. Input 1 and outputs 1 to 3 are used by selecting (assigning) functions according to their setting.
2. The "Trip" output and the "Device error" output are dedicated. The 52a (CB ON answerback) input and the "TC (trip coil) disconnection monitoring" input are dedicated.
3. The "Device error" output is an NC contact (The contact is normally energized. If an alarm occurs, it is deenergized and the contact closes.) Hence, there is a time delay of approx. 100ms until the contact opens after the power is turned on. Please consider using a timer when you configure an external sequence (if external devices may be held with one-shot signal).
4. When a heavy load greater than the capacity of the output contact is to be driven, be sure to use in combination with FUJI Power Relays.
5. If this unit is located at the edge of communication line when the communication functions (RS-485) are used, short-circuit No. 3 and No. 5 of terminal block A. (The UM5AC is equipped with a built-in terminating resistor.) Otherwise, open between No. 3 and No. 5.

## ■ Dimensions, mm

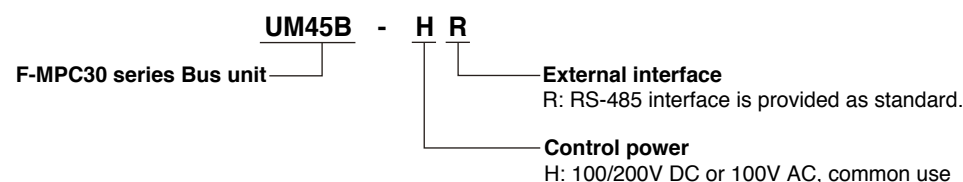


## F-MPC30 Bus unit

### ■ Features

- Voltage protective functions to protect bus systems, such as overvoltage and phase-sequence, are equipped in a single unit as standard, and it applies to 3-phase 3-wire system and 3-phase 4-wire system.
- Erroneous-breaking preventive function, adopting duplicated analog circuit and AND-output circuit.
- With its self-monitoring function, this unit quickly responds in case a fault occurs.
- The network system can be easily configured via Modbus (RTU).

### ■ Type numbers



### ■ Specifications

#### ● General specifications

Item	Specifications
Control power supply	100/200V DC (80 to 286V DC) 100V AC (85 to 132V AC) common use
Power consumption (main unit)	15W or less (100/200V DC) 25VA or less (100V AC)
Rated frequency	50/60Hz (changeover)
Rated voltage	① Line voltage input 100, 110, 120V AC Note 1 Fig. 1-1
	② Phase voltage input $100/\sqrt{3}$ , $110/\sqrt{3}$ , $120/\sqrt{3}$ V AC (Line voltage input 100, 110, 120V AC) Note 1 Fig. 1-2
	③ Phase voltage input 100, 110, 120V AC (Line voltage input $100\times\sqrt{3}$ , $110\times\sqrt{3}$ , $120\times\sqrt{3}$ V AC) Note 1 Fig. 1-2
	Select one from ①, ② and ③. Specify the rated voltage. Note 2
Rated burden (VT secondary)	1.0VA or less
Insulation resistance	10MΩ or more between electric circuits and ground 5MΩ or more between circuits and between contact circuit terminals
Vibration resistance	16.7Hz, 0.4mm double amplitude, 1.96m/s <sup>2</sup> , 10 minutes each in X, Y, and Z directions 10Hz double amplitude 5mm (front, back, left and right), 25mm (up and down)
Shock resistance	300m/s <sup>2</sup> , three times each in X, Y, and Z directions
Withstand voltage	2kV AC 1 minute between electric circuits and ground, excluding RS-485 signal lines
Noise immunity	Vibratory surge JEC 2500 (conforming to ANSI), square wave, 1.5kV, 1ns/1μs for 10 minutes
Ambient temperature	−10 to +60 °C (operation guaranteed) (no icing or no condensation)
Storage temperature	−20 to +70 °C (no icing or no condensation)
Humidity	20 to 90%RH (no condensation)
Atmosphere	Free from corrosive gases or excessive dusts
Grounding	Class D grounding (100Ω or less)
Mass	1.0kg
Instantaneous power failure time	20ms (operation continues) though the indication disappears.
Electrostatic noise immunity	In contact with metal part: ±8kV Panel surface (no contact with nonmetal part): ±15kV
Lightning impulse withstand voltage	4.5kV (between electric circuits and ground)

Note 1 and Note 2 on the next page.

Conformity standard: JEC-2500 (Protective relays for electric power system), JIS C 1102-1,2,4 (Direct acting indicating analogue electrical measuring instruments and their accessories), IEC255-5, 6 (Electrical relays Part 5, 6).

# F-MPC30 series

## Bus unit

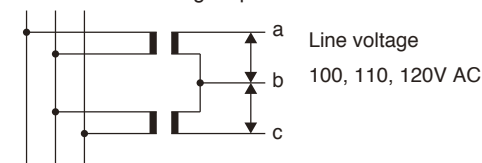
Note 1: External VT connecting method and transformation ratio.

Fig. 1-1 In case of line voltage input

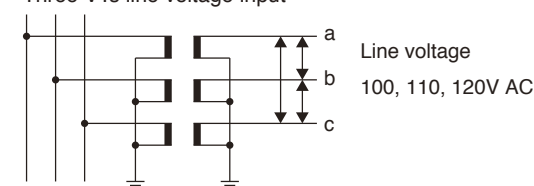
(Select the setting value "1" for the setting code 04)

\* There is no measurement or display of phase voltage. The protective function is activated by line voltage.

### • Two VTs line voltage input



### • Three VTs line voltage input



Note 2:

Select one from the following 23 values for the rated line voltage on the VT primary side.

- 210, 220, 380, 400, 440, 460, 3300, 4160, 6600V
- 11000, 13200, 13800, 15000, 20000, 22000, 22900, 24000V
- 33000, 34500, 35000, 66000, 77000, 110000V

Select 100, 110 or 120V for the rated line voltage on the VT secondary side.

Select a combination of VT primary and secondary side rated line voltages for the setting code 01. Any combination can be made.

Example

- For 6600V/100V, select 6.60-0 as the setting value.
- For 6600V/110V, select 6.60-1 as the setting value.
- For 6600V/120V, select 6.60-2 as the setting value.

## • External I/O specifications

Item		Specifications	
Input circuit	Maximum voltage • ON range	286V DC or less 40 to 70V DC	132V AC or less 40 to 70V AC
	Rated current	Approx. 1.2mA at 100V DC, Approx. 2.4mA at 200V DC	Approx. 1.2mA at 100V AC
	No. of points	General-purpose: 1, Fixed: 2 (52a, TC disconnection monitoring)	
Output circuit	No. of points • Making/breaking capacity	Circuit breaker trip 1 point	Making current: 15A (110V DC), 10A (220V DC) Allowable continuous current: 4A
		General-purpose contact 3 points	Making/breaking current: 0.2A (110V DC, inductive load L/R = 15ms or less) 0.1A (220V DC, inductive load L/R = 15ms or less) Allowable continuous current: 1A

## • Measurement and display specifications

Item		Effective display range		Accuracy *1	Measuring range
Line voltage Min. line voltage	External VT connection	VT rated secondary voltage	VT secondary voltage range	±1.5%	0, and effective measuring range
	Fig. 1-1, Fig. 1-2	Line voltage 100V	5.0 to 150V (FS)		Example: When VT rated secondary voltage is 110V in line voltage; 0, 5.5 to 150V *2
		Line voltage 110V	5.5 to 150V (FS)		
		Line voltage 120V	6.0 to 150V (FS)		
	Fig. 1-3	Line voltage 100V×√3	8.7 to 260V (FS)		
		Line voltage 110V×√3	9.5 to 260V (FS)		
		Line voltage 120V×√3	10.4 to 260V (FS)		
Phase voltage Min. phase voltage	External VT connection	VT rated secondary voltage	VT secondary voltage range	±1.5%	0, and effective measuring range
	Fig. 1-2	Phase voltage 100V/√3	5.0 to 150V (FS)		
		Phase voltage 110V/√3	5.5 to 150V (FS)		
		Phase voltage 120V/√3	6.0 to 150V (FS)		
	Fig. 1-3	Phase voltage 100V	8.7 to 260V (FS)		
		Phase voltage 110V	9.5 to 260V (FS)		
		Phase voltage 120V	10.4 to 260V (FS)		
Max. fault voltage (59) Min. fault voltage (27)		Same as the above line voltage and phase voltage		±5%	Same as the above line voltage and phase voltage
Frequency		50Hz setting: 45 to 55Hz (FS) 60Hz setting: 55 to 65Hz (FS)		±0.5%	50Hz setting: 45 to 55Hz *3 60Hz setting: 55 to 65Hz

Note: \*1 The accuracy does not include the error of the combined transformer.

\*2 (Other indications) Fault value display: Display fault value in case of a fault.

\*3 If the frequency is out of the measurement range, code EEE is displayed instead of the measurement value. The "Hz" LED lights up.



## ● History data specifications

Data item	Display range	Code
59 (OV) detection count	0 to 9999 (times)	<b>H6</b>
27 (UV) detection count	0 to 9999 (times)	<b>H7</b>
Reverse phase (RΦV) detection count	0 to 9999 (times)	<b>HA</b>
Running time	0 to 9999 x 100 (h)	<b>Hc</b>

Data item	Display range	Code
Make/brake operation count	0 to 9999 x 10 (times)	<b>Hd</b>
27 (UV2) detection count	0 to 9999 (times)	<b>HE</b>
VR detection count	0 to 9999 (times)	<b>HF</b>

## ● Specifications of protective relays

Item	Setting range		Characteristics	
	Operate value	Operating time	Operate value	Operating time
59 (OV) detection count <sup>*1</sup>	VT secondary: 60 to 150V (in 1V steps), lock	0.0 to 5.0 (in 0.5s steps) 5.0 to 60s (in 1s steps)	±5%	±5% (lower limit ±50ms)
27 (UV) detection count <sup>*2</sup>	VT secondary: 10 to 110V (in 1V steps), lock	0.0 to 5.0 (in 0.5s steps) 5.0 to 60s (in 1s steps)	<sup>*3</sup>	±5% (lower limit ±50ms) Within ±35ms when 0s is set.
Reverse phase (RΦV)	—	—	—	0.5s or less
Voltage established (VR)	VT secondary: 10 to 110V (in 5V steps), lock	0.0 to 5.0 (in 0.5s steps) 5.0 to 60s (in 1s steps)	±5% (Lower limit ±2V)	±5% (Lower limit ±100ms)

Note: <sup>\*1</sup>: Judgment is made by the line voltage (a-b) in case of line voltage input (Note 1, Fig. 4-1); by a-n phase voltage in case of phase voltage input (Note 1, Fig. 1-2, Fig. 1-3).

<sup>\*2</sup>: "Three-phase AND", "three-phase OR", or "2 out of 3 (2/3 judgment)" can be set for judgment.

<sup>\*3</sup>: The tolerance of operate value is equivalent to JEC 2511 Class 5V.

Tolerance of operate value =  $[2.3\% + \{(\text{Rated value}) / (\text{Voltage setting value})\} \times 0.16] \times 2$

## ● Communication specifications

### • Modbus mode

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronization	
Connecting form	1 : N (N: UM45B-HR)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	8 (fixed)
	Parity bit	Odd, even, or none (selectable)
	Stop bit	1/2 (automatically selectable) 1/2: with or without parity
Transmission code	HEX value (Modbus RTU mode)	
Error detection	CRC-16	
Terminal symbol	D1(+): DXA, D0(-): DXB	

### • F-MPC-Net mode

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronous transmission	
Connecting form	1 : N (N: UM45B-HR itself)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	7/8 (selectable)
	Parity bit	None, odd, or even (selectable)
	Stop bit	1 (fixed)
Transmission code	ASCII code	
Error detection	Horizontal parity: even parity	

Note: • Use KPEV-SB (0.5mm<sup>2</sup>), CPEV-SB (0.9mm dia.) or equivalent communication cable. Connect the shielding wire to the SG terminal (No. 2 of terminal block A).

• Communication cable must not be branched. Connect terminating resistors at both ends of communication cable. If the UM45B is located at the edge of communication line, short-circuit No. 3 and No. 5 of terminal block A. The UM45B is equipped with a built-in terminating resistor of 100Ω.

• Use the communication cable such that its transmission distance becomes 1,000m or less.

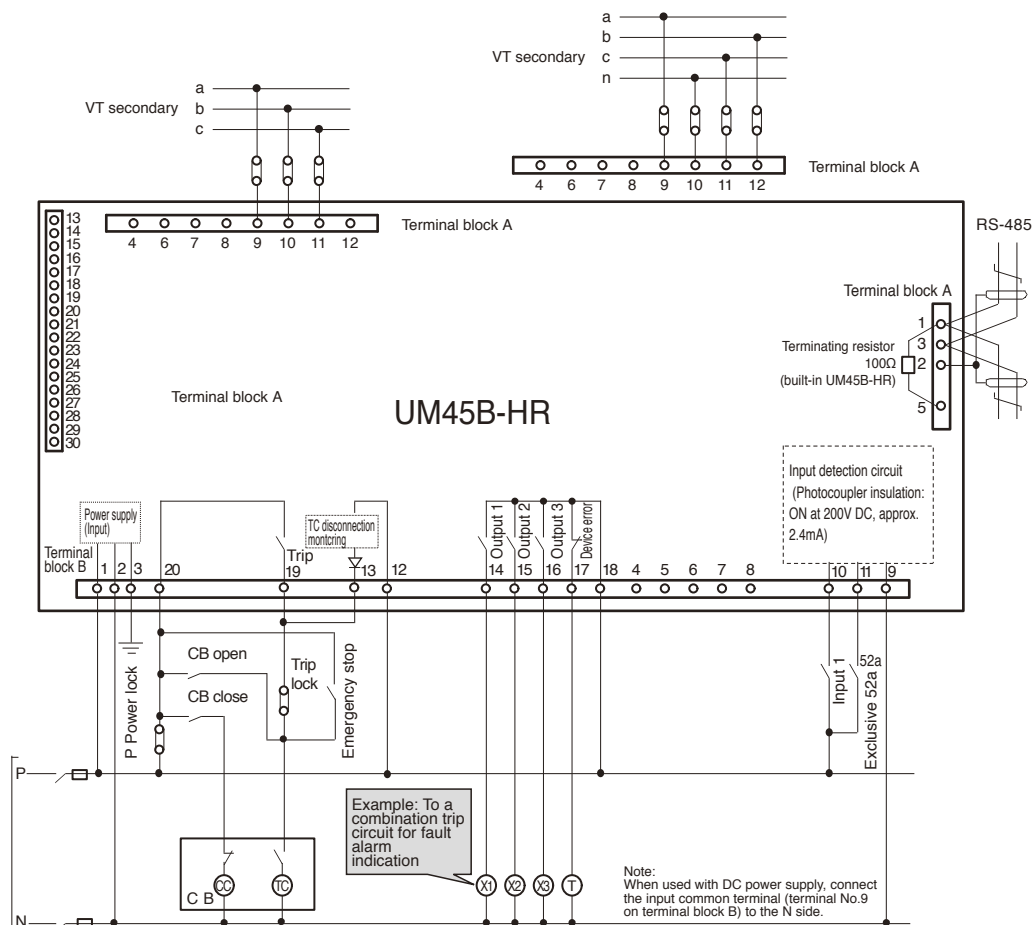
Keep the wiring as far from high voltage equipment or power cables as possible.

# F-MPC30 series

## Bus unit

### ■ Basic wiring diagram

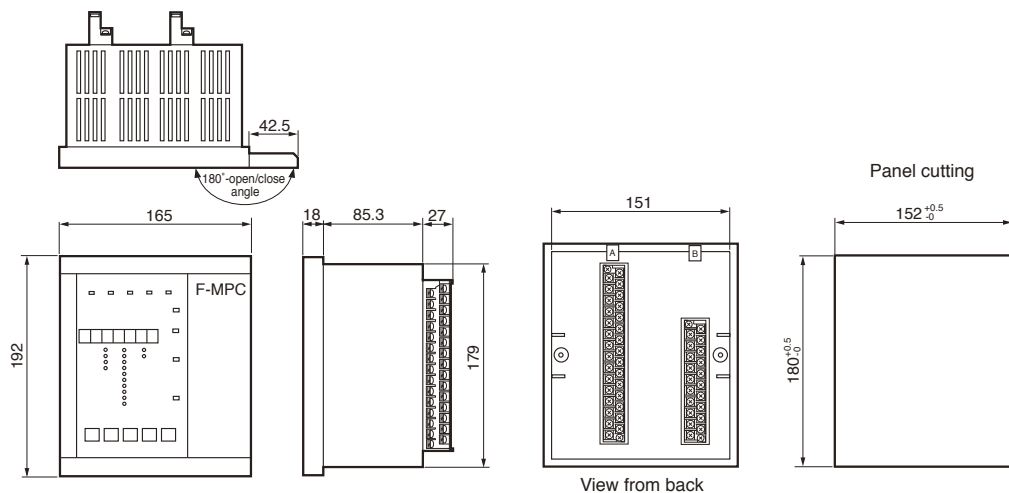
Bus unit / UM45B-HR (External 2VTs, 3VTs)



Notes:

1. Input 1 and outputs 1 to 3 are used by selecting (assigning) functions according to their setting.
2. The "Trip" output and the "Device error" output are dedicated. The 52a (CB ON answerback) input and the "TC (trip coil) disconnection monitoring" input are dedicated.
3. The "Device error" output is an NC contact (The contact is normally energized. If an alarm occurs, it is deenergized and the contact closes.) Hence, there is a time delay of approx. 100ms until the contact opens after the power is turned on. Please consider using a timer when you configure an external sequence (if external devices may be held with one-shot signal).
4. When a heavy load greater than the capacity of the output contact is to be driven, be sure to use in combination with FUJI Power Relays.
5. If the UM45B is located at the edge of communication line when the communication functions (RS-485) are used, short-circuit No. 3 and No. 5 of terminal block A. (The UM45B is equipped with a built-in terminating resistor.) Otherwise, open between No. 3 and No. 5.

### ■ Dimensions, mm



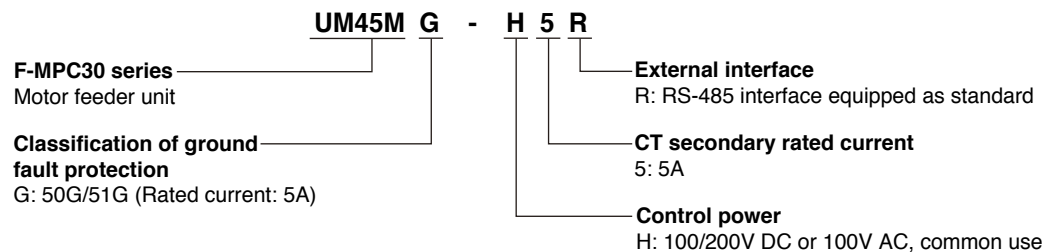
## F-MPC30 Motor feeder unit

### ■ Features

- Protective function to protect high-voltage motors, such as ground-fault, frequency and overvoltage, is equipped in a single unit.
- The erroneous-breaking preventive function by adopting duplicated analog circuit and AND-output circuit.
- With its self-monitoring function, this unit quickly responds in case a fault occurs.
- The network system can be easily configured via Modbus (RTU).



### ■ Type numbers



### ■ Specifications

#### ● General specifications

Item	Specification
Control power supply	100V/200V DC (80 to 286V DC) or 100V AC (85 to 132V), common use
Power consumption (main unit)	15W or less (100/200V DC) 25VA or less (100V AC)
Rated VA consumption of CT	Max. 1.0VA
Rated current (CT secondary side)	5A AC
Rated zero-phase current	5A AC
Insulation resistance	10MΩ or more between electric circuits and ground 5MΩ or more between circuits and between contact circuit terminals
Vibration resistance	16.7Hz, double amplitude 0.4mm, 1.96m/s <sup>2</sup> 10 minutes in each of 3 directions
Shock resistance	300m/s <sup>2</sup> , 3 times in each of 3 directions
Withstand voltage	2kV AC 1 minute between active parts and ground, excluding RS-485 signal lines.
Noise immunity	Vibratory surge JEC2500 6.8 Waveform 2, square wave, 1.5kV (1ns/1μs, 10 minutes)
Overload capacity	CT circuit: 40 times the rating, 1 second, twice
Ambient temperature	-10°C to 60°C: operation guaranteed. (No condensation)
Storage temperature	-25°C to 70°C (no condensation)
Relative humidity	20% to 90%RH (no condensation)
Atmosphere	No corrosive gas or excessive dust
Grounding	Class D grounding (100Ω or less)
Mass	1.4kg
Instantaneous power failure time	20ms (operation continues) though the indication disappears
Electrostatic noise immunity	In contact with metal part: ±8kV Panel surface (no contact with nonmetal part): ±15kV
Lightning impulse withstand voltage	4.5kV between electric circuits and ground

Conformity standard: JEC-2500 (Protective relays for electric power system), JEC-2510 (Over current relays), JIS C 1102-1,2 (Direct acting indicating analogue electrical measuring instruments and their accessories), JIS C 4602 (Overcurrent relays for 6.6kV receiving), IEC255-3, 5, 6, 8 (Electrical relays Part 3, 5, 6, 8).

#### ● External I/O specifications

Item	Specification
Input circuit	ON voltage: 70V AC/DC or less, OFF voltage: 40V AC/DC or more Allowable max. value 143V DC or less, 132V AC or less
Output circuit	CB trip Making current: 15A (110V DC), current-carrying time 0.5s, resistive load 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



# F-MPC30 series

## Motor feeder unit

### ● Measurement and display specifications (equivalent to JIS 1.5 Class)

Item	Effective display range	Accuracy *1
Current	0, 0.8% through CT rating to 8 times the CT rating	±1.5%: 0, 0.8% to 100% (FS: 100%) ±5%: 100 to 800% (FS: 800%)
Zero-phase current	CT: 0, 2% through CT rating to 8 times the CT rating	±1.5%: 0, 2% to 100% (FS: 100%) ±5%: 100% to 800% (FS: 800%)
Max. fault current	0, 0.8% to 20 times the CT rating	±5%: 0 to 2000% (FS: 2000%)
Max. fault zero-phase current	2% to 8 times the CT rating	±5%: 0 to 800% (FS: 800%)

Note: \* "0, a% to n" means that "0" is indicated when the value is between "0 to a%".

\*1 Excluding the error of the combined CT

### ● History data specifications

Item	Display range	Code
51DT operation count	0 to 9,999 (times)	<b>H1</b>
49 operation count	0 to 9,999 (times)	<b>H2</b>
51G operation count	0 to 9,999 (times)	<b>H3</b>
50G operation count	0 to 9,999 (times)	<b>H4</b>
46 operation count	0 to 9,999 (times)	<b>H9</b>
48/51LR	0 to 9,999 (times)	<b>HP</b>
37 operation count	0 to 9,999 (times)	<b>Hu</b>

Note: \* (Other indications) Fault value display: Display fault value in case of a fault.

\*1 "Code" in the above table is the code that is displayed on this unit.

Item	Display range	Code
49A operation count	0 to 9,999 (times)	<b>Hb</b>
Running time	0 to 9,999×100 (hr)	<b>Hc</b>
Making/breaking operation count	0 to 9,999×10 (times)	<b>Hd</b>
OCGA operation count	0 to 9,999 (times)	<b>Hn</b>
Startup operating time	0 to 999.9(s)	<b>h1</b>
ΣTs	0 to 9,999(s)	<b>h2</b>
ΣE(%)	0 to 500(%)	<b>h3</b>

### ● Protective relay specifications

Item		Setting range		Characteristics	
		Operate value	Operating time	Operate value	Operating time
51DT (short-time trip)		1 to 20 times the CT rating (in 0.2 times steps), lock	0.00 to 5.00s (in 0.05s steps) 0.00s means 40ms or less	±5% of setting value	Less than 1s: ±50ms 1s or more: ±5%
48/51LR (Lock)	Running	0.4 to 10 times the CT secondary side rated current (in 0.1 times steps), lock Common to running and startup	0 to 80s (in 1s steps)	±5% of setting value	±5%
	Startup		Startup time magnification Ks: 1.0 to 3.0 times (in 0.1 times steps)		
50G (instantaneous/short- time trip)		0.1 to 8 times the rated zero- phase current (in 0.1 times steps), lock	0.0 (0.05s), 0.1 to 99.9s (in 0.1s steps)	±5% of setting value	±5% (Lower limit ±50ms)
51G INV CT secondary side (5A) SI, EI, VI, LT		2% to 100% of rated zero- phase current (in 1% steps), lock	Time magnification: 0.5 to 20.0 times (In 0.1 times steps) (Operating time: min 150ms)	±5% of setting value (±100mA)	Setting value 300%:±12% 500%,1000%: ±7% (Lower limit ±100ms)
49, 37 common		CT secondary side rated motor current I <sub>M</sub> : 40% to 120% of CT secondary side rated current (in 2% steps) Cold wire's time constant magnification Kc: 1 to 5 times (in 1-time steps) ... Magnification with respect to thermal time constant			
49 (Heat accumulation: ΣE%)		105% to 125% of I <sub>M</sub> setting current (K <sub>θ</sub> ) (in 5% steps), lock	2.0 to 240.0s (in 0.5s steps) (Cold characteristic t <sub>600</sub> %;600%: Operating time of I <sub>M</sub> ) (Operating time: min. 1s)	±5% of setting value (±50mA)	Setting value 600%: ±5% (Lower limit ±200ms)
		K <sub>n</sub> reverse-phase heat magnification: 0 to 10 (in 1-time steps)			
37 (under current)		30% to 80% of I <sub>M</sub> setting value (in 2% steps), lock	1 to 600s (in 1s steps)	±5% of setting value (±50mA)	±5% (OR operation of 3-phase current)
46 (phase failure)		Reverse-phase current percentage (I <sub>2</sub> /I <sub>M</sub> %) : 10% to 50% (in 5% steps), lock	Fixed (25s for 10%, 1s for 50% to 500%, 0.5s for 500% or more)	±5% of setting value (±50mA)	Less than 1s: ±50ms 1s or more: ±5%
66 (Restart limit)	Restart count	Startup count S <sub>n</sub> : 1 to 5times (in 1-time steps), lock Startup time T <sub>s</sub> : 2 to 240s (in 1s steps) Time constant reduction ΔT <sub>s</sub> : 2 to 500s/h (in 0.5 steps)		—	
	Heat accumulation (ΣE%)	ΣE%: 20% to 80% (in 5% steps), lock	—	Same as above item: 49	
OCA (Overload pre-alarm)		ΣE%: 50% to 100% (in 5% steps), lock	Same as the operating time of above 49	Same as above item: 49	
OCGA (leakage current pre- alarm)		50%, 60%, 70%, 80% of the setting current for operate value (51G or 67DG). lock	10 to 200s (in 10s steps)	±5% (±100mA)	±5%

Note: Restart limit is displayed and output when the motor is stopped. In the code part, "hp" is displayed; in the data part, (1) "the residual time till startup" is displayed in case of startup count limit or (2) "the percentage with respect to the setting value of heat accumulation" is displayed in case of heat accumulation limit.

● **Communication specifications**

• **Modbus mode**

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronization	
Connecting form	1 : N (N: UM45MG-H5R)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	8 (fixed)
	Parity bit	Odd, even, or none (selectable)
	Stop bit	1/2 (automatically selectable) 1/2: with or without parity
Transmission code	HEX value (Modbus RTU mode)	
Error detection	CRC-16	
Terminal symbol	D1(+): DXA, D0(-): DXB	

• **F-MPC-Net mode**

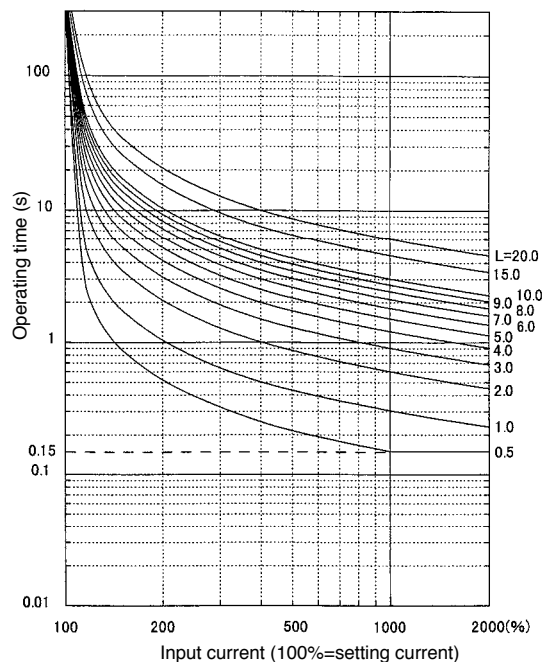
Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronous transmission	
Connecting form	1 : N (N: UM45MG-H5R)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	7/8 (selectable)
	Parity bit	None, odd, or even (selectable)
	Stop bit	1 (fixed)
Transmission code	ASCII code	
Error detection	Horizontal parity: even parity	

Note: • Use KPEV-SB (0.5mm<sup>2</sup>), CPEV-SB (0.9mm dia.) or equivalent communication cable. Connect the shielding wire to the SG terminal (No. 2 of terminal block A).  
 • Communication cable must not be branched. Connect terminating resistors at both ends of communication cable. If the UM45M is located at the edge of communication line, short-circuit No. 3 and No. 5 of terminal block A. The UM45M is equipped with a built-in terminating resistor of 100Ω.  
 • Use the communication cable such that its transmission distance becomes 1,000m or less.  
 Keep the wiring as far from high voltage equipment or power cables as possible.

# F-MPC30 series Motor feeder unit

## ■ Time-current characteristics of 51G relay

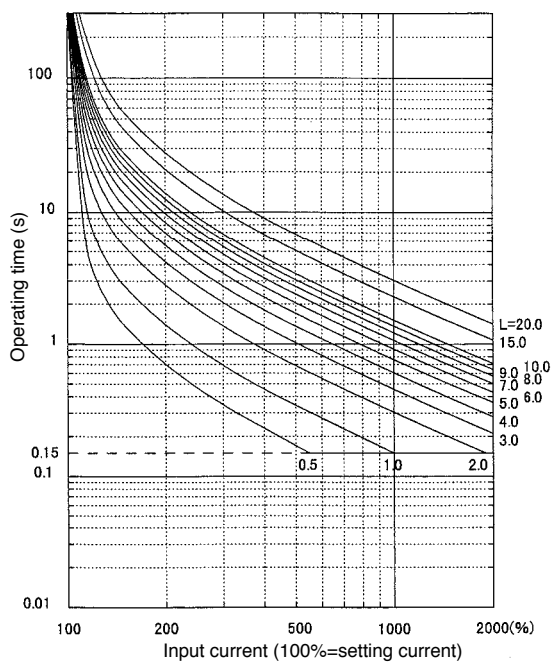
### Inverse (SI) characteristics



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

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

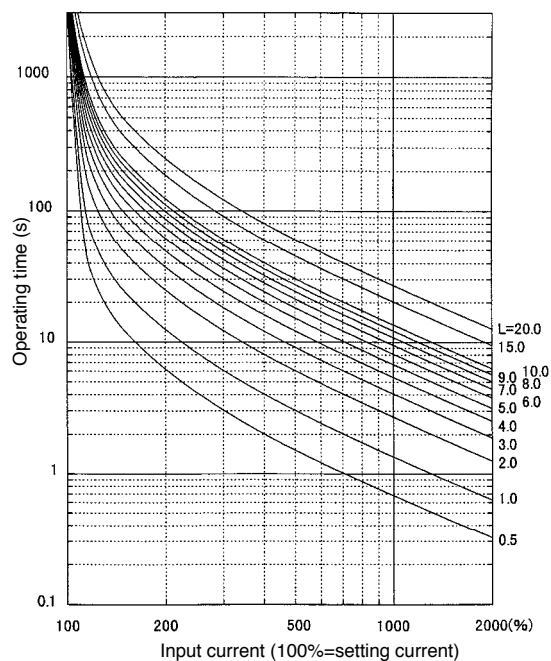
### Inverse (VI) characteristics



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

$$t = \frac{13.5}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

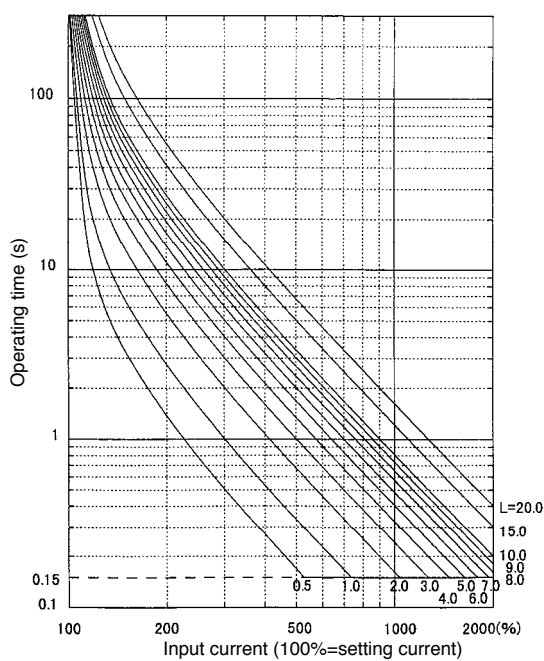
### Inverse (LT) characteristics



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

$$t = \frac{120}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

### Inverse (EI) characteristics



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

$$t = \frac{80}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

## ■ Protective characteristic curves

Characteristic	Operate value K $\Theta$ Code No.15	Ratio to rated load current I <sub>p</sub>	Calculating formula for operate time t
Cold characteristic (at startup)	105%	—	$t = \tau \times \ln(I^2 / (I^2 - K\Theta^2))$ where $\tau = T_{600} / \ln(6^2 / (6^2 - K\Theta^2))$ Refer to Example 1.
	115%	—	
	125%	—	
Hot characteristic (during operation)	105%	50% running	$t = \tau \times \ln(I^2 - I_p^2 / (I^2 - K\Theta^2))$ where $\tau = T_{600} / \ln(6^2 / (6^2 - K\Theta^2))$ Refer to Example 2.
		75% running	
		100% running	
	115%	50% running	
		75% running	
		100% running	
	125%	50% running	
		75% running	
		100% running	

The heating constant  $\tau$  of motor can be obtained from “the setting operate time  $T_{600}$  of cold characteristic” and “setting operate time  $K\Theta$ ”.  
 $\tau = T_{600} / \ln(6^2 / (6^2 - K\Theta^2))$

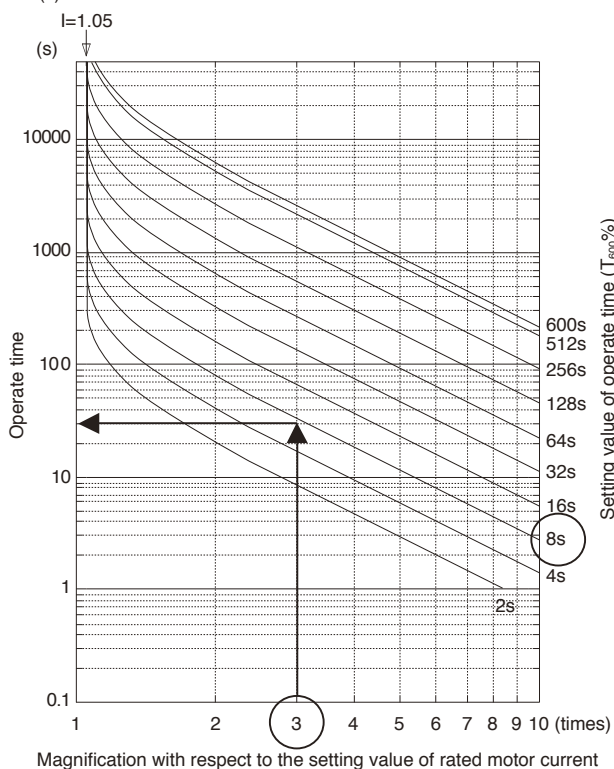
Following are an example of calculating operate time  $t$ ,  
 where  $\ln$  means natural logarithm.

$T_{600}$  is the setting value of operate time for code No.16 (2 to 600 seconds).

$I$  is the magnification (1.05/1.15/1.25 to 10 times) with respect to the setting value of rated motor current.

Example 1: Supposing cold characteristic (at start up), operate value  $K\Theta = 105\% = 1.05$ , operate value time  $T_{600} = 8$  seconds, magnification  $I = 3$  times, then

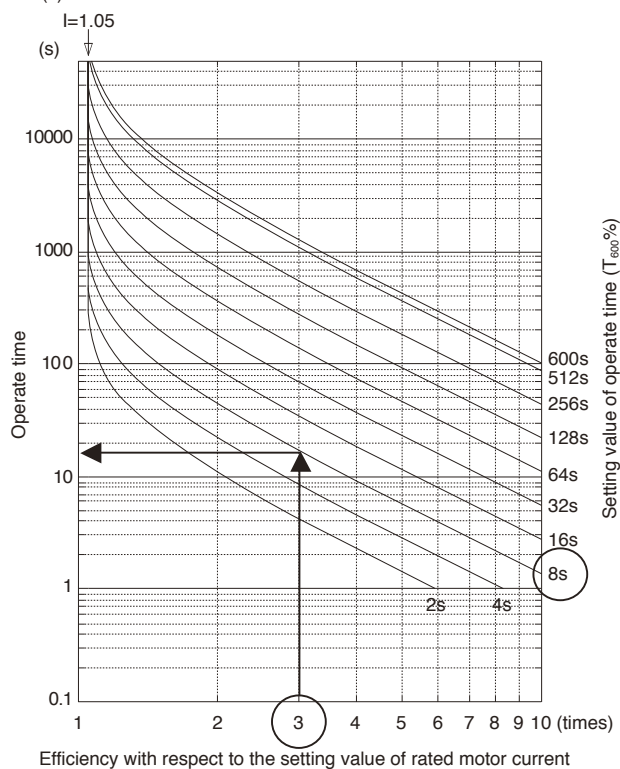
$$\begin{aligned}
 t &= \tau \times \ln(I^2 / (I^2 - K\Theta^2)) \\
 &= T_{600} / \ln(6^2 / (6^2 - K\Theta^2)) \times \ln(I^2 / (I^2 - K\Theta^2)) \\
 &= 8 / \ln(6^2 / (6^2 - 1.05^2)) \times \ln(3^2 / (3^2 - 1.05^2)) \\
 &= 8 / \ln(1.0316) \times \ln(1.1396) \\
 &= 31.61 \text{ (s)}
 \end{aligned}$$



Magnification with respect to the setting value of rated motor current

Example 2: Supposing hot characteristic (during operation), operate value  $K\Theta = 105\% = 1.05$ , operate value time  $T_{600} = 8$  seconds, magnification  $I = 3$  times, and Supposing also the ratio to rated load current  $I_p = 0.75$ , then

$$\begin{aligned}
 t &= \tau \times \ln(I^2 - I_p^2 / (I^2 - K\Theta^2)) \\
 &= T_{600} / \ln(6^2 / (6^2 - K\Theta^2)) \times \ln(I^2 - I_p^2 / (I^2 - K\Theta^2)) \\
 &= 8 / \ln(6^2 / (6^2 - 1.05^2)) \times \ln(3^2 - 0.75^2 / (3^2 - 1.05^2)) \\
 &= 8 / \ln(1.0316) \times \ln(1.0684) \\
 &= 17.01 \text{ (s)}
 \end{aligned}$$



Efficiency with respect to the setting value of rated motor current

Note: The setting value of operate time is in 0.5-second steps (lower limit: 2, upper limit: 600).

In the above characteristic curves, part of the setting operate time is omitted.

$$t = \tau \times \ln \frac{I^2 - (0.75)^2}{I^2 - (1.05)^2}$$

Hot characteristics of overload relay (49) when operate value is set to 105% (during 75% running)



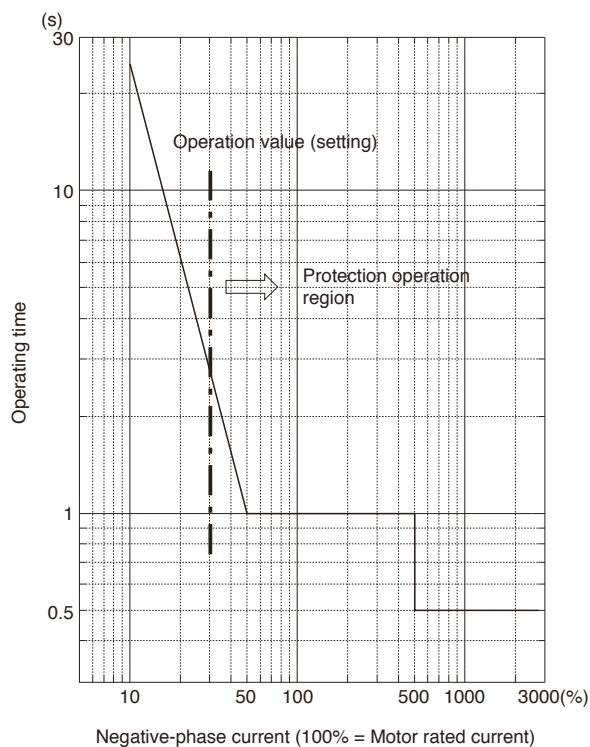
# F-MPC30 series

## Motor feeder unit

### ■ Protection Characteristics of Open-phase (46) Relay

Calculates negative-phase current ( $I_2$ ) from three-phase current, and performs open-phase operation with a ratio of  $I_2/I_M$ . Performs operation value setup with a negative-phase current percent. The range of operation value setup corresponds to ( $I_2/I_M$ ) of 10 to 50% (in 5% steps).

The operating time is reverse time for 10 to 50% (with constant  $I^2t$ ), 1s for 50% (25s for 10%), definite time for 50% or more, 1s for 50% (open-phase region) to 500%, and 0.5s for 500% or more (starting current detection at negative phase failure).



\* The operating time is calculated from the negative-phase current as follows:

(1) Negative-phase current  $I$ :  $10\% \leq I \leq 50\%$

$$t = \frac{0.25}{I^2} \quad (I \geq \text{Setup value})$$

(2) Negative-phase current  $I$ :  $50\% < I \leq 500\%$

$$t = 1.0\text{s (fixed)}$$

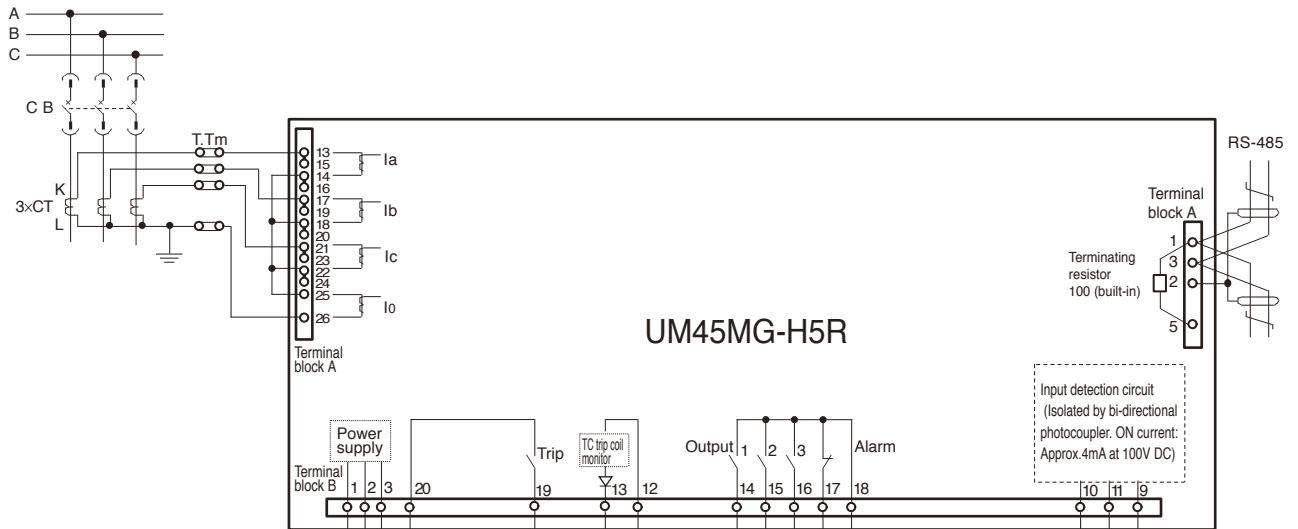
(3) Negative-phase current  $I$ :  $500\% < I$

$$t = 0.5\text{s (fixed)}$$

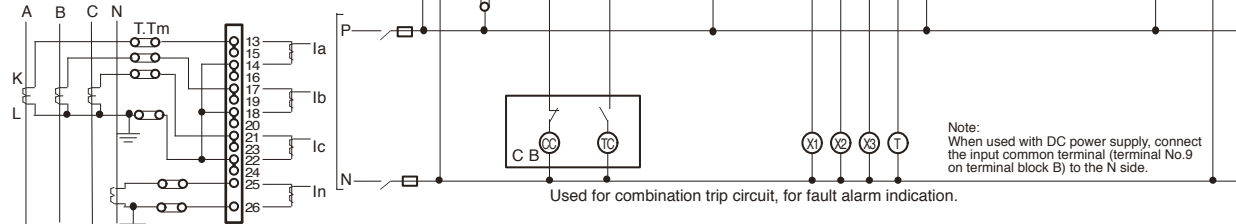
## ■ Basic wiring diagram

### Motor feeder unit / UM45MG-H5R (external 3CT)

3-phase, 3-wire / Zero-phase current detection (residual circuit)

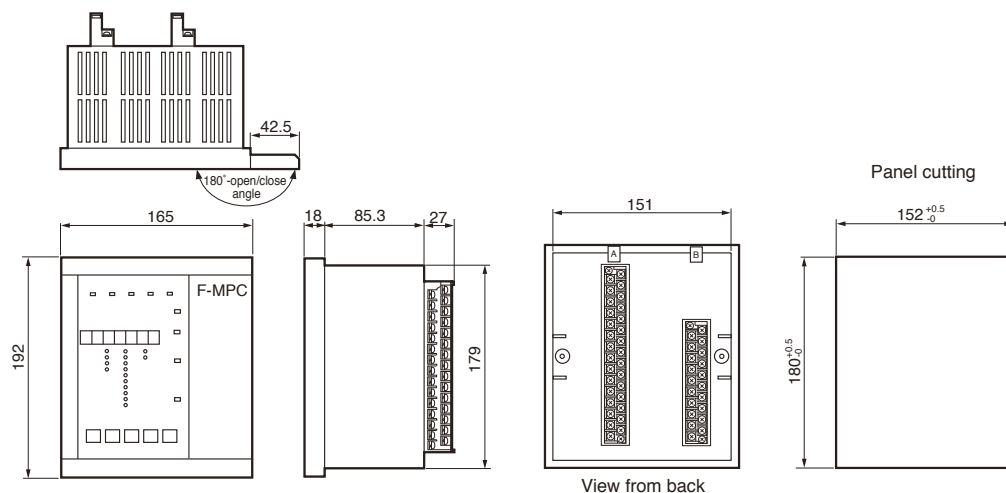


### 3-phase, 4-wire / N-phase dedicated CT connection example



1. Input 1 and outputs 1 to 3 are used by selecting (assigning) functions according to their setting.
2. The "Trip" output and the "Device error" output are dedicated. The 52a (CB ON answerback) input and the "TC (trip coil) disconnection monitoring" input are dedicated.
3. The "Device error" output is an NC contact (The contact is normally energized. If an alarm occurs, it is deenergized and the contact closes.) Hence, there is a time delay of approx. 100ms until the contact opens after the power is turned on. Please consider using a timer when you configure an external sequence (if external devices may be held with one-shot signal).
4. When a heavy load greater than the capacity of the output contact is to be driven, be sure to use in combination with FUJI Power Relays.
5. If this unit is located at the edge of communication line when the communication functions (RS-485) are used, short-circuit No. 3 and No. 5 of terminal block A. (The UM45M is equipped with a built-in terminating resistor.) Otherwise, open between No. 3 and No. 5.

## ■ Dimensions, mm



# F-MPC30 series

## Crane power supply protective unit

### F-MPC30 Crane power supply protective unit

#### ■ Features

- Protective functions to protect crane power supply voltage, such as ground-fault, frequency and overvoltage, are equipped in a single unit.
- The erroneous-breaking preventive function by adopting duplicated analog circuit and AND-output circuit.
- With its self-monitoring function, this unit quickly responds in case a fault occurs.
- The network system can be easily configured via Modbus (RTU).



#### ■ Type numbers

**UM45C - E 5 R**

##### F-MPC30 series

Crane power supply protective unit

##### External interface

R: RS-485 interface is provided as standard

##### Control power

E: 100V DC or 100V AC, common use

#### ■ Specifications

##### ● General specifications

Item	Specifications
Control power supply	100V DC (DC80 to 143V DC) or 100V AC (85 to 132V AC), common use
Power consumption (main unit)	15W or less (100V DC) 25VA or less (100V AC)
Rated frequency	50/60Hz (selectable by setting)
VT secondary rated voltage	① Line voltage input 100, 110, 120V AC Note 1 Fig. 1-1
	② Phase voltage input $100/\sqrt{3}$ , $110/\sqrt{3}$ , $120/\sqrt{3}$ V AC (Line voltage input 100, 110, 120V AC) Note 1 Fig. 1-2
	③ Phase voltage input 100, 110, 120V AC (Line voltage input $100 \times \sqrt{3}$ , $110 \times \sqrt{3}$ , $120 \times \sqrt{3}$ V AC) Note 1 Fig. 1-2
	Select ①, ② or ③ and specify the rated voltage. For VT primary rated voltage Note 2
Rated burden (VT secondary)	1.0VA or less
Insulation resistance	10MΩ or more between electric circuits and ground 5MΩ or more between circuits and between contact circuit terminals
Vibration resistance	16.7Hz, 0.4mm double amplitude, 1.96m/s <sup>2</sup> , 10 minutes each in X, Y and Z directions
Shock resistance	300m/s <sup>2</sup> , three times each in X, Y and Z directions
Withstand voltage	2kV AC 1 minute between electric circuits and ground, excluding RS-485 signal lines
Noise immunity	Vibratory surge JEC2500 (conforming to ANSI), square wave, 1.5kV, 1ns/1μs for 10 minutes
Ambient temperature	-10 to +60 °C (operation guaranteed) (no condensation)
Storage temperature	-25 °C to 70 °C (no condensation)
Humidity	20% to 90%RH (no condensation)
Atmosphere	Free from corrosive gases or excessive dusts
Grounding	Class D grounding (100Ω or less)
Mass	1.4kg
Instantaneous power failure time	20ms (operation continues) though the indication disappears.
Electrostatic noise immunity	In contact with metal part: ±8kV Panel surface (no contact with nonmetal part): ±15kV
Lightning impulse withstand voltage	4.5kV (between electric circuits and ground)

Note 1 and Note 2 on the next page.

Conformity standard: JEC-2500 (Protective relays for electric power system), JEC-2510 (Over current relays), JIS C 1102-1,2,4 (Direct acting indicating analogue electrical measuring instruments and their accessories), IEC255-5, 6 (Electrical relays Part 5, 6).

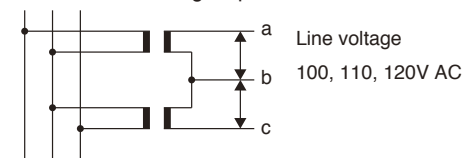
Note 1: External VT connecting method and transformation ratio.

Fig. 1-1 In case of line voltage input

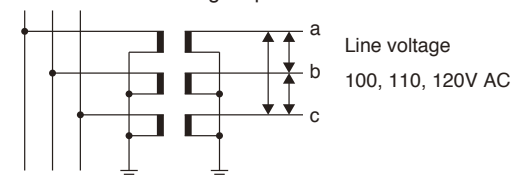
(Select the setting value "1" for the setting code 04)

\* There is no measurement or display of phase voltage. The protective function is activated by line voltage.

• Two VTs line voltage input



• Three VTs line voltage input



Note 2:

Select one from the following 24 values for the rated line voltage on the VT primary side.

- 210, 220, 380, 400, 440, 460, 480, 3300, 4160, 6600V
- 11000, 13200, 13800, 15000, 20000, 22000, 22900, 24000V
- 33000, 34500, 35000, 66000, 77000, 110000V

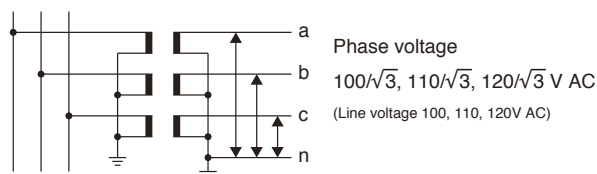
Select 100, 110 or 120V for the rated line voltage on the VT secondary side.

Select a combination of VT primary and secondary side rated line voltages for the setting code 01. Any combination can be made.

- Example
- For 6600V/100V, select 6.60-0 as the setting value.
  - For 6600V/110V, select 6.60-1 as the setting value.
  - For 6600V/120V, select 6.60-2 as the setting value.

Fig. 1-2 In case of phase voltage input

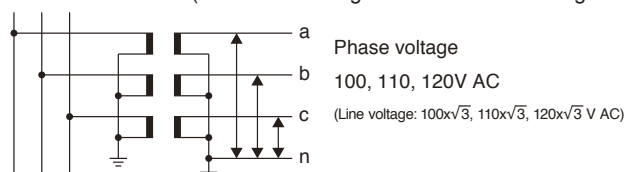
(Select the setting value "2" for the setting code 04)



\* The protective function is activated by phase voltage.

Fig. 1-3 In case of phase voltage input

(Select the setting value "3" for the setting code 04)



\* The protective function is activated by phase voltage.

### External I/O specifications

Item		Specifications	
Input circuit	Maximum voltage • ON range	143V DC or less    ON range: 40 to 70V DC	132V AC or less    ON range: 40 to 70V AC
	Rated current	Approx. 1.2mA at 100V DC	Approx. 1.2mA at 100V AC
	No. of points	General-purpose: 1, Fixed: 2 (52a, TC disconnection monitoring)	
Output circuit	No. of points • Making/breaking capacity	Circuit breaker trip: 1 point	Making current: 15A (110V DC), 10A (110V AC) Making current: 0.4A (110V DC), 10A (110V AC) Allowable continuous current: 4A
		General-purpose contact: 3 points Device error: 1 point	Making/breaking current: 0.2A (110V DC, inductive load L/R = 15ms or less) 0.1A (220V DC, inductive load L/R = 15ms or less) 2A (250V AC, COSΦ: 0.3 to 0.4) Allowable continuous current: 1A

### Measurement and display specifications

Item		Effective display range		Accuracy *1	Measuring range
Line voltage Min. line voltage	External VT connection Fig. 1-1, Fig. 1-2	VT rated secondary voltage	VT secondary voltage range	±1.5%	0, and effective measuring range  Example: When VT rated secondary voltage is 110V in line voltage; 0, 5.5 to 150V *2
		Line voltage 100V	5.0 to 150V (FS)		
		Line voltage 110V	5.5 to 150V (FS)		
	Fig. 1-3	Line voltage 120V	6.0 to 150V (FS)		
		Line voltage 100V×√3	8.7 to 260V (FS)		
		Line voltage 110V×√3	9.5 to 260V (FS)		
Phase voltage Min. phase voltage	External VT connection Fig. 1-2	VT rated secondary voltage	VT secondary voltage range	±1.5%	0, and effective measuring range
		Phase voltage 100V/√3	5.0 to 150V (FS)		
		Phase voltage 110V/√3	5.5 to 150V (FS)		
	Fig. 1-3	Phase voltage 120V/√3	6.0 to 150V (FS)		
		Phase voltage 100V	8.7 to 260V (FS)		
		Phase voltage 110V	9.5 to 260V (FS)		
Max. fault voltage (59) Min. fault voltage (27)		Same as the above line voltage and phase voltage		±5%	Same as the above line voltage and phase voltage
Frequency Fault frequency when a frequency relay worked		50Hz setting: 42.5 to 57.5Hz (FS) 60Hz setting: 52.5 to 67.5Hz (FS)		±0.5%	50Hz setting: 42.5 to 57.5Hz 60Hz setting: 52.5 to 67.5Hz
Ground-fault current (zero-phase current) Fault current when a ground relay worked		0, 0.1 to 2A 0.2 to 8A		±1.5% ±5%	0, 0.1 to 16A *3

Note: \*1 The accuracy does not include the error of the combined transformer.

\*2 "0, a to n" means that "0" is indicated when the value is below "a."

\*3 If the frequency is out of the measurement range, code EEE is displayed instead of the measurement value. The "Hz" LED lights up.



# F-MPC30 series

## Crane power supply protective unit

### ● History data specifications

Item	Display range	Code
51G operation count	0 to 9,999 (times)	<b>H3</b>
50G operation count	0 to 9,999 (times)	<b>H4</b>
OF operation count	0 to 9,999 (times)	<b>h4</b>
UF operation count	0 to 9,999 (times)	<b>h5</b>

Item	Display range	Code
59(OV) operation count	0 to 9,999 (times)	<b>H6</b>
27(UV) operation count	0 to 9,999 (h)	<b>H7</b>
Running time	0 to 9,999×100 (h)	<b>Hc</b>
Make/brake operation count	0 to 9,999×10 (times)	<b>Hd</b>

### ● Protective relay specifications

Item		Setting range		Characteristics	
		Operate value	Operating time	Operate value	Operating time
59(OV)	*1	VT secondary: 60 to 150V (in 1V steps), lock	0.0 to 5.0 (in 0.5s steps) 5.0 to 60s (in 1s steps)	±5%	±5% (lower limit ±50ms)
27(UV)	*2 *4	VT secondary: 10 to 110V (in 1V steps), lock	0.0 to 5.0 (in 0.5s steps) 5.0 to 60s (in 1s steps)	*3	±5% (lower limit ±50ms) Within ±35ms when 0s is set
81H/81L (OF/UF)	*4	+/-0.5 to 5Hz (in 0.1Hz steps) (Enabled when VT secondary voltage is 46V or more)	0.1 through 5.0 to 60s 0.1–5.0: in 0.1 steps 5.0–60: in 1s steps	±0.2Hz	±5% (lower limit ±50ms)
Auto reset: Automatically reset when coming out of +/- 0.2Hz of operate value					
Ground relay	50G	0.2 to 8A (in 0.1A steps)	0 to 99.9s (in 0.1s steps)	±5%	±5% (lower limit ±50ms)
	51G For characteristic equation *5	0.2 to 2A (in 0.1A steps) Characteristic: SI/VI/LT/EI	Time magnification: 0.5 to 20 times (in 0.1 times steps)	±5% (min±50mA)	When time magnification is L≥10, Setting value 300%: ±12% 500,1000%: ±7% (Lower limit ±100ms) When time magnification is L<10 *6

Note: \*1 Judgment is made by the line voltage (a-b) in the case of line voltage input (Note 1, Fig. 1-1); by a-n phase voltage in the case of phase voltage input (Note 1, Fig. 1-2, Fig. 1-3).

\*2 "Three-phase AND", "three-phase OR", or "2 out of 3 (2/3 judgment)" can be set for judgment.

\*3 The tolerance of operate value is equivalent to JEC 2511 Class 5V.

Calculating formula for allowable tolerance :  $[2.3 + \{(Rated\ value) / (Voltage\ setting\ value)\} \times 0.16] \times 2\ (\%)$

\*4 The linkage of 27(UV) and 81L(UF) can be set. (Protection is disabled when 52a contact is set OFF.)

\*5 Characteristic equation

$$SI = \frac{0.14}{I^{0.02} - 1.0} \times \frac{L}{10}$$

$$EI = \frac{80}{I^2 - 1.0} \times \frac{L}{10}$$

$$VI = \frac{13.5}{I - 1} \times \frac{L}{10}$$

$$LT = \frac{120}{I - 1} \times \frac{L}{10}$$

I: % input (100%(2A)=1) L: Time magnification (time setting: 0.5 to 20)

\*6 51G operate time error

This unit conforms to "Table 11 Error due to operate time setting (static type)" in "6.5.2 Test and Inspection" of JEC-2510 (Over-current relays).

● **Communication specifications**

• **Modbus mode**

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronization	
Connecting form	1 : N (N: UM45C-E5R)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	8 (fixed)
	Parity bit	Odd, even, or none (selectable)
	Stop bit	1/2 (automatically selectable) 1/2: with or without parity
Transmission code	HEX value (Modbus RTU mode)	
Error detection	CRC-16	
Terminal symbol	D1(+): DXA, D0(-): DXB	

• **F-MPC-Net mode**

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronous transmission	
Connecting form	1 : N (N: UM45C-E5R)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	7/8 (selectable)
	Parity bit	None, odd, or even (selectable)
	Stop bit	1 (fixed)
Transmission code	ASCII code	
Error detection	Horizontal parity: even parity	

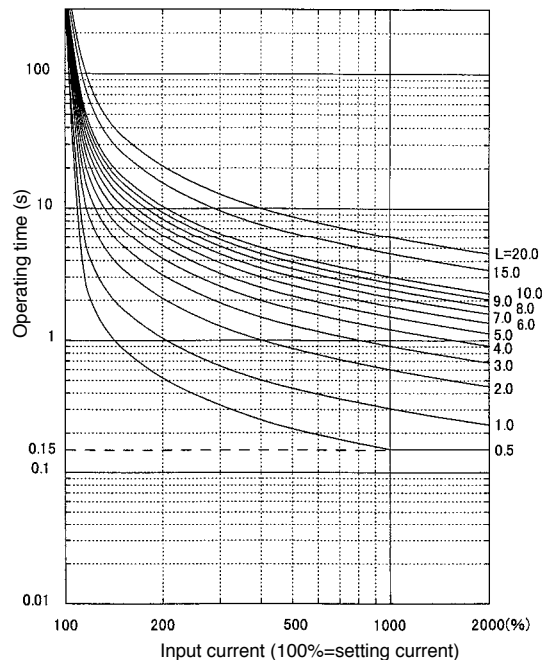
Note: • Use KPEV-SB (0.5mm<sup>2</sup>), CPEV-SB (0.9mm dia.) or equivalent communication cable. Connect the shielding wire to the SG terminal (No. 2 of terminal block A).  
 • Communication cable must not be branched. Connect terminating resistors at both ends of communication cable. If the UM45C is located at the edge of communication line, short-circuit No. 3 and No. 5 of terminal block A. The UM45C is equipped with a built-in terminating resistor of 100Ω.  
 • Use the communication cable such that its transmission distance becomes 1,000m or less.  
 Keep the wiring as far from high voltage equipment or power cables as possible.

# F-MPC30 series

## Crane power supply protective unit

### ■ Time-current characteristics of 51G relay

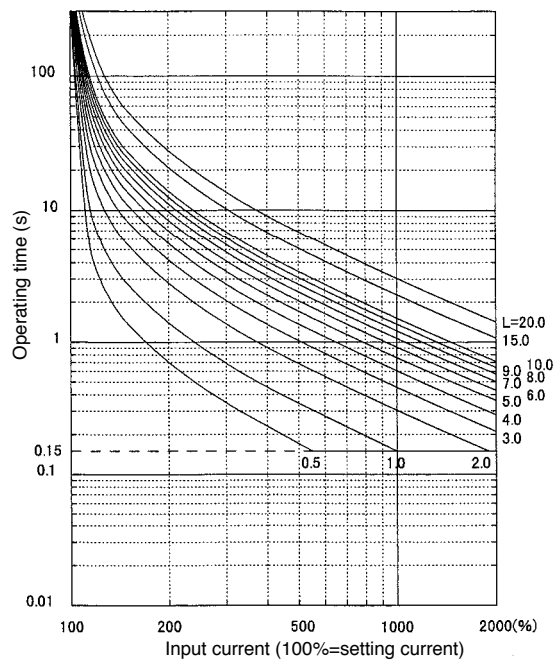
#### Inverse (SI) characteristics



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

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

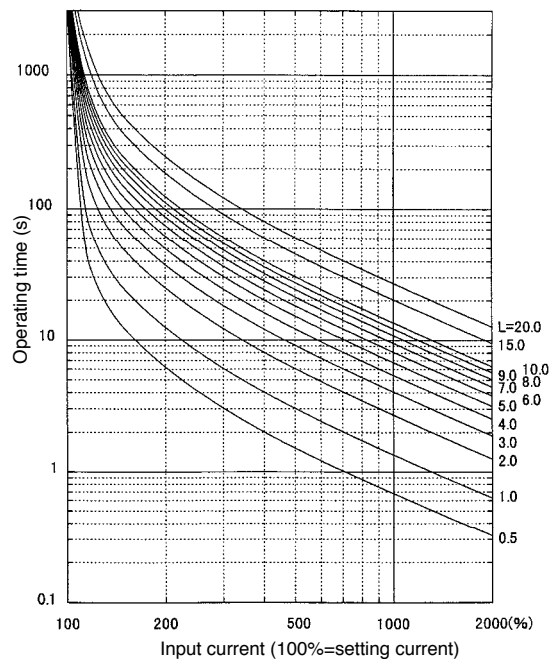
#### Inverse (VI) characteristics



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

$$t = \frac{13.5}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

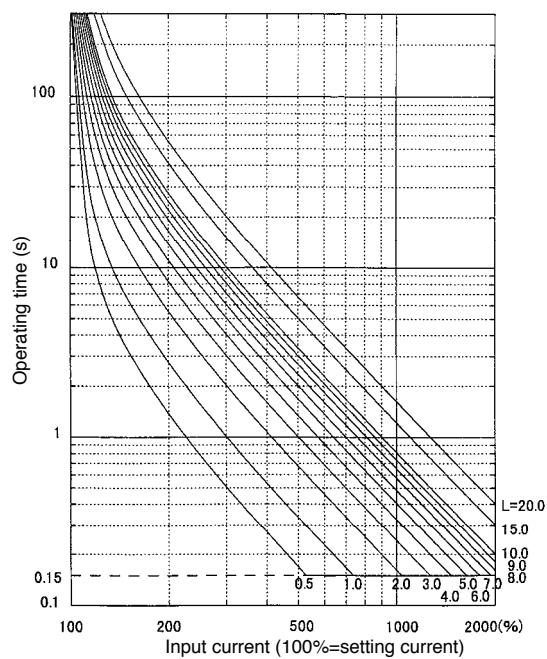
#### Inverse (LT) characteristics



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

$$t = \frac{120}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

#### Inverse (EI) characteristics

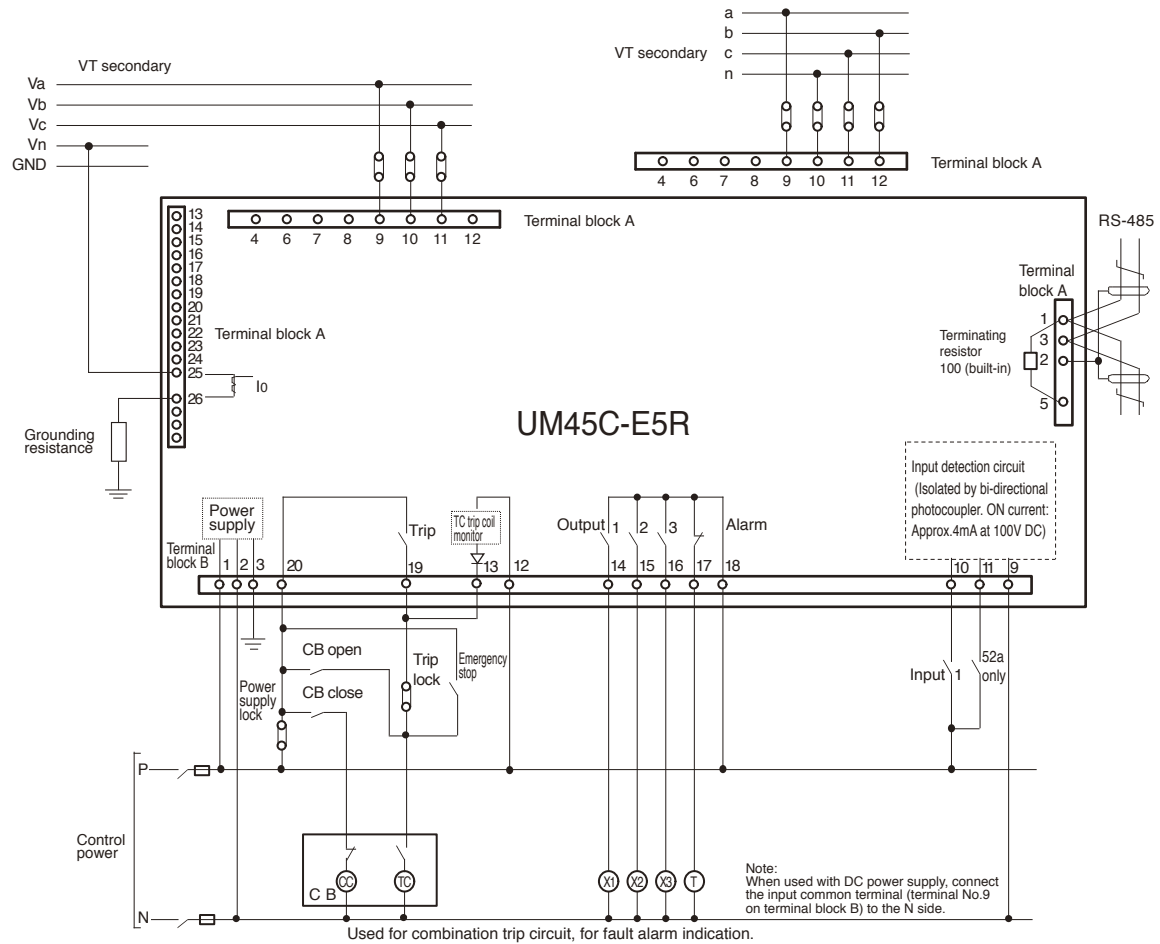


Note:  
Time setting (lever) is of 0.1 time steps (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{80}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

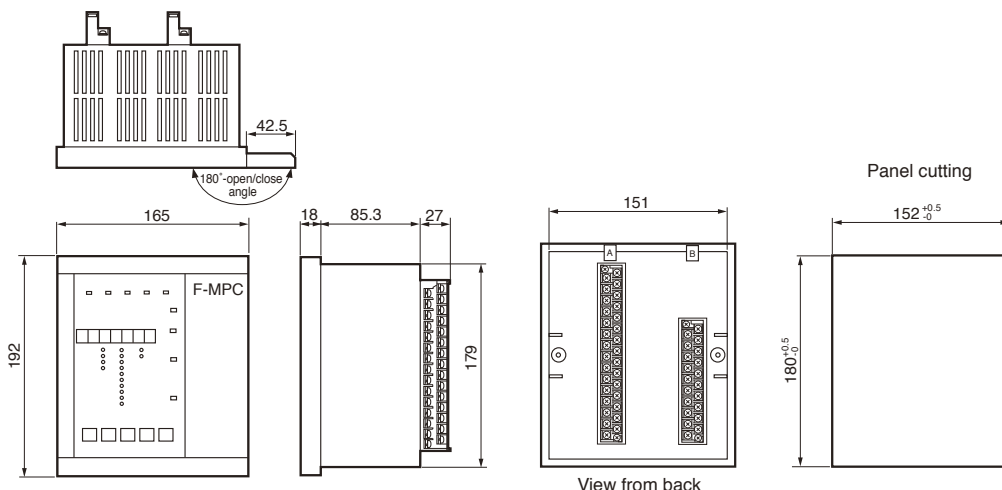
### Basic wiring diagram

#### Crane power supply protective unit / UM45C-E5R (External 2VTs, 3VTs)



1. Input 1 and outputs 1 to 3 are used by selecting (assigning) functions according to their setting.
2. The "Trip" output and the "Device error" output are dedicated. The 52a (CB ON answerback) input and the "TC (trip coil) disconnection monitoring" input are dedicated.
3. The "Device error" output is an NC contact (The contact is normally energized. If an alarm occurs, it is deenergized and the contact closes.) Hence, there is a time delay of approx. 100ms until the contact opens after the power is turned on. Please consider using a timer when you configure an external sequence (if external devices may be held with one-shot signal).
4. When a heavy load greater than the capacity of the output contact is to be driven, be sure to use in combination with FUJI Power Relays.
5. If this unit is located at the edge of communication line when the communication functions (RS-485) are used, short-circuit No. 3 and No. 5 of terminal block A. (The UM45C is equipped with a built-in terminating resistor.) Otherwise, open between No. 3 and No. 5.

### Dimensions, mm





# F-MPC60B series

## Transformer protective unit

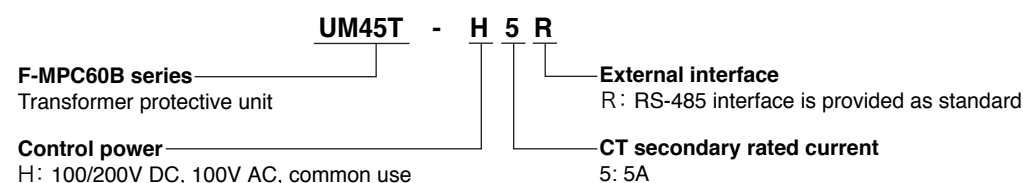
### F-MPC60B Transformer protective unit

#### ■ Features

- Protection, measurement, and communication functions provided as standard.
- The erroneous-breaking preventive function by adopting duplicated analog circuit and AND-output circuit.
- With its self-monitoring function, this unit quickly responds in case a fault occurs.
- The network system can be easily configured via Modbus (RTU).



#### ■ Type numbers



#### ■ Specifications

##### ● General specifications

Item	Specifications
Applicable transformer	Two-winding transformer, Three-winding transformer
Control power supply (Standard)	100/200V DC (80-286V DC), 100V AC (85-132V AC), common
Power consumption (main unit)	15W or less (100/200V DC) 25VA or less (100V AC)
Rated frequency	50/60Hz (Changeover)
Rated current (CT secondary side)	5A AC
Rated burden (CT secondary side)	1.0VA or less
Insulation resistance	10MΩ or more between electric circuits and ground 5MΩ or more between electric circuits, between circuit terminals
Withstand voltage	2kV AC between electric circuits and ground, excluding between primary-secondary-tertiary in CT circuit same-phase, and RS-485 signal line 1kV AC between circuit terminals
Vibration resistance	• 10Hz, double amplitude 5mm (front, back, left and right), 2.5mm (up and down) • 1.96m/s <sup>2</sup> 16.7Hz double amplitude 0.4mm, 10 minutes in each of 3 directions.
Shock resistance	300m/s <sup>2</sup> , 3 times in each of 3 directions
Noise immunity	Oscillating frequency 1MHz, primary peak value 2.8kV, 1/2 attenuation time 3-6 cycles Repetitive frequency 6-10 times/1 cycle of commercial power frequency (asynchronous) JEC 2500 Wave 2 (equivalent to ANSI) Peak voltage: Square wave 1.5kV impulse (1ns/100ns, 10 minutes) Radio noise: Frequency 150MHz-, 400MHz-, 900MHz-band, Rated output 10V/m Mobile phone (800MHz/1.5MHz 0.8W), PHS (1.90GHz 10mW) closely contact
Electrostatic noise immunity	In contact with metal part: ±8kV, Panel surface (no contact with nonmetal part): ±15kV
Overload capacity	CT circuit: 40 times the rating, 1 second, twice
Ambient temperature	0°C to 40°C: Characteristics guaranteed (No icing or no condensation)
Storage temperature	-20°C to 70°C
Relative humidity	20% to 90%RH (no condensation)
Atmosphere	No corrosive gas or excessive dust
Grounding	Class D grounding (100Ω or less)
Mass	1.4kg
Instantaneous power failure time	20ms (operation continues) though the indication disappears
Lightning impulse withstand voltage	4.5kV between electric circuits and ground

Conformity standard: JEC-2500 (Protective relays for electric power system), JEC-2510 (Over current relays), JIS C 1102-1,2 (Direct acting indicating analogue electrical measuring instruments and their accessories), IEC255-5, 6 (Electrical relays Part 5, 6).

### ● External I/O specifications

Item	Specifications	
Input circuit	ON voltage: 70V or less AC/DC , OFF voltage: 40V or more AC/DC40V	
Output circuit	CB trip	Making current: 15A (110V DC), 10A (220V DC) Resistive load Allowable continuous current: 4A
	Other than above	Making/breaking current: 0.2A (110V DC, inductive load L/R=15ms) Allowable continuous current: 1A Making/breaking current: 0.1A (220V DC, inductive load L/R=15ms) Allowable continuous current: 1A

### ● Measurement and display specifications

Item	Effective display range	Accuracy *2	Measuring range	No. of Display digit
Differential circuit current Idr, Ids, Idt	Reference current converted effective value 3 to 100% *1	±5%	0, 3 to 100%	3 digits
Differential circuit fault current (87Rdf, 87HOC)	Reference current converted effective value 3 to 100% *1	±5%	0, 3 to 1000%	4 digits
	100 to 1000%	Error ratio ±10%		

Note: \* "0, a to n" means that "0" is indicated when the value is between "0 to a".

\*1 Differential circuit current Id is expressed in the following equation.

$$Id (\%) = \{ (Primary\ input\ current / Primary\ reference\ current) - (Secondary\ input\ current / Secondary\ reference\ current) - (Tertiary\ input\ current / Tertiary\ reference\ current) \} \times 100$$

\*2: Range of 3 to 100%: For example at 50%, 45 to 55%      Range of 100 to 1000%: For example at 200%, 180 to 220%

### ● History data specifications

Item	Display range	Code	Item	Display range	Code
Operation hours	0-9,999 (times)	Hc	87Rdf	0-9,999 (times)	HF
Operation count	0-9,999 (times)	Hd	87HOC	0-9,999 (times)	HH

Note: "Code" in the above table is indicated with the upper two digits of the 7-segment LED of this unit.

### ● Specifications of protective relays

Division	Item		Setting range etc.		Characteristics		
					Tolerance (Error)	Operating time, reset time	
87RDf Ratio differential	Operating formula	Id > Kd×ΣI (kd: Ratio conversion coefficient) and Id > Ki (Current sensitivity) Id=I1+I2+I3(Vector sum of converted reference current) ΣI= √I1 <sup>2</sup> +I2 <sup>2</sup> +I3 <sup>2</sup>			Operating time: 50ms or less Reset time: 100ms (300% of setting value)		
	Reference current setting	2.9 to 8.7A (in 0.1A step)					
	Characteristics	Current sensitivity Ki	Reference current setting × 30%(Fixed), lock				Control point *1 Within ±5% Others Within ±10%
		Ratio characteristics Kd	30, 40, 50% (Selective setting)				Control point *2 Within ±10% Others Within ±20%
		Harmonics suppression	Not operate at second harmonics 15, 25% or more (15, 25% selective setting) *3				15%: 10 to 15% 25%: 20 to 25%
		Phase characteristics	Ratio characteristics setting: 30%: 180°±20° 40%: 180°±29° 50%: 180°±39°				
		Reset value	90% or more of measured operate value				
		Frequency characteristics	Variation of operate value and ratio characteristics	±5%			
Harmonics suppression characteristics	15%: 5 to 15% 25%: 10 to 25%						
87HOC (Differential circuit overcurrent)	Operating formula	Id > (Current setting value)			Operating time: 40ms or less Reset time: 100ms or less		
	Characteristics	Current setting	2.0 to 10.0 times of reference current setting (in 1.0 step), lock	±5%			
		Reset value	90% or more of measured operate value				
		Frequency characteristics	±5% of rated value				
87RDf 87HOC (Common)	Non-operating time setting at startup	Lock, 0.1 to 999s (in 0.1s step) When non-operating time setting at startup is set, the functions of 87RDf and 87HOC are locked within the setting time after startup. Use this function when harmonics suppression does not work effectively at startup, like the starting current does not contain much harmonics.					

Note: \*1 Tolerance at control point (Coil I, min. reference current setting tap, min. ratio tap) is shown.

\*2 Tolerance at control point (Coil I to coil II, flow-out current 200% against each ratio tap) is shown.

\*3 The preventive function against malfunction due to exciting inrush current works (locked) when the second harmonics contains 15% or 25% or more of the fundamental wave.

# F-MPC60B series

## Transformer protective unit

### • Operation of fail-safe relay

Division			Remarks
87RDF	Operation formula	$I_d > K_i$	Synchronized with main relay setting
	Current setting	Reference current setting x 27% (fixed)	
87HOC	Current sensitivity	90% or more of current setting value	Synchronized with main relay setting

### ● Communication specifications

#### • Modbus mode

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronization	
Connecting form	1 : N (N: UM45T-H5R)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including a master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	8 (fixed)
	Parity bit	Odd, even, or none (selectable)
	Stop bit	1/2 (automatically selectable) 1/2: with or without parity
Transmission code	HEX value (Modbus RTU mode)	
Error detection	CRC-16	
Terminal symbol	D1(+): DXA, D0(-): DXB	

#### • F-MPC-Net mode

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronous transmission	
Connecting form	1 : N (N: UM45T-H5R)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including a master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	7/8 (selectable)
	Parity bit	None, odd, or even (selectable)
	Stop bit	1 (fixed)
Transmission code	ASCII code	
Error detection	Horizontal parity: even parity	

Note: • Use KPEV-SB (0.5mm<sup>2</sup>), CPEV-SB (0.9mm dia.) or equivalent communication cable. Connect the shielding wire to the SG terminal (No. 2 of terminal block A).

• Communication cable must not be branched. Connect terminating resistors at both ends of communication cable. If the UM45T is located at the edge of communication line, short-circuit No. 3 and No. 5 of terminal block A. The UM45T is equipped with a built-in terminating resistor of 100Ω.

• Use the communication cable such that its transmission distance becomes 1,000m or less.

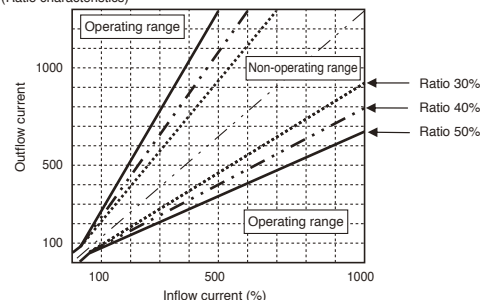
Keep the wiring as far from high voltage equipment or power cables as possible.

### ● Number of external I/O

Item	Specifications			Remarks
CT input	Primary AC input	A (r, s, t)	3CT	CT rated secondary current 5A
	Secondary AC input	A (r, s, t)	3CT	
	Tertiary AC input	A (r, s, t)	3CT	
Contact output	Trip 1	87RDf, 87HOC (Differential)		(Fixed)
	Unit fault	NC normally-energized		(Fixed)
	Alarm output	NO		*Selective output
100V DC input	Trip coil disconnection monitoring	1 point		(Fixed)
	CB52a	1 point		(Fixed)
	General-use input	3 points		*Selective input

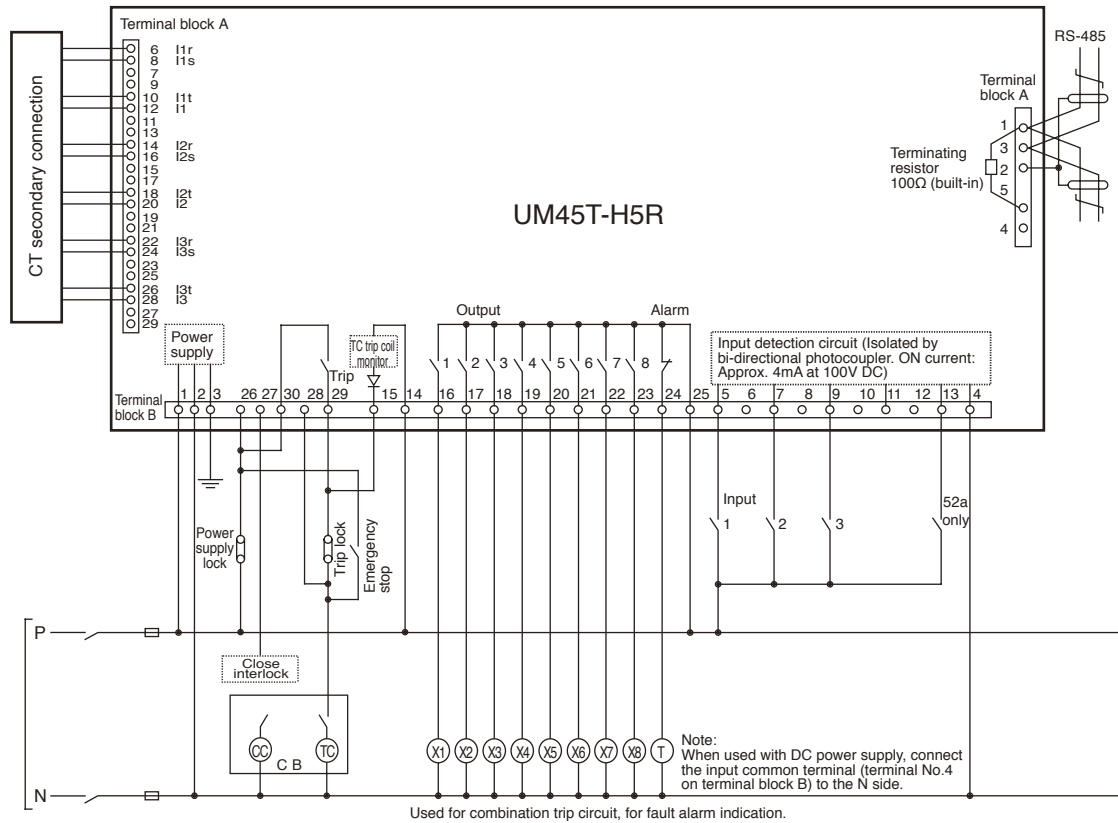
### ● RDf relay Operating characteristic

(Ratio characteristics)



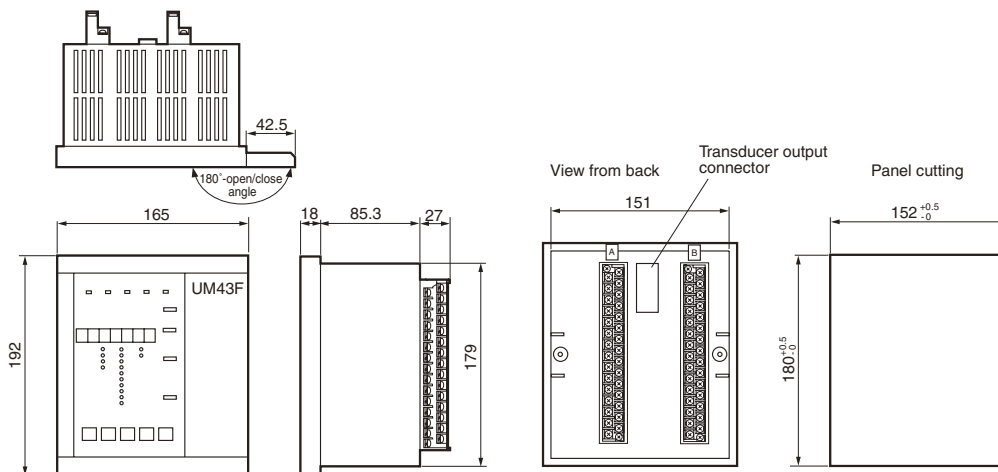
### Basic wiring diagram

#### Transformer protective unit / UM45T-H5R



- Input 1 to 3 and output 1 to 8 are used by selecting (assigning) functions according to their setting.
- The "Trip" output and the "Device error" output are dedicated. The 52a (CB ON answerback) input and the "TC (trip coil) disconnection monitoring" input are dedicated.
- The "Device error" output is an NC contact (The contact is normally energized. If an alarm occurs, it is deenergized and the contact closes.) Hence, there is a time delay of approx. 100ms until the contact opens after the power is turned on. Please consider using a timer when you configure an external sequence (if external devices may be held with one-shot signal).
- When a heavy load greater than the capacity of the output contact is to be driven, be sure to use in combination with FUJI Power Relays.
- If this unit is located at the edge of communication line when the communication functions (RS-485) are used, short-circuit No. 3 and No. 5 of terminal block A. (The UM45T is equipped with a built-in terminating resistor.) Otherwise, open between No. 3 and No. 5.

### Dimensions, mm



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



# F-MPC60B series

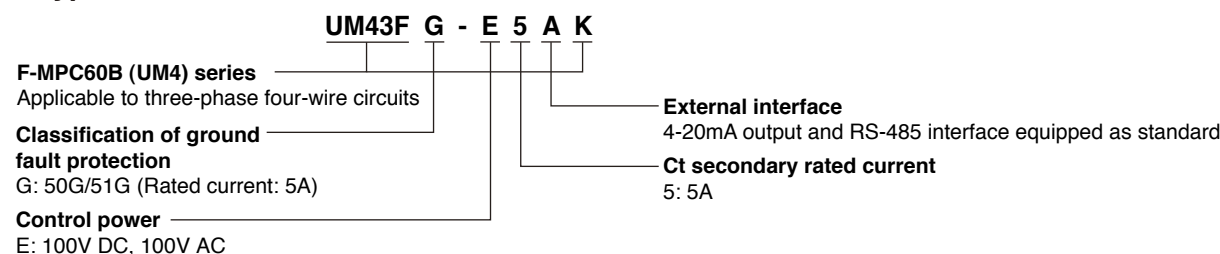
## Power receiving unit

### F-MPC60B Power receiving unit UM43FG-E5AK

#### ■ Features

- Applicable to three-phase three-wire and three-phase four-wire circuits. Setup change can be performed with easy operations even for circuit change, such as CT ratio, VT ratio, etc.
- The erroneous-breaking preventive function by adopting duplicated analog circuit and AND-output circuit.
- With its self-monitoring function, this unit quickly responds in case a fault occurs.
- The network system can be easily configured via Modbus (RTU).

#### ■ Type numbers



#### ■ Specifications

##### ● General specifications

Item		Specification
Control power supply		100V DC (80 to 143V DC) 100V AC (85 to 132V AC) common use
Power consumption (main unit)		15W or less
Rated VA consumption of VT, CT		Max. 1.0VA
Rated current (CT secondary side)		5A AC
Rated voltage	VT secondary, phase voltage	110V AC
	VT secondary, line voltage	110V/√3 AC
Rated zero-phase current		110Vx√3 AC
Insulation resistance		5A AC
Vibration resistance		10MΩ or more between electric circuit and ground
Shock resistance		16.7Hz, double amplitude 0.4mm, 1.96m/s <sup>2</sup> 10 minutes in each of 3 directions
Withstand voltage		300m/s <sup>2</sup> , 3 times in each of 3 directions
Noise immunity		2kV AC 1minute between active parts and ground, excluding RS-485 signal lines, transducer output.
Overload capacity		JEC2500 (equivalent to ANSI), Square wave 1.5kV (1ns/1μs, 10 minutes)
Ambient temperature		CT circuit: 40times the rating, 1minute, twice VT circuit: 10times the rating, 10minutes
Storage temperature		-10°C to 60°C: Operation guaranteed (0°C to 40°C: characteristics guaranteed)
Relative humidity		-25°C to 70°C
Atmosphere		20% to 90%RH (no condensation)
Grounding		No corrosive gas or excessive dust.
Mass		Class D grounding (100Ω or less)
Instantaneous power failure time		1.4kg
Electrostatic noise immunity		20ms (operation continues) though the indication disappears
Lightning impulse withstand voltage		In contact with metal part: ±8kV Panel surface (no contact with nonmetal part): ±15kV
		5kV between electric circuits and ground

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

Conformity standard: JEC-2500 (Protective relays for electric power system), JEC-2510 (Over current relays), JEC-2511 (Voltage relays), JIS C 1102-1,2,3,4,5,7 (Direct acting indicating analogue electrical measuring instruments and their accessories), JIS C 1111 (Electrical measuring transducers for converting a.c. electrical quantities to analogue or digital signals), JIS C 1216 (Electrical measuring transducers for converting a.c. electrical quantities to analogue or digital signals), JIS C 4602 (Overcurrent relays for 6.6kV receiving), IEC255-3, 5, 6 (Electrical relays Part 3, 5, 6).

### ● External I/O specifications

Item	Specification	
Input circuit	100V DC (143V DC or less)/100V AC (132V AC or less) ON voltage: 40V DC to 70V DC/40V AC to 70V AC	
Output circuit	CB 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

Item	Effective display range	Display range and accuracy *2
Current/demand current/max demand current	0 0.8% to CT rated to CT rated x8 *1	±1.5%: 0, 0.8 to 100% ±5%: 100 to 800%
Zero-phase current/max zero-phase current history	CT:0, 2% to CT rating to CT rated x 8	±1.5%: 0.2% to CT rating, ±5%: Rated value or more
Active power/demand active power/reactive power	±0.004 to ±1kW at transformer secondary (VT rated voltage 110VAC conversion)	±1.5%: 0, ±0.004 to ±1kW (Refer to Fig. 1.)
Power factor	Lead 0% to 100% Lag 0%±5% (Refer to Fig. 1.)	±5% (Fig 1)
Active and reactive electric energy *2	0 to 99999 multiplying factor: 1, 10, 100, 1000	JIS C 1216 (meter with a transformer) Equivalent to ordinary instruments shown in Table 4
Line voltage	9.5V to 260V at VT secondary	±1.5%
Phase voltage	5.5V to 150V at VT secondary	* Rated phase voltage = Line voltage/√3
Frequency	45 to 55Hz (50Hz) 55 to 65Hz (60Hz)	±0.5%
Harmonic current	3rd, 5th, and 7th orders, and total	

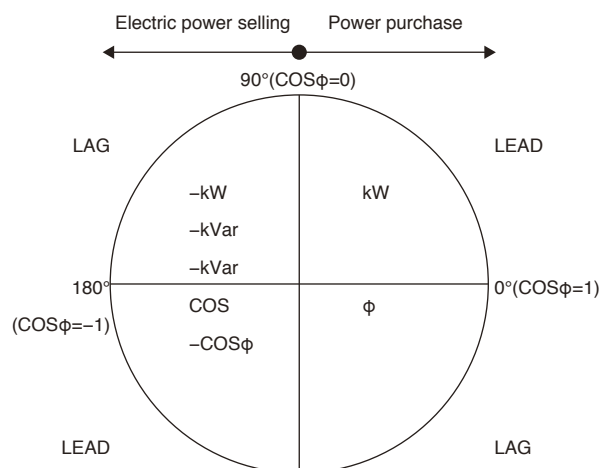
Notes: • "0, a to n%" means that "0" is indicated when the value is between "0 to a%".

• The "±" sign is used for display of "power selling/purchase" in electrical measurement and display of "LEAD/LAG" in power factor measurement (a blank for positive values). The sign "±" has the following meaning for each measurement item, as shown in Fig. 1.

\*1 The fault max current up to 2000% (accuracy: ±5%) can be displayed.

\*2 There are two different indications in the power indication: total electric energy indication (zero clear not possible) and periodic power indication (zero clear possible).

Fig 1



- 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
  - : Lagging current by reactive volt-ampere meter method
  - ※: "LEAD/LAG" reverses with electric power selling/purchase.
- Power factor: COSφ
  - +: LEAD
  - : LAG

### ● History data specifications

Item	Display range	Code
50(INST) operation count	0-9,999 (times)	H0
51DT1 operation count	0-9,999 (times)	H1
51(OC) operation count	0-9,999 (times)	H2
51G operation count	0-9,999 (times)	H3
50G operation count	0-9,999 (times)	H4
59(OV) operation count	0-9,999 (times)	H6
27(UV) operation count	0-9,999 (times)	H7

Item	Display range	Code
OCA operation count	0-9,999 (times)	Hb
Running times	0-9,999 x 100(hr)	Hc
Making operation count	0-9,999 x 10 (times)	Hd
OCGA operation count	0-9,999 (times)	Hn
51DT2 operation count	0-9,999 (times)	HP

When displaying history data with a 7-segment LED, the upper two digits of the 7-segment LED are displayed as the display code.

# F-MPC60B series

## Power receiving unit

### ● Specification of protective relays

Item	Current/voltage operate value setting range	Operating time (timer) setting range	Characteristics	
			Operate value	Operating time
50 (Instantaneous)	1 to 16 times the CT rating (in 0.2 times steps), lock	(Fixed)	±5%	40ms or less
51DT1 (Definite-time)	1 to 16 times the CT rating (in 0.2 times steps), lock	0-5s (in 0.05s steps)	±5%	Less than 1s: ±50ms 1s or more: ±5%
51DT2 (Definite-time)	20% to 240% of CT rating (in 2% steps), lock	0-10s (in 0.1s steps)	±5%	Less than 1s: ±50ms 1s or more: ±5%
51 (Inverse time) SI, EI, VI, LT, I <sup>2</sup> t	20% to 240% of CT rating (in 2% steps), lock	0.5 to 20 times (in 0.1 times steps) (Operating time: min. 150ms)	±5%	Setting value 300%: ±12% 500, 1000%: ±7% (Lower limit ±100ms)
50G, 50N (Instantaneous, definite-time)	0.1 to 8 times the CT rating (in 0.1 times steps), lock	0.0 through 10s to 180s (in 0.1s/1s steps) *1	±5%	±5% (Lower limit ±50ms)
51G, 51N SI, EI, VI, LT	2% to 100% of CT rating (in 1% steps), lock	0.5 to 20 times (in 0.1 times steps) (Operating time: min. 150ms) *1	±5% (min. ±100mA)	Equivalent to 51 above.
59 (OV)	VT secondary: 60 to 150V (in 1V steps), lock	0.0 through 5.0 to 6.0s (in 0.5s/1s steps)	±5%	±5% (min±50ms)
27 (UV)	VT secondary: 10 to 110V (in 1V steps), lock	0.0 through 5.0 to 6.0s (in 0.5s/1s steps)	±5%	±5% (min±35ms)
OCA (Overcurrent pre-alarm)	10% to 100% of CT rating (in 5% steps), lock	10 to 200s (in 10s steps)	±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 steps)	±10% (min. ±100mA)	±5%

Note: \*1 The preventive function against malfunction due to exciting inrush current works when flowing exceeding 15% of the current rating for fundamental wave. (Locked if the content of second harmonics is approx. 15% or more.)  
However, for 50G, the preventive function against malfunction due to exciting inrush current does not work if 0s is set for operating time.

### ● Transducer output specifications (with converter output)

Since the output signal is internally processed based on 8-bit operations, the output is made in steps of about 0.4%.  
For transducer output signals 1 to 6 (six quantities), 15 different setups (14 settings for signal or lock) are possible.

Item		Specification	
Transducer output signal		4 to 20 mA (allowable load of 270Ω or less)	Allowable error
Signal type	Current (I <sub>A</sub> , I <sub>B</sub> , I <sub>C</sub> , I <sub>N</sub> )	4-20 mA for 0 to CT rating	±1.5%
	Line voltage (V <sub>AB</sub> , V <sub>BC</sub> , V <sub>CA</sub> ) *1	VT secondary (1) 4 to 20 mA for 0 to 150V (2) 4 to 20 mA for 0 to 150X√3 V	
	Phase voltage (V <sub>AN</sub> , V <sub>BN</sub> , V <sub>CN</sub> ) *1	VT secondary (1) 4 to 20 mA for 0 to 150√3 V (2) 4 to 20 mA for 0 to 150V	
	Active power (W)	4 to 20 mA (4 mA for reverse power flow) for 0 to 1kW (CT 5A, VT 110VAC conversion)	
	Reactive power (Var)	4 to 12 to 20 mA for -1kvar to 0 to 1kvar (CT5A, VT110VAC conversion)	
	Frequency (Hz)	4 to 20 mA for 45 to 55Hz or 55 to 65Hz	
	Power factor (PF)	Lead 0.5 to 1 to Lag 0.5/4 to 12 to 20 mA	±5%

Note: With the transducer output connector, the "-" side of the output signal is the common side. If the output signal becomes larger than the upper limit or smaller than the lower limit, the limiter is applied. The lower limit is fixed to 4 mA and the upper limit to 20 mA.

\*1 (1) Line voltage of 100/110/120V (2) Line voltage of (100/110/120V) x√3 V

### ● kWh pulse output specifications

Item	Specification
Output	Open-collector output
Output capacity	150VDC max. 100 mA
Pulse width	200±20ms
Output pulse unit	10 <sup>n</sup> kWh/pulse (n = -2 to 4 setup) or 2,000 pulses/kWh

● **Communication specifications**

• **Modbus mode**

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronization	
Connecting form	1 : N (N: UM5AC)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	8 (fixed)
	Parity bit	Odd, even, or none (selectable)
	Stop bit	1/2 (automatically selectable) 1/2: with or without parity
Transmission code	HEX value (Modbus RTU mode)	
Error detection	CRC-16	
Terminal symbol	D1(+): DXA, D0(-): DXB	

• **F-MPC-Net mode**

Item	Specifications	
Standard	EIA RS-485	
Communication method	2-wire type, half-duplex	
Synchronous method	Start-stop synchronous transmission	
Connecting form	1 : N (N: UM5AC itself)	
Transmission distance	1000m	
No. of connectable stations	Max. 32 (including one master unit)	
Station address	01 to 99	
Transmission speed	4800/9600/19200bps	
Data format	Start bit	1 (fixed)
	Data length	7/8 (selectable)
	Parity bit	None, odd, or even (selectable)
	Stop bit	1 (fixed)
Transmission code	ASCII code	
Error detection	Horizontal parity: even parity	
Terminal symbol	D1(+): DXA, D0(-): DXB	

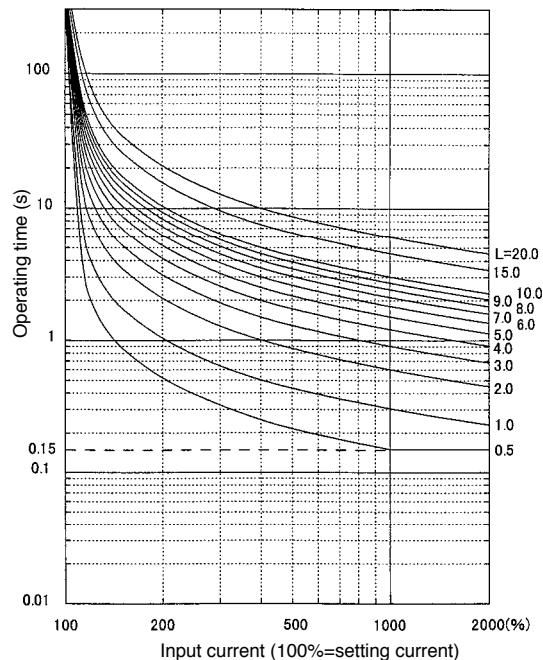
Note: • Use KPEV-SB (0.5mm<sup>2</sup>), CPEV-SB (0.9mm dia.) or equivalent communication cable. Connect the shielding wire to the SG terminal (No. 2 of terminal block A).  
 • Communication cable must not be branched. Connect terminating resistors at both ends of communication cable. If the UM5AC is located at the edge of communication line, short-circuit No. 3 and No. 5 of terminal block A. The UM5AC is equipped with a built-in terminating resistor of 100Ω.  
 • Use the communication cable such that its transmission distance becomes 1,000m or less.  
 Keep the wiring as far from high voltage equipment or power cables as possible.

# F-MPC60B series

## Power receiving unit

### ■ Time-current characteristics of 51G relay

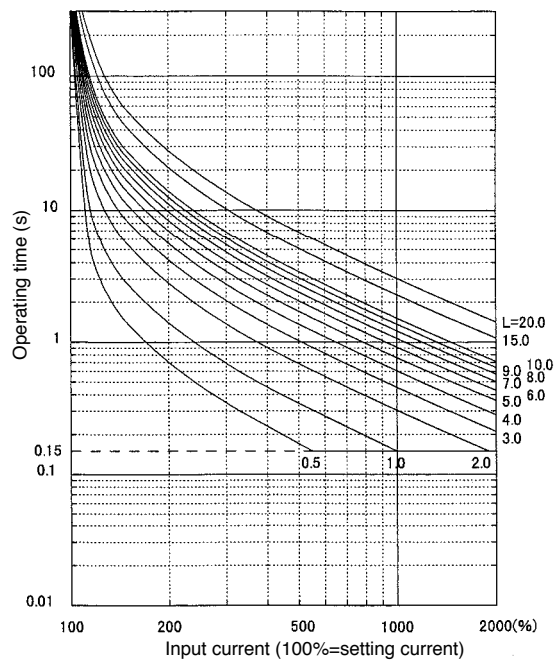
#### Inverse (SI) characteristics



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

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

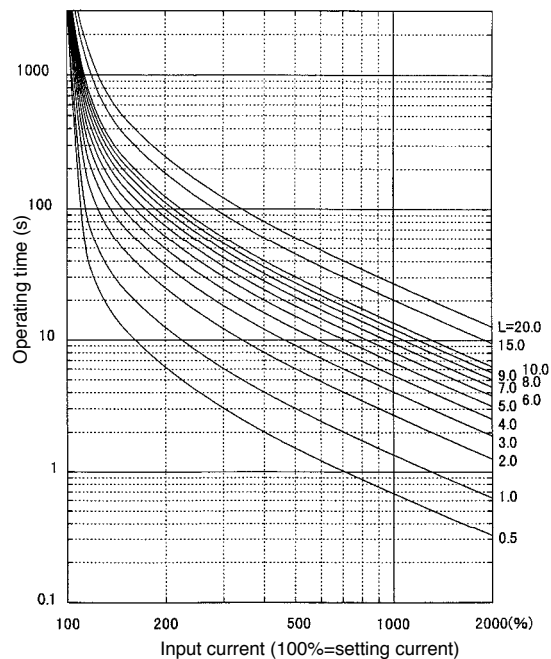
#### Inverse (VI) characteristics



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

$$t = \frac{13.5}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

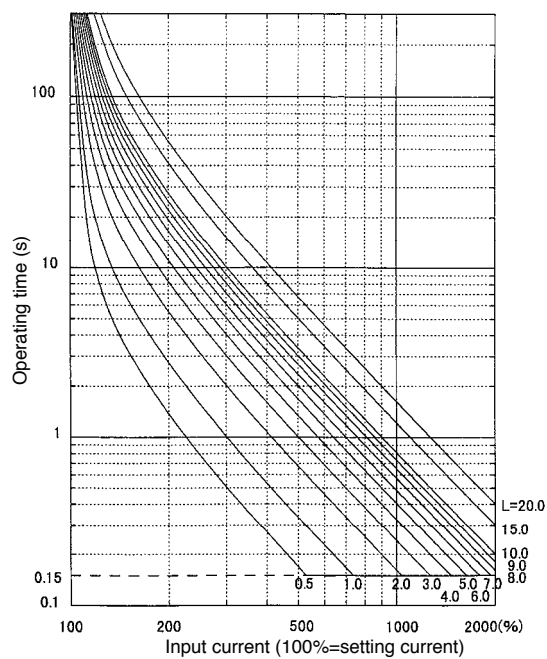
#### Inverse (LT) characteristics



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

$$t = \frac{120}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

#### Inverse (EI) characteristics

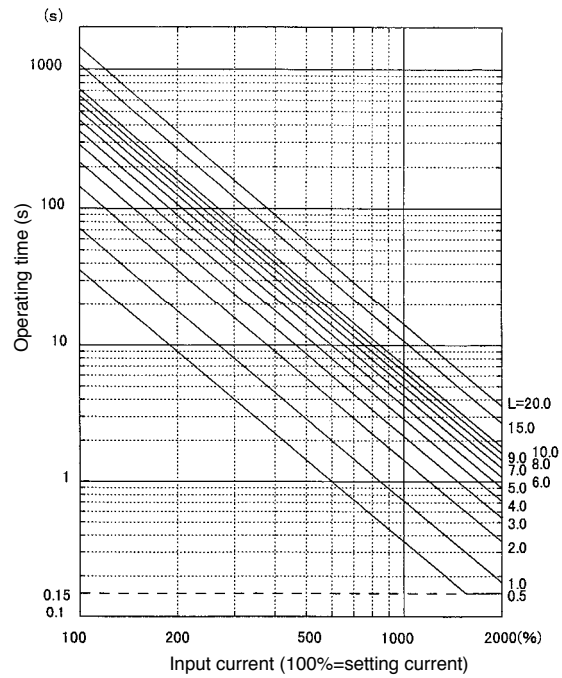


Note:  
Time setting (lever) is of 0.1 time steps (Lower limit: 0.5, upper limit: 20.0). Indication of a part of the lever is omitted in the characteristics indicated above.

$$t = \frac{80}{I - 1} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$



### OC relay characteristics



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

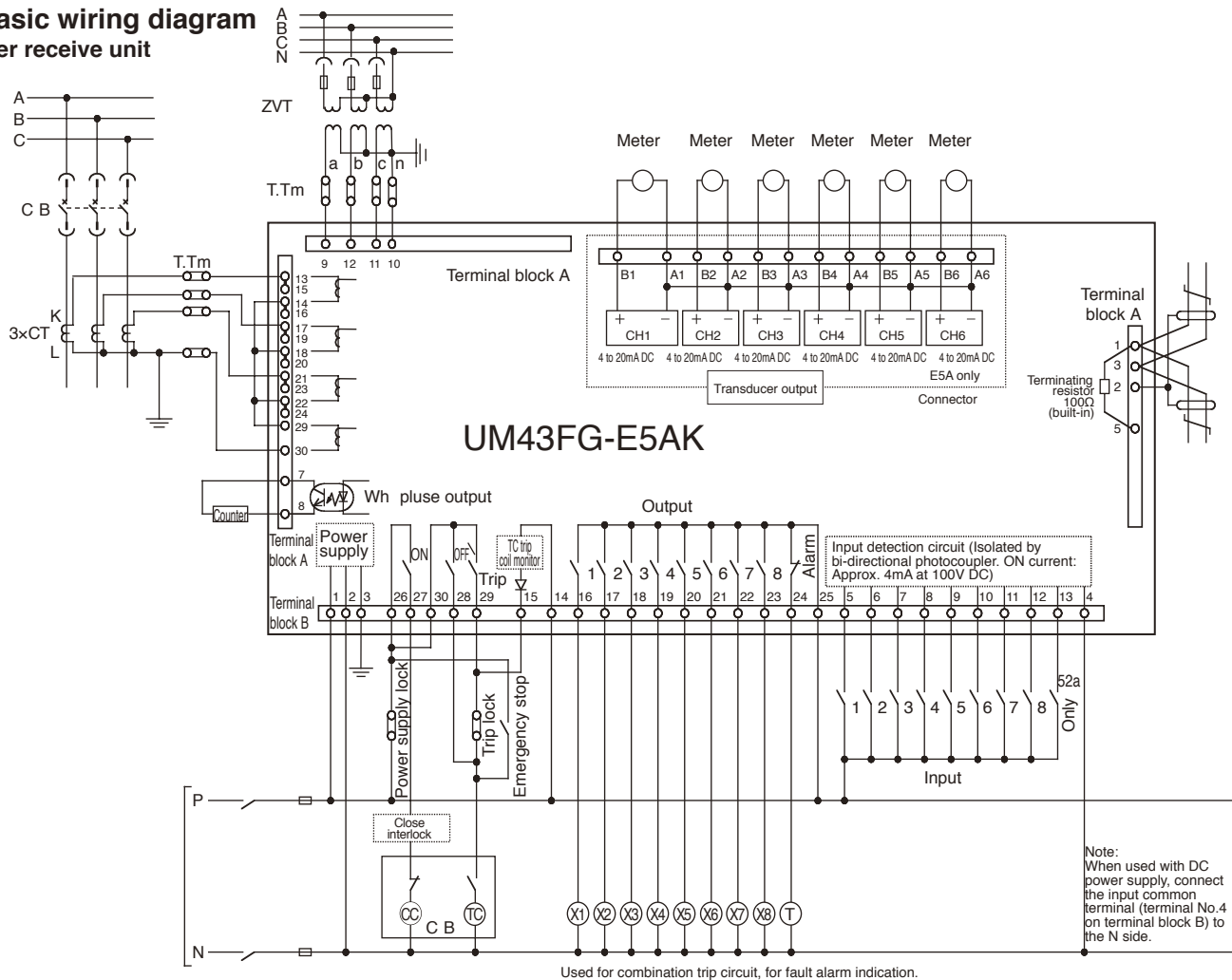
$$t = \frac{720}{I^2} \times \frac{L}{10} \quad (L: \text{Time setting lever})$$

# F-MPC60B series

## Power receiving unit

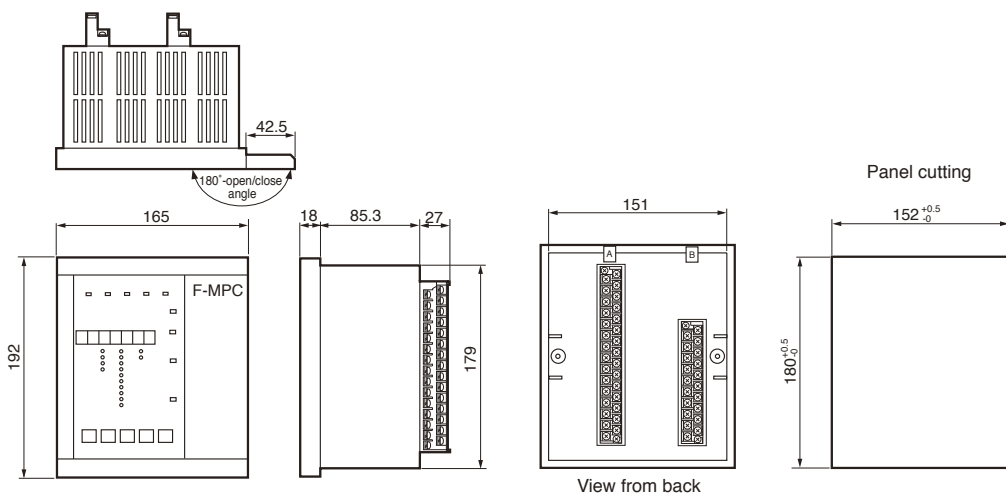
### Basic wiring diagram

#### Power receive unit



1. Input 1 to 3 and output 1 to 8 are used by selecting (assigning) functions according to their setting.
2. The "Trip" output and the "Device error" output are dedicated. The 52a (CB ON answerback) input and the "TC (trip coil) disconnection monitoring" input are dedicated.
3. The "Device error" output is an NC contact (The contact is normally energized. If an alarm occurs, it is deenergized and the contact closes.) Hence, there is a time delay of approx. 100ms until the contact opens after the power is turned on. Please consider using a timer when you configure an external sequence (if external devices may be held with one-shot signal).
4. When a heavy load greater than the capacity of the output contact is to be driven, be sure to use in combination with FUJI Power Relays.
5. If this unit is located at the edge of communication line when the communication functions (RS-485) are used, short-circuit No. 3 and No. 5 of terminal block A. (The UM45T is equipped with a built-in terminating resistor.) Otherwise, open between No. 3 and No. 5.
6. Use a twisted wire for the transducer output wire.

### Dimensions, mm



## AC power unit

### ■ Features

This unit is an AC/DC power supply unit, which is used together with a multifunctional digital relay powered by AC control power, and is capable of instantaneous power failure backup.

This unit incorporates the power supply for capacitor trip device as well.

- The usage of this unit concerning the 27 (UV) protective function is shown below.

27 (UV) protective function	AC power unit (UM2P-A1)	Remarks
27 operating time = 0s, or 27 is not used.	Unnecessary	Protection 50 (INST) & protection 27 operate.
27 operating time ≤ 1.0s	Necessary	Protection 27 operates.
27 operating time > 1.0s	Necessary External capacitor required.	See Note <sup>2</sup> of the table shown below.

- This unit incorporates the power supply for capacitor trip device (capacitance 1500μF) used for circuit breaker in addition to the one for F-MPC's control circuit.
- One multifunctional digital relay can be connected to this one AC power unit.



**UM2P-A1**

### ■ Specifications

Item	Specifications	
Type	UM2P-A1	
Input voltage	Rated voltage	100V AC
	Allowable voltage tolerance	85 to 125V AC
Output voltage	Control power for multifunctional digital relay	80 to 143V DC (at control power 85 to 125V AC)
	Power supply for capacitor trip device	80 to 175V DC (at input control power ON)
Output current	Control power for multifunctional digital relay: 0.15A (MPC60B control power capacity + Di input current) at 110V DC Power supply for capacitor trip device: C = 1500μF Only one AC power unit can be connected to one F-MPC60B/50.	
Power failure compensation time (Allowable instantaneous power failure duration)	Control power for multifunctional digital relay: 1s or more (Protective relay is operable for 1s after power failure occurrence) Power supply for capacitor trip device: Charging voltage 75V DC or more after 30s elapses upon power failure occurrence at 60V AC.	
Ambient temperature	-10 to +60°C (no icing or no condensation)	
Inrush current	15A or less, 4.5mA or less (100V AC 50Hz)	
Display	LED (Capacitor charging level indication of capacitor trip device)	
Insulation resistance	10MΩ or more (500V DC) between electric circuits and ground, and between electric circuits <sup>1</sup>	
Withstand voltage	2kV AC 1 minute between electric circuits and ground, and between electric circuits <sup>1</sup>	
Lightning impulse withstand voltage	1.2/50μs 4.5kV between electric circuits and ground	
Control power voltage	85 to 125V AC	

Note: <sup>1</sup> "Between electric circuits" means "between ① - ② connected together and ③ - ④ - ⑤ - ⑥ connected together."

<sup>2</sup> As the power failure compensation time is 1s, if UV (undervoltage) relay function is enabled and 1s or more of the operating time is set with a power receiving unit only, the UV relay cannot operate with this AC power unit only upon power failure occurrence.

If the UV relay operating time has to be set to 1s or more, use an external capacitor (not supplied, 200V DC or more of withstand voltage) to connect to the multifunctional digital relay's control output section of this unit, referring to the table below.

<sup>3</sup> For the input power to UM2P-A1, supply 100V AC from the CB primary side.

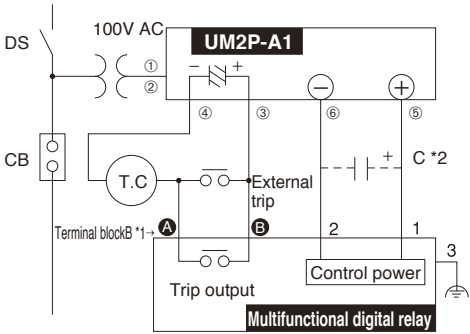
In case the power is supplied from the secondary side, the UM2P-A1 is in power failure state upon CB open so that F-MPC cannot indicate the fault state.

Protection 27 (UV) operating time	External capacitor capacitance	Example of capacitor
1.2 to 2.0s	1500μF	LNT2D152MSM, NICHICON CORPORATION-made
2.2 to 5.0s	6800μF	LNT2D682MSM, NICHICON CORPORATION-made
6.0s or more	1600 x t (μF)	t: Protection 27 operating time (setting value)

# F-MPC30/60B series

## Related products

### Overview of devices combined



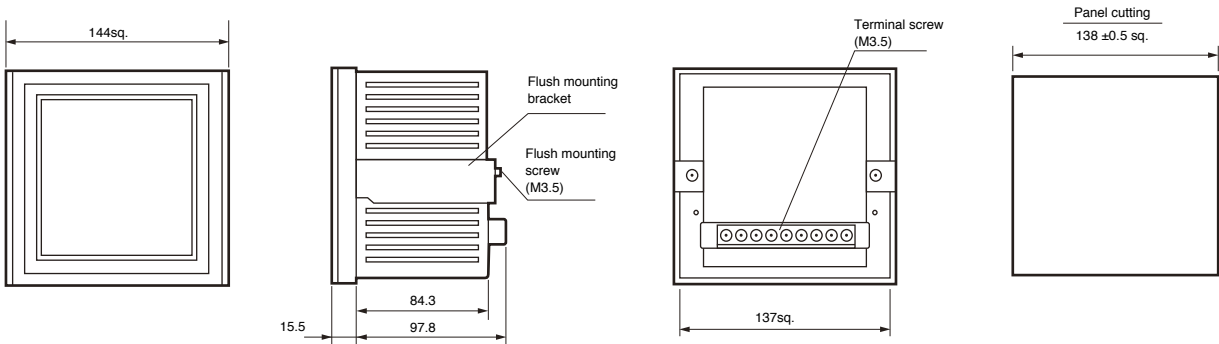
\*1 Correspondent terminal number

	F-MPC50	F-MPC60B
A	19	29
B	20	30

\*2 The power cut guarantee time of this power unit UM2P-A1 is 1 second. Therefore, the protection 27(Under Voltage)" cannot normally operate in power cut when it is set at exceeding 1 second in 27(Under Voltage) operation time.  
Connect when the operating time of 27(under voltage) is 1seconds or more. "condenser the withstand voltage is over 200VDC" to "the control output part of the multifunctional relay: F-MPC", referring to the fallowing table, Note that the condenser is not included in the accessories and should be prepared by customers.

Operating time of 27(UV)	Capacity	Example of condenser
1.2s to 2.0s	1500μF	LNT2D152MSM, NICHICON CORPORATION-made
2.2s to 5.0s	6800μF	LNT2D682MSM, NICHICON CORPORATION-made
6.0s or more	1600μF x t (μF)	t: operating time of 27(UV)

### Dimensions, mm



### Arrester for network circuit CN227-RS42

#### ■ Features

**Protects devices in network circuit from lightning surge.**

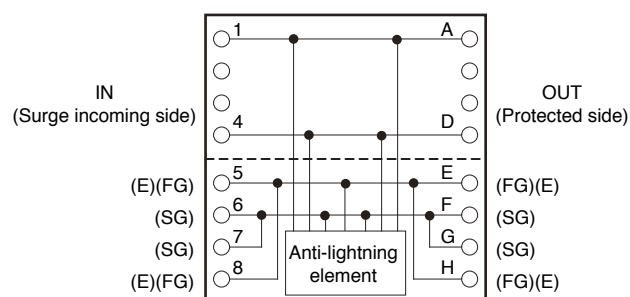
- Communications network RS-485 compliant
- High protective performance against lightning surge, designed best suited for your application
- CN227-RS42  
Slim in 22.5mm width, European terminal block.  
Two-wire system (RS42), minimized signal loss, high surge immunity (10kA 8/20μF), and long service life.



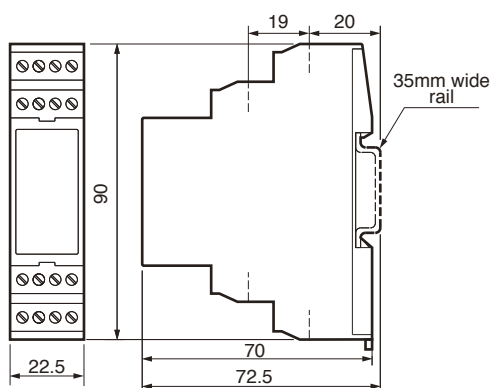
#### ■ Specifications

Type	CN227-RS42
Application	RS-485, T-Link (for PLC) 2-wire system
Rated voltage (Uc)	60V DC
Transmission frequency bandwidth	Up to 2MHz DC
Clamping voltage	Between lines 25V or less To ground 400V or less
Discharging capability (8/20μs)	10kA
Environmental condition	Ambient temperature: -10 to +60 °C Relative humidity: 90% or less (No condensation)
Interface	Screw terminal connection type Connectable wire size (Solid wire: 0.5 to 1.5mm dia., twisted wire: 0.5 to 2.5mm <sup>2</sup> )

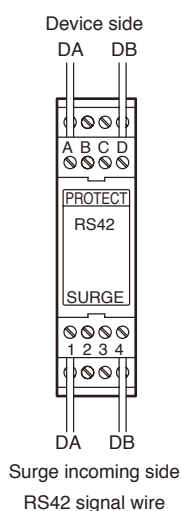
#### ■ Internal wiring diagram



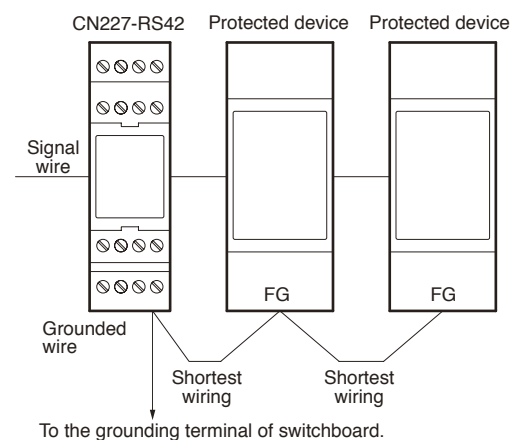
#### ■ Dimensions, mm



#### ■ External wiring



#### ■ Grounded wiring





# F-MPC04 series

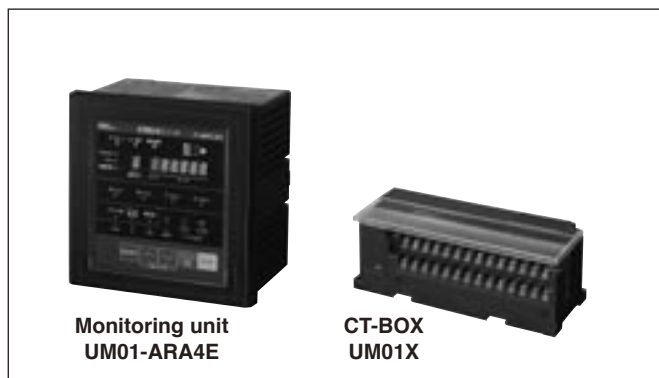
## Integrated power monitoring unit

### F-MPC04

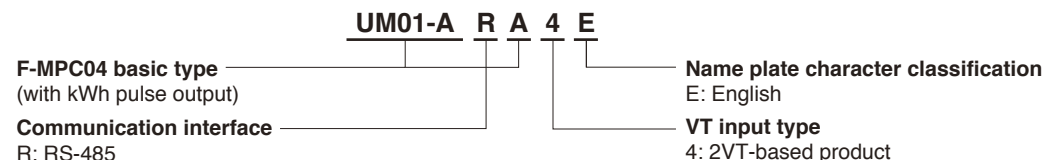
#### F-MPC04 Integrated power monitoring unit

##### ■ Features

- A single unit can be applied to multiple power distribution systems.  
Provided with communication interface as standard economically realizing management for each facility and instrument.
- Easy post-attachment to existing switchboards  
Split CTs are available for easy installation to existing switchboards.
- Realizes in-depth power management.  
Measurement, preventive maintenance, maintenance, electrical quality, and other circuit information can be managed and transmitted to host, contributing to energy saving and laborsaving.
- Also enables measurement of harmonic current.  
Can measure the 3rd, 5th, 7th orders, and total harmonic currents.
- Monitoring of insulation degradation and preventive maintenance through measurement of leakage current  
Degradation tendency diagnosis by trend data and preventive maintenance by 2-stage output of leakage pre-alarm/leakage relay are possible.



##### ■ Type numbers



##### ■ Models

Product name	Specification	Type
Integrated power monitoring unit (main unit)	Based on RS-485, 2VT	UM01-ARA4E
	Based on T link, 2VT	UM01-ATA4E
CT-BOX	For CT secondary current 5A	UM01X-5
	For CT secondary current 1A	UM01X-1
	For CT secondary current 7.34 mA	UM01X-0

Notes: \*1 Refer to the following tables for terminal relays, terminal boards with connector, and relay connector terminal boards.

\*2 Refer to the following tables for combinations of current sensors, CT-BOXes, and units.

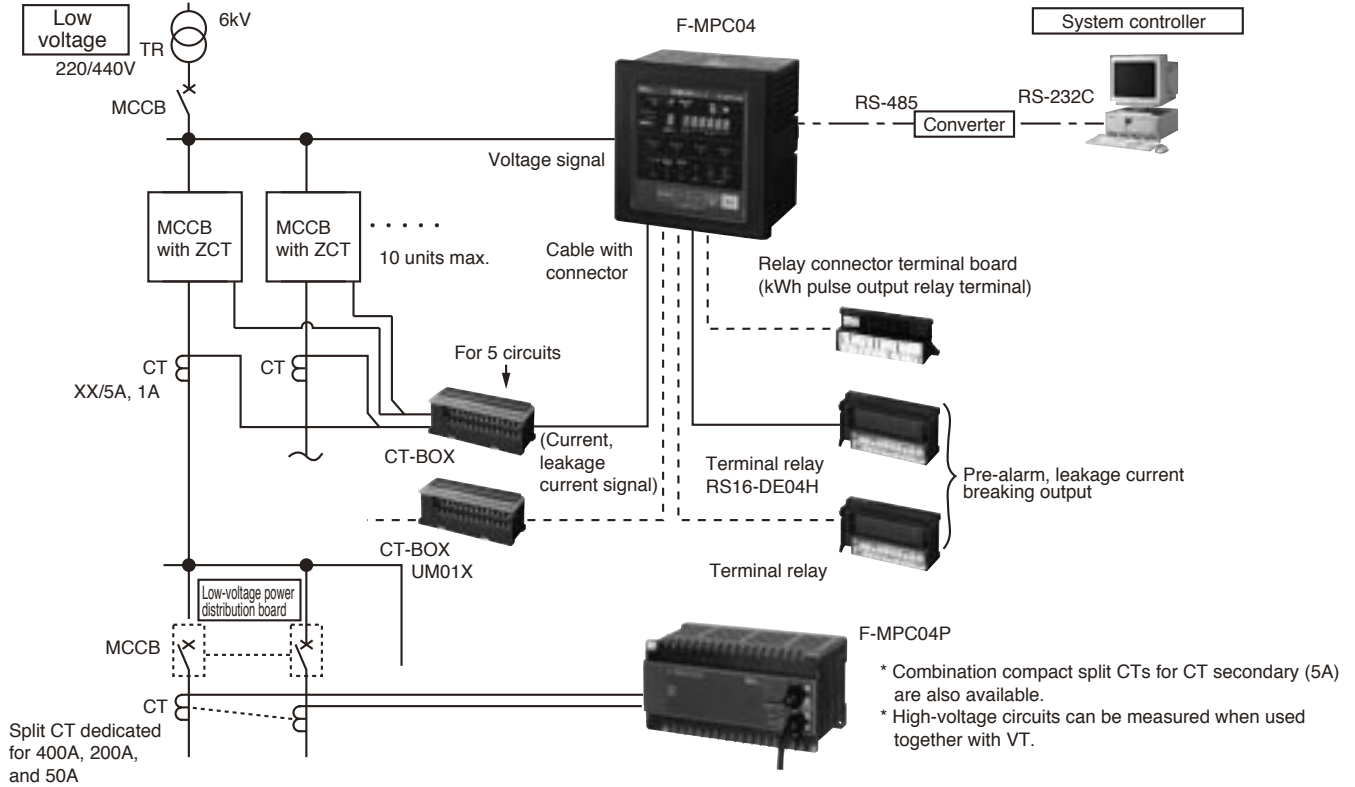
Product name	Specification	Type	Remarks
Terminal relay	For 5 circuits	RS16-DE04H	Refer to page 61.
Cable with connector	Length 1m/2m/3m	AUX014-20□	
Relay connector terminal board	kWh pulse output	AU-CW21B-04	Refer to page 62.

Applicable circuit	Number of measurement feeders
3-phase 3-wire	Up to 10 feeders
1-phase 2-wire	
1-phase 3-wire	
3-phase 4-wire	Up to 6 feeders

##### • Applicable CT

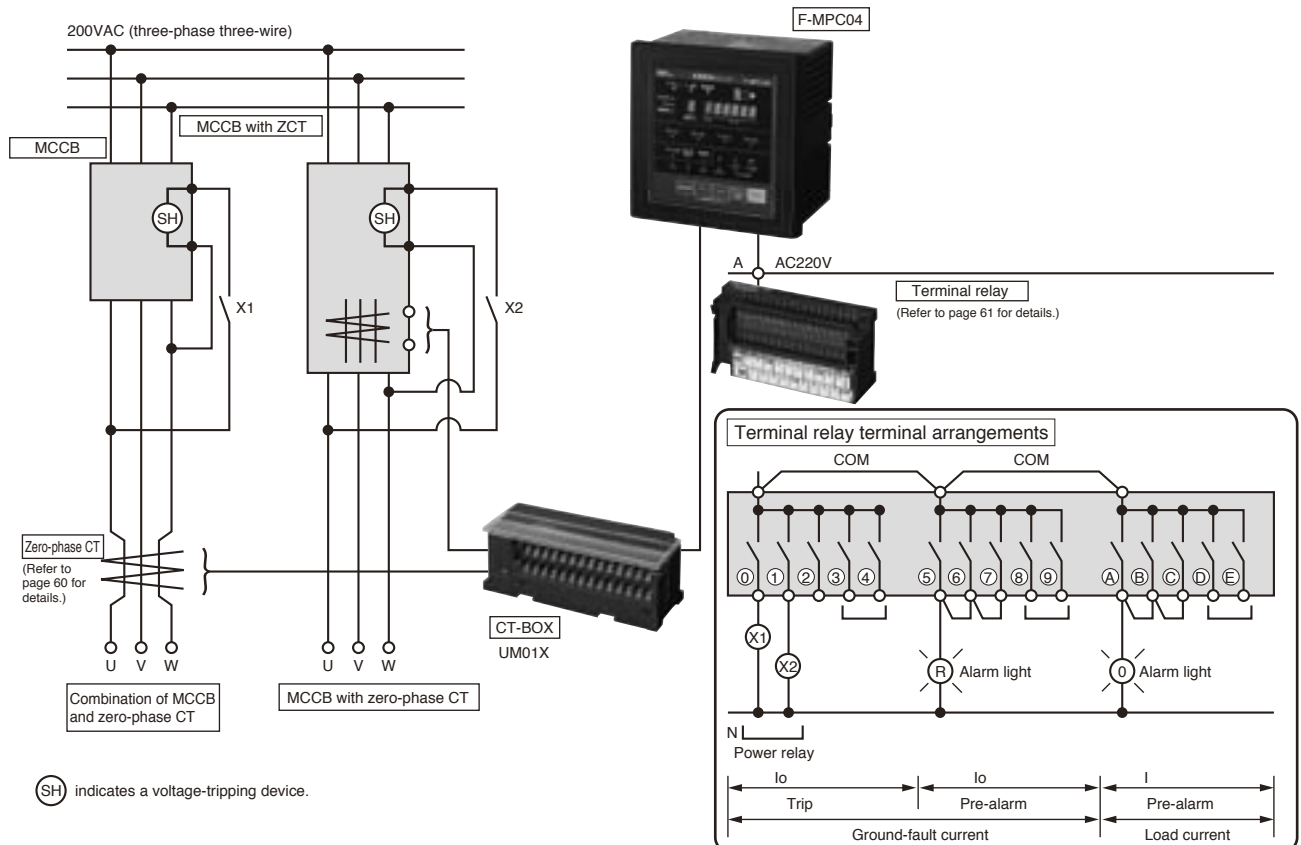
CT	CT secondary current	Applicable CT-BOX	Applicable integrated power monitoring unit
Split CT Type: CC2D81-0057	7.34 [mA]	UM01X-0	UM01-ARA4EH0 UM01-ATA4EH0
Split CT Type: CC2N□□□□□□ Type: CC2D□□□□□□	1 [A]	UM01X-1	UM01-ARA4E UM01-ATA4E
General-purpose CT XX/1A	1 [A]	UM01X-5	
General-purpose CT XX/5A	5 [A]		

## ■ System configuration



## ■ Example of combined application

With a combination of low-voltage power distribution systems, a system of leakage current measurement, leakage pre-alarm, and leakage current breaking can easily be constructed.



# F-MPC04 series

## Integrated power monitoring unit

### F-MPC04

#### ■ Specifications

##### • General specifications

Item	Specification
Rating	Rated frequency
	50 or 60Hz (Select at initial setup.)
	Rated voltage
	Applicable to both 110V and 220VAC, 110VAC for use with VT secondary
Zero-phase CT	Rated current
	Conforms to CT-BOX specifications (5A, 1A, 7.34 mA in CT secondary, power consumption: 0.1VA max., excluding power loss in external cable resistance)
Control power supply	EW type or MCCB output with ZCT (FUJI Electric model)
Inrush current	85 to 264VAC (with dedicated control power supply terminals)
	18A max., 3 ms max. (100VAC 50Hz) 36A max., 3 ms max. (200VAC 50Hz)
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 (without freezing or condensation)
Storage temperature	Storage: -20 to +70°C (without freezing or condensation)
Relative humidity	20 to 90%RH (without condensation)
Atmosphere	Free from corrosive gases and excessive dusts or particles
Alarm and shutdown outputs	Allowable continuous output current: 1A max.
	Make and break current: 250VAC 5A, 30VDC 5A max.
Insulation resistance	Terminal relay RS16-DE04H output
	10MΩ or more between collective circuit and ground 5MΩ or more between circuits, between contacts
Dielectric strength to commercial frequency	2000VAC for one minute between collective circuit and ground, excluding signal circuits
Dielectric strength to lightning impulse	4.5kV (1.2 x 50μs) between collective circuit and ground, excluding signal circuits
Instantaneous overload strength	20 times the rated current for 0.5s x 9 times, for 2s once
Shock resistance	JIS C 60068-2-27 Half sine wave 300m/s <sup>2</sup> x 3 times in each of X, Y, and Z directions
Noise immunity	1 to 1.5MHz damped vibration waveform with 2.5 to 3kV peak voltage (2s)
	1ns x 1μs 1.5kV square wave applied for 10 minutes
Vibration resistance	JIS C 60068-2-6 10 to 58Hz: single amplitude of 0.075mm, 58 to 150Hz: constant acceleration of 10 m/s <sup>2</sup> 8 minutes x 10 cycles in each of X, Y, and Z directions
Electrostatic noise resistance	Mounting steel panel surface (metal contact): ±8kV, front panel surface (non-metal non-contact): ±15kV
Allowable instantaneous power failure time	20ms (operation continued) excluding display
Mass	Main unit
	1,000g
	CT-BOX
	300g/unit
	Terminal relay
	200g/unit

Note : \*1 The above values apply to a combination of the integrated power monitoring unit with CT-BOXes and terminal relays.

##### • Measurement and display specifications

Measurement item	Effective measurement range	Main unit display	Communication data	Accuracy (%) *1	Remarks
Current	0, 1 to 150% of CT secondary rating	4 digits		±2.5% FS	Displays "0.00" for about 1.0% or less.
Voltage	20 to 264VAC at VT secondary *3			±2.5% FS	Dedicated power supply terminal is provided.
	3-phase 3-wire: 242V max.				
	3-phase 4-wire (phase voltage): 264V max. 3-phase 4-wire (line voltage): $\sqrt{3}$ x 264V				
Zero-phase current	0.50 to 1,200 mA			±20% FS	Displays "0" for 50 mA or less.
Active power	Transformer with secondary conversion 0 to ±2.0kw	Signed 4 digits		±2.5% FS	Dual power meter method, Measures (Ir, Ii, Vuv, Vvw) with 0.4% of rated current or more.
Reactive power	Transformer with secondary conversion 0 to ±2.0kvar			±2.5% FS	Dual power meter method
Power factor	Lead 0% to 100%, Lag 0%	Signed 3 digits □.□□	Signed 4 digits □.□□□	±5% (90° phase-angle conversion)	
Active power energy	Positive active electric energy 0 to 99,999 Negative active electric energy 0 to 99,999	5 digits	4 digits	JIS ordinary class or equivalent *4	
Reactive power energy	Positive reactive electric energy 0 to 9,999 Negative reactive electric energy 0 to 9,999	None	4 digits	JIS ordinary class or equivalent Note: No display on main unit	
Min voltage	85 to 264VAC at VT secondary of each phase	4 digits		±2.5% FS	
Max voltage	85 to 264VAC at VT secondary of max phase			±2.5% FS	
Harmonic current	3rd, 5th: 0, 1 to 150% of CT secondary rating 7th: 0, 1 to 150% of CT secondary rating Total: Total of 3rd, 5th and 7th			±2.5% FS (7th: ±5.0% FS)	Current: r phase, t phase 3rd, 5th, and 7th orders, and total

Notes: \*1 The measurement accuracy includes errors of CT-BOX and ZCT but does not include errors of combination VTs and CTs.

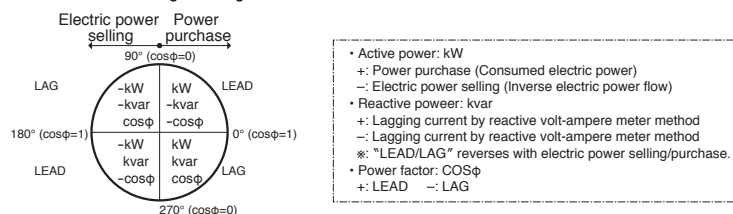
\*2 Current, voltage, and power performance characteristics conform to JIS C 1102 (indicating electrical instruments). Measurement indication values are moving average indication values of about 4s (for current) or about 1s (for voltage).

For the electric energy, sampling and integration is performed at intervals of about 0.7s. Since intermittence load, such as a welding machine, may not be measured, the single-circuit F-MPC04S (refer to page 54) is recommended.

\*3 The numerical values in the table indicate the line voltage of a three-phase three-wire circuit and the phase voltage of a three-phase four-wire circuit.

When a three-phase four-wire circuit is applied, select voltage display (phase voltage display or line voltage display) from the settings above.

\*4 The "±" sign is used for display of "power selling/purchase" in electrical measurement and display of "LEAD/LAG" in power factor measurement (a blank for positive values). The "±" sign has the following meaning for each measurement item.



• **Demand measurement**

Item	Specification
Current A (r, s, t), active power, zero-phase current I <sub>0</sub> , harmonic current, voltage	Time limit: Select setup (common to all circuits) from 0, 1, 5, 10, 15, and 30 minutes. Display item: 1) Demand value 2) Max demand value (past max value to reset operation) Display and measurement range: Based on the above measurement and display specifications.

• **Leakage relay specifications**

Sensitivity current		Operating time		
Setting	Operation value	Setting time	Inertia no operating time	Operating time
200/500/1,000 mA or Lock	50 to 100% of setup value (No operation for less than 50%, operation for 100%)	0.1s	—	100 ms or less
		0.3s	100 ms or more	0.3s or less
		0.5s	300 ms or more	0.5s or less
		1.0s	500 ms or more	1.0s or less

Notes : \*1 Any combination of sensitivity current and operating time can be set.

\*2 The numerical values in the table are operation specifications of trip relay. The pre-alarm relay operates with half values of the above operation values and the operating time is fixed to 10 seconds. The pre-alarm relay can be used as an alarm for increased leakage current caused by degraded cable insulation, soaking, etc.

• **Accident value display**

Load current pre-alarm value, pre-alarm current value of leakage relay (automatic return), and max current value display at breaking (display returned by reset operation)

• **kWh pulse output specifications**

- Transistor open-collector output 35VDC max., 50 mA (residual voltage when ON is 2.5V or less)
- Pulse width: 200±20ms
- Output pulse unit: 10<sup>n</sup>kWh/pulse, n is -2 to 3 (selected depending on the CT and VT ratios)

• **Leakage relay combination ZCT**

- Used together with the wiring breaker with ZCT and zero-phase CT (refer to page 60).

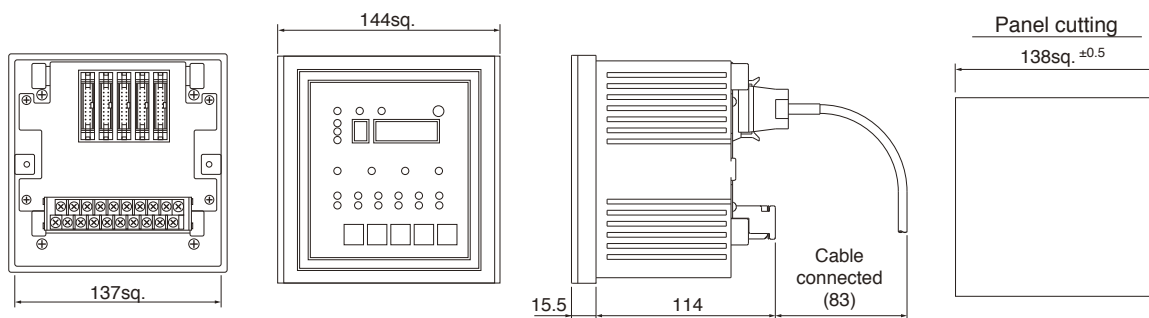
• **Communication specifications**

Item	RS-485 *1
Standard	EIA RS-485
Data exchange	1:N (this unit) polling/selecting
Transmission distance	1,000m
Number of connected stations	Up to 32 (including master station)
Address setup	01 to 99/Lock (Lock at the time of shipment)
Transmission speed	4,800/9,600/19,200 bps (19,200 bps at the time of shipment)
Data format	Start bit
	Data length
	Parity bit
	Stop bit

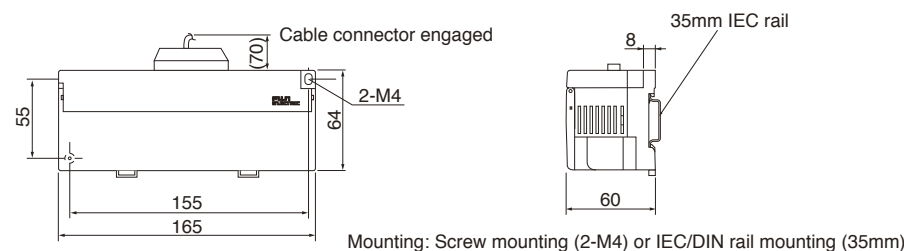
Note : \*1 Refer to "RS-485 Communication Application Manual (FH867)" for details on RS-485 communication protocols.

■ **Dimensions, mm**

• **Integrated power monitoring unit**



• **CT-BOX**



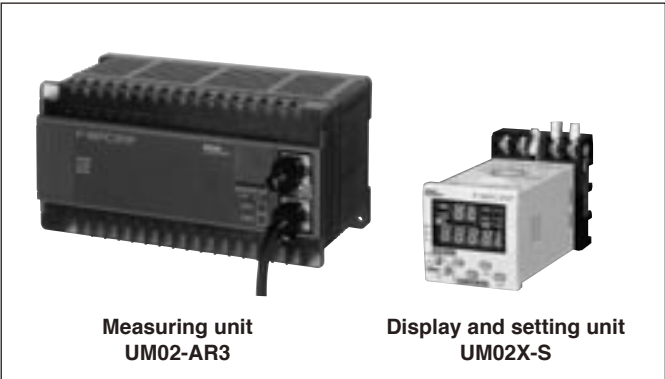
\* Terminal relay: See page 61.

F-MPC04 series  
Multi-circuit power monitoring unit  
F-MPC04P

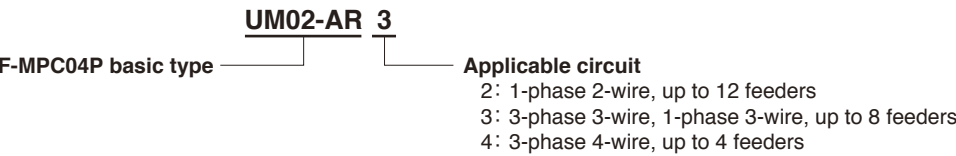
F-MPC04P Multi-circuit power monitoring unit

■ Features

- Enables measurement of multiple circuits with a single unit.  
Can measure up to 12 feeders (single-phase two-wire type), 8 feeders (three-phase three-wire type), and 4 feeders (three-phase four-wire type).  
(Power distribution systems connected to one common power rail are under measurement.)
- Easy to be applied to existing switchboards.  
Space-saving structure with easy installation to power distribution board or lighting board allows the use as an on-site measuring instrument for a power monitoring system regardless of new or existing boards, enabling economical system construction.
- Can be used as an on-site indicating instrument.  
When used together with optional display and setting units, the unit can be used as an on-site indicating instrument.
- Networking capability  
The unit is provided with RS-485, an external interface, as standard, making it possible to use the same communication line as other F-MPC Series units.



■ Type numbers



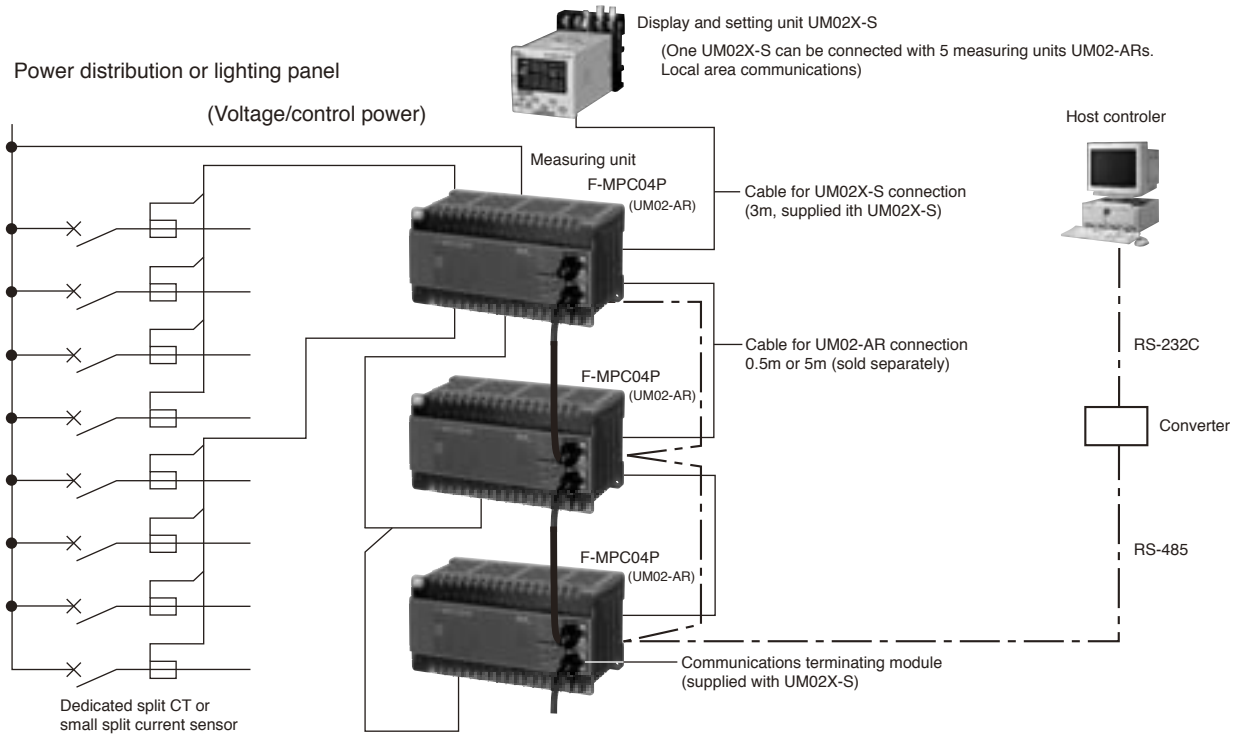
■ Models

Product name	Specification	Type
Multi-circuit power monitoring 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
Display and setting unit	-	UM02X-S
Option cable	0.5m	UM02X-C005
	5m	UM02X-C050

Note: \*1 As CTs, use dedicated type numbers CC2D81-0057, CC2D81-0506, CC2D65-2008, CC2D54-4009, CC2B65-2008, and CC2B54-4009.  
Refer to page 58 for details.  
General-purpose CTs (secondary rated current 5A or 1A) cannot be connected directly.  
Use general-purpose CTs (secondary rated current 5A) together with type number CC2D81-0057. (Penetrate the secondary output line of general-purpose CT to type number CC2D81-0057, and connect the secondary output of type number CC2D81-0057 with F-MPC04P.)



## ■ 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 them.

# F-MPC04 series

## Multi-circuit power monitoring unit

### F-MPC04P

#### ■ Specifications

##### • General specifications

Item	Specification
Control power supply	100/200VAC common use (85 to 264VAC) AR2: between terminals P1 and N, AR3: between terminals U and V AR4: between terminals P1 and P2
Inrush current	15A, 3 ms or less (100VAC 50Hz) 30A or less, 3 ms or less (200VAC 50Hz)
Load to control power supply	20VA or less (Make selection with about 15VA for 200VAC or about 10VA for 100VAC.)
Rated input	Voltage input (VT ratio) Direct input: 100V, 200V, 400VAC (AR4 only) VT primary/secondary: 220, 440, 3.3k, 6.6k/110, 440, 220VAC <sup>*1</sup>
	Current input (CT ratio) Split CT: 5AAC, 50AAC, 200AAC, 400A (primary rating setup 10 to 7,500A) <sup>*1</sup>
Ambient temperature	-10 to +55°C (without condensation or freezing)
Storage temperature	-20 to +70°C (without condensation or freezing)
Relative humidity	20 to 90%RH (without condensation)
Atmosphere	No corrosive gases
Insulation resistance	10MΩ or more between collective circuit and ground
Dielectric strength to commercial frequency	2000VAC (2,500VAC for AR4) for one minute between control power supply (collective) and ground
Dielectric strength to lightning impulse	4.5kV (1.2 x 50μs) (6.0kV for AR4) between control power supply (collective) and ground
Instantaneous overload strength	Current circuit: 20 times the rated current for 0.5s x 9 times
Vibration resistance	JIS C 60068-2-6 10 to 58Hz: single amplitude of 0.075mm, 58 to 150Hz: constant acceleration of 10 m/s <sup>2</sup> 8 minutes x 10 cycles in each of X, Y, and Z directions
Allowable instantaneous power failure time	20ms (operation continued) excluding RS-485 communication
Shock resistance	JIS C 60068-2-27 Half sine wave 300m/s <sup>2</sup> for 11 ms x 3 times in each of X, Y, and Z directions
Noise immunity	1ns x 1μs 1.5kV square wave applied for 10 minutes
Mass	Power measurement unit: Approx. 500g
	Display and setting unit: Approx. 200g

Note: <sup>\*1</sup> Make VT and CT ratio settings from the display and setting unit or host controller.

##### • Measurement specifications

Measurement item	Effective measurement range	Display and setting unit	Communication data	Accuracy ( <sup>*1</sup> )
Current (AR4 measures N-phase current also.)	When split type (200AAC, 400A) is used together: 0, In 0.4% to 500A When split type (50AAC) is used together: 0, In 0.4% to 50A When split type (5A) is used together: 0 to CT rating x n Refer to ( <sup>*4</sup> ) for characteristics when split type (5A) is used together.	4 digits	4 digits	±1.5%FS
Active power		Signed □ □ □ □	Signed □ □ □ □	±5% (90°C phase-angle conversion)
Reactive power <sup>*2</sup>				
Power factor		5 digits	4 digits	JIS ordinary class or equivalent ±2.5% when 5A split CT is used.
Active electric energy <sup>*2</sup>				
Max active power <sup>*3</sup>	Same as above (0, 1, 5, 10, 15, or 30-minute demand time can be set)	4 digits	4 digits	±1.5% FS
Voltage	In the case of AR2 (single-phase two-wire) and AR3 (three-phase three-wire) Voltage display 85 to 264V (Direct and VT secondary voltage conversion) Min and max voltage values are calculated from average for about 0.3 s. In the case of AR4 (three-phase four-wire) Phase-voltage display 50 to 288V (Direct and VT secondary voltage conversion) Line voltage display 86 to 498V Min and max voltage values are calculated from average for about 0.3 s.	None	4 digits	
Min voltage value for each phase <sup>*2</sup>				
Max phase-voltage value <sup>*2</sup>				

Notes: <sup>\*1</sup> The measurement accuracy does not include errors of combination CTs.

<sup>\*2</sup> The display of measurement specifications indicates the number of digits of the display setting unit and RS-485 communication data. The reactive power, min voltage value, and max voltage value are set only as communication data, and therefore they cannot be displayed on the display and setting unit.

<sup>\*3</sup> Max active power and active electric energy can be initialized from the display and setting unit or host controller. When the VT ratio or CT ratio are changed, they are initialized automatically.

<sup>\*4</sup> With type number CC2D81-0057, the lower limit of minute current measurement is selected through selection of 1-turn or 3-turn setup. The overview is shown below.

Classification	Measurement/display range	Measurement lower limit (Electric energy starting current)	Accuracy	
			Current and power	Electric energy
1 turn	0, 2% to rating x 10	2.0% of rating	• 0 to rating: ±1.5% rating	±2.5%
3 turns	0, 0.7% to rating	0.7% of rating	• More than rating: ±1.5% FS	(5 to 100% of rating, load power factor -0.8 to +0.8)

Note: Sampling interval/measurement display value (communication) of current and power, and sampling and integration intervals of electric energy are shown below. In the case of an intermittent load, such as a welding machine, accurate measurement may be disturbed and therefore the use of the single-circuit F-MPC04S (refer to page 51) is recommended.

Type	Sampling interval/measurement display value (communication) of current and power	Sampling and integration intervals of electric energy
UM02-AR2	Moving average of about 0.2s/about 1.5s	About 0.2s
UM02-AR3	Moving average of about 0.2s/about 1.5s	About 0.2s
UM02-AR4	Moving average of about 0.1s/about 0.4s	About 0.1s

# F-MPC04 series

## Multi-circuit power monitoring unit

### F-MPC04P

#### • Display and setting unit specifications

Item	Specification	Remarks
Control power	No dedicated power supply required	Supplied from the power measurement unit.
Power measurement unit communication specifications	EIA RS-485 (19,200bps fixed)	
Number of connectable power measurement units	Five max.	UM02-AR2, AR3, AR4
Connection cable length between units Display item	23m or less • Operation status display, measurement value, VT/CT setup value, failure	(Total length between display and setting unit and all measurement units) Display selection with operation switch
Setup	Voltage/current (CT)/demand time/pulse multiplying factor/number of turns of CT secondary/host controller communicate mode (separate communication interface)	The measurement unit is provided with a separate RS-485 interface as a host controller interface.

Note: \*1 The display and setting unit is provided with the measurement unit automatic recognition function to perform initial communication for measurement unit check when the power is turned on.  
If on-site display is not necessary after making setup to the measurement unit, there is no problem on measurement unit operation even if the display and setting unit is not used together.

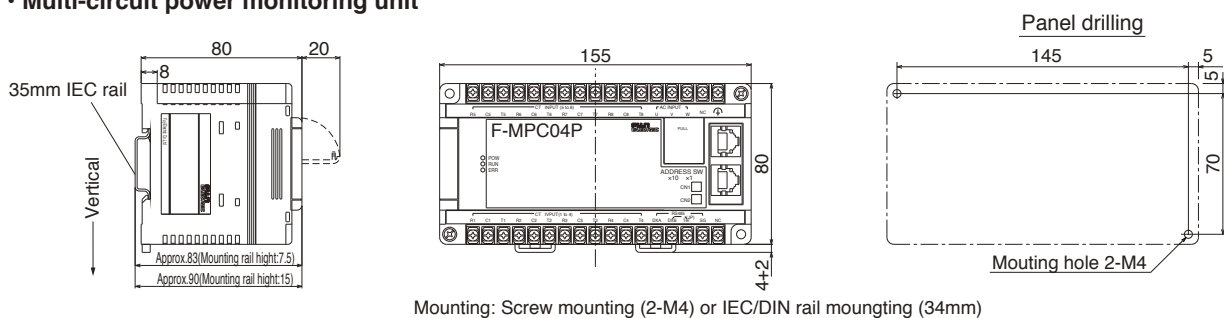
#### • Communicaton specifications

Item	Specification	
Standard	EIA RS-485	
Transmission mode	Half duplex (2 wires)	
Data exchange system	1: N (this unit) polling/selecting	
Transmission distance	1,000 m (total length)	
Number of connectable units	31 units max./line	
Address (station) setup	01 to 99 (set with digital switch)/Lock (Lock at the time of shipment)	
Transmission characters	ASCII code	
Transmission speed	4,800/9,600/19,200bps (selection) (19,200bps at the time of shipment)	
Data format	Start bit	1 bit (fixed)
	Data length	7/8 bits (selection) (7 bits at the time of shipment)
	Parity bit	None/even/odd (selection) (Odd at the time of shipment)
	Stop bit	1 bit (fixed)
	BCC	Even horizontal parity

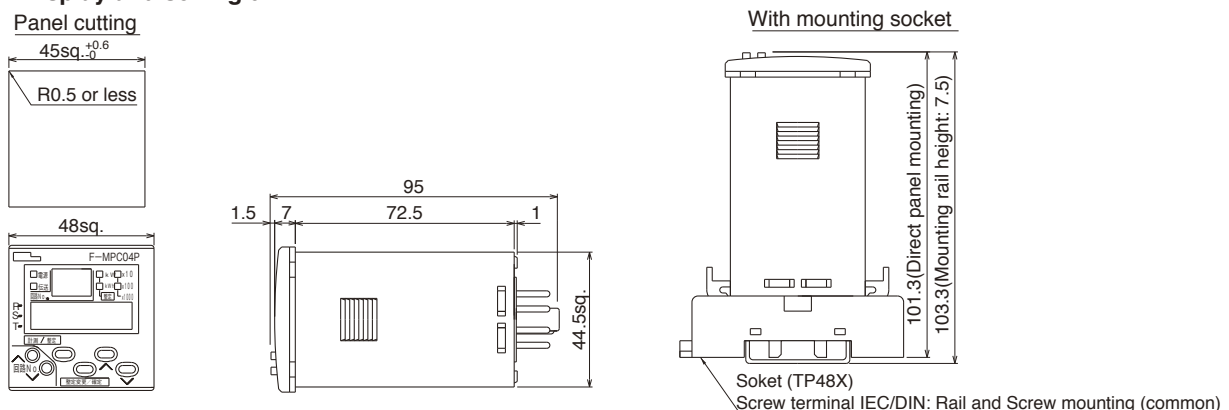
Note: \*1 Set (change) the transmission rate using the display and setting unit. Communication specifications cannot be changed from the host controller.  
Unless otherwise specified, the use of the above-mentioned default values (values at the time of shipment) is recommended.  
Refer to "RS-485 Communication Application Manual (FH867)" for details on RS-485 communication protocols.

#### ■ Dimensions, mm

##### • Multi-circuit power monitoring unit



##### • Display and setting unit



F-MPC04 series  
Single-circuit power monitoring unit  
F-MPC04S

F-MPC04S Single-circuit power monitoring unit

■ Features

- Diverse output functions which best suit preventive maintenance can be selected.  
Power alarm/current pre-alarm output, electric energy pulse signal.  
Leakage alarm and leakage pre-alarm output (only for types with leakage current measuring function)
- Can measure inrush current (rms value) of a welding machine, etc.  
Samples all voltage and current cycles at high speeds and performs calculation.
- Compact design allows the unit to be installed almost anywhere.  
Space-saving structure allows easy installation.  
Suitable for monitoring on a facility, section, and floor basis.
- Networking capability  
The unit is provided with RS-485, an external interface, as standard.  
Constant monitoring of insulation degradation through leakage current measurement (only for types with leakage current measuring function).  
Can measure leakage current ( $I_{ob}$  rms value) containing only commercial frequency components in addition to leakage current ( $I_o$  rms value) containing harmonics.  
Can check mixing of harmonics and make measurement and alarm output without being affected by harmonics.

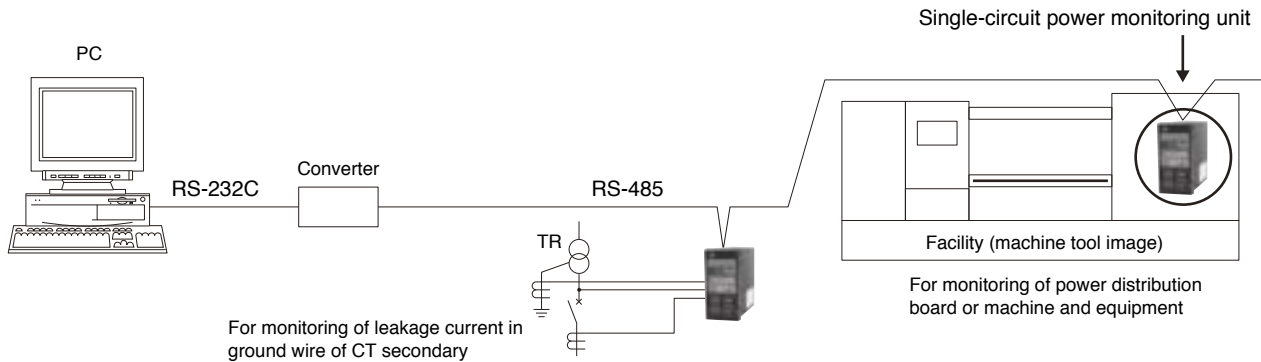


■ Models

Product name	Specification	Type
Single-circuit monitoring unit	Without leakage current measurement function	UM03-ARA3
	With leakage current measurement function	UM03-ARA3G

Note: \*1 As CTs, use type numbers CC2D81-0057, CC2D81-0506, CC2D65-2008, CC2D54-4009, CC2B65-2008, and CC2B54-4009. Refer to page 58.  
General-purpose CTs (secondary rated current 5A or 1A) cannot be connected directly.  
Use the general-purpose CT (5A) together with type number CC2D81-0057.  
Use dedicated ZCT as combination ZCT with the UM03-ARA3.

■ System configuration



## ■ Rated input

Voltage input (VT ratio)	Direct input 100VAC/200VAC Use VT when input exceeds 264V.
	Any combination of VT primary and VT secondary, selected through setup. Primary: 210, 220, 380, 440, 460, 3.3k, 4.16k, 6.6k, 11k, 13.8k, 15k, 22k, 33kVAC Secondary: 100, 110, 120VAC
Current input (CT ratio)	Combination of general-purpose CT (xxx/5A) and compact split CT (CC2D81-0057) * <sup>1</sup> CT primary rated current is selected from 10A to 7500A through setup.
	Combination with dedicated CT is selected from 5A, 50A, 200A, 400AAC through setup.
Leakage current input	Select (1) EW type ZCT or (2) MCCB with ZCT.

Note: \*<sup>1</sup> The measurement accuracy does not include errors of CT or ZCT.

## ■ Specifications

### ● General specifications

Item	Specification
Number of measurement circuits	1 circuit 3-phase 3-wire: 2CT, 1-phase 3-wire: 2CT, 1-phase 2-wire: 1CT
Control power supply	100 to 200VAC (85 to 264VAC) 50/60Hz (45 to 66Hz)
Inrush current	15A or less, 3 ms or less (110VAC 50Hz) 30A or less, 3 ms or less (220VAC 50Hz)
Power consumption	Approx. 7VA (220VAC:00), approx. 5VA (110VAC)
VT consumption load	Approx. 0.2VA
Continuous overload strength	Current input circuit
	1.1 times the maximum scale (1.5 times the rated current) for 2 hours
Short-time overload strength	Voltage input circuit
	291VAC (264VAC x 1.1) 2 hours
Short-time overload strength	Current input circuit
	20 times the maximum scale (1.5 times the rated current) for 0.5s x 9 times
Short-time overload strength	Voltage input circuit
	Twice the maximum scale (264VAC) for 0.5s x 9 times
Vibration resistance	10 to 58Hz: Single amplitude of 0.075mm 58 to 150Hz: constant acceleration of 10 m/s <sup>2</sup> , 8 minute x 10 cycles in each of X, Y, and Z directions
Shock resistance	Sine wave 300 m/s <sup>2</sup> twice in each of the X, Y, and Z directions
Dielectric strength/insulation resistance (500VDC megger)	2kV/10MΩ or more between control power supply terminal (collective) (terminal Nos. 8 and 9) and other terminal (collective)
	2kV/10MΩ or more between measurement input terminal (collective) (terminal Nos. 5 to 7) and other terminal (collective)
	2kV/10MΩ or more between alarm output terminal (collective) (terminal Nos. 1 to 4) and other terminal (collective)
	500V/10MΩ or more between power pulse output terminal (collective) (terminal Nos. 11 and 12) and other terminal (collective)
Ambient temperature	-10 to +55°C
Storage temperature	-20 to +70°C
Relative humidity	20 to 90%RH (without condensation)
Atmosphere	No corrosive gases, no excessive dust
Grounding	Type D ground (100Ω or less)
Allowable instantaneous power failure time	20ms (operation continued)
Altitude	2,000 m or lower
Mass	Approx. 400g (main unit only, CT not included)

### ● Measurement specifications

Measurement item	Effective measurement range	Display	Accuracy * <sup>1</sup>
Current (R/S/T display)	When combination CT (200VAC) is used together: 0, In 0.4% (0.8A) to 300A	4 digits	±1.5% FS
Demand current	When combination CT (400VAC) is used together: 0, In 0.4% (1.6A) to 600A	4 digits	However, S-phase current ±2.5%FS
Max demand value	When combination CT (5A) is used together:	4 digits	±2.5% FS
Demand value of total harmonic current	(1) 0, In 0.4% (0.2A) to 50A	4 digits	±1.5% FS
Max demand value * <sup>2</sup>	(2) 0 to CT rating x 1.5 (CT secondary conversion 7.5A) (Max display range to -9,999A)	4 digits	±1.5% FS
Active power (± display)		4 digits	±3% FS
Demand power		3 digits	±5% (90°C phase-angle conversion)
Max demand value		5 digits	JIS ordinary class or equivalent (power factor 0.5 to 1.0 to -0.5)
Reactive power (±)		5 digits	±5%
Power factor (±)	The demand time is 0, 1 to 15 min (in 1-min steps), 30 min can be set.)	5 digits	
Active electric energy (positive power only)		4 digits	±1.5% FS, ±2.5% FS for Vv-w voltage
Reactive electric energy (± absolute value added)		3 digits	±0.5% FS
Voltage	Input voltage conversion 60 to 264VAC	4 digits	
Frequency * <sup>3</sup>	45 to 66Hz	3 digits	
Leakage current (I <sub>o</sub> /I <sub>05</sub> ) max demand value * <sup>4</sup>	0, 10 to 1,000mA	4 digits	±2.5% FS

Note: \*<sup>1</sup> The measurement accuracy is a value for FS (full span).

\*<sup>2</sup> The total harmonic current relates only to phase R and phase T. Only the demand value and max demand value are displayed. The current value is not displayed.

\*<sup>3</sup> If the frequency is out of the measurement range (lower than 45 Hz or higher than 66 Hz), 0.0 [Hz] is displayed.

\*<sup>4</sup> Measurement of leakage current is possible only with UM03-ARA3G.



# F-MPC04 series

## Single-circuit power monitoring unit

### F-MPC04S

#### ● Output specifications

Item	UM03-ARA3	UM03-ARA3G	Specification
Power (Wh) pulse output	○	○	Transistor open-collector output 35VDC 100 mA
Alarm output	Current pre-alarm (OCA) * <sup>1</sup>	○	Relay output 250VAC 1A (continuous allowable current)
	Power alarm * <sup>1</sup>	○	
	Leakage pre-alarm (OCGA)	None	
	Leakage alarm (OCG)	None	

Note: \*<sup>1</sup> Select either the current pre-alarm output or the power alarm output through setup.

#### (1) Power pulse output

Item	Specification
Output specification	35VDC 100 mA (Residual voltage when ON 2.5V or less)
Output pulse width	100ms±20ms
Output interval	200 ms or more
Pulse multiplying factor	10 <sup>n</sup> kWh/pulse (n = -3 to 2 setup)

#### (2) Alarm output

Item	Setup range		Accuracy	
	Operation value	Time	Operation value	Time
Current pre-alarm (OCA) * <sup>1</sup>	I: 20 to 120% of rated value Lock (in 5% steps)	Depends on the demand time setting.	±5% (However, rated min±1.5%)	±10%
Power alarm * <sup>1</sup>	0 to 9,999kWh (in 1-kWh steps)			
Leakage alarm (OCG) (I <sub>o</sub> operation)	Operation current 100, 200, 500mA, Lock	0.1, 0.3, 0.5, 1.0s	75% of setup value ±5%	75% of setup value ±5% (min ±25ms)
Leakage pre-alarm (OCGA)	50±5mA 100 to 500 mA (in 50mA steps), Lock	0.1, 0.3, 0.5, 1.0, 10s or demand time * <sup>2</sup>	±5% unless left is described	±5%

Note: \*<sup>1</sup> Select either the current pre-alarm output or the power alarm output through setup.

\*<sup>2</sup> When demand time is selected, the unit operates on I<sub>o</sub> (leakage current only with fundamental wave).

#### ● Communication specifications

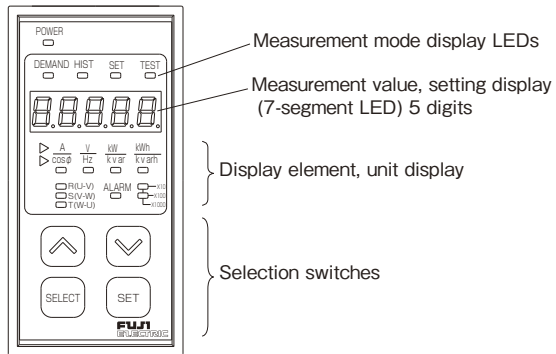
Item	Specification		Setting at the time of shipment
Standard	EIA RS-485		—
Transmission mode	Half duplex (2-wire)		—
Data exchange system	1: N (this unit) polling/selecting		—
Transmission distance	1,000m (total length)		—
No. of connectable units	31 max./line		—
Address (station No.)	1 to 99 (setup)		Without station number setup
Transmission characters	ASCII code		—
Transmission speed	4,800/9,600/19,200bps (selection)		19,200bps
Data format	Start bit	1 bit (fixed)	—
	Data length	7/8 bits (selection)	7bit
	Parity bit	None/even/odd (selection)	Odd
	Stop bit	1 bit (fixed)	—
	BCC	Even horizontal parity	—

# F-MPC04 series

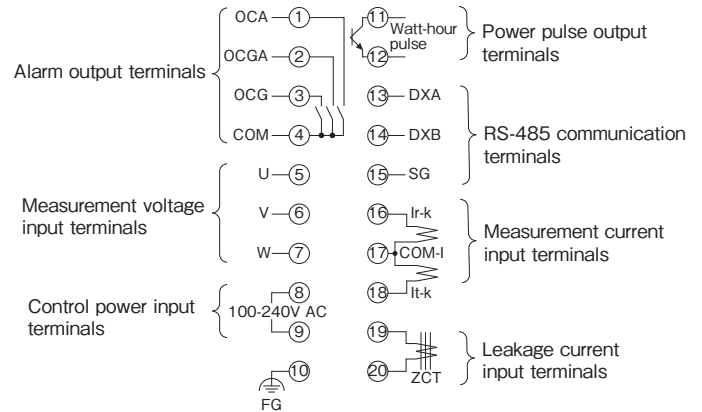
## Single-circuit power monitoring unit

### F-MPC04S

#### ■ Front panel

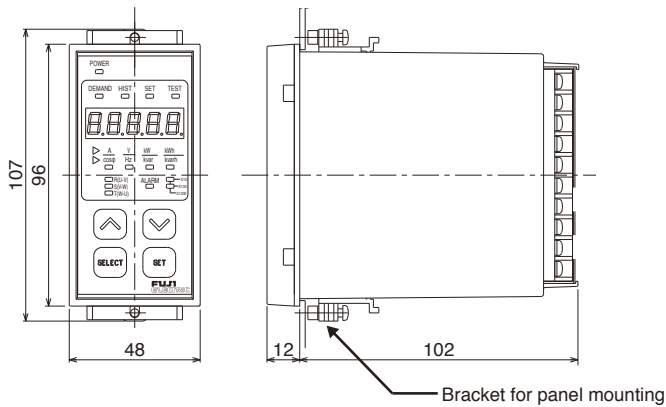


#### • Terminal arrangements

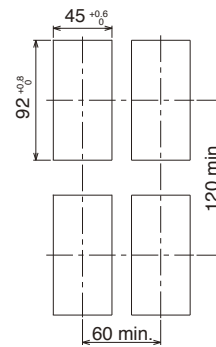


Note: Alarm output terminal ② ③ and ZCT input terminal ⑲ ⑳ of the UM03-ARA3 (without leakage current measuring function) are NC terminals. Do not connect anything to these terminals.

#### ■ Dimensions, mm



Panel cutting and recommended mounting intervals



# F-MPC04 series

## Related products

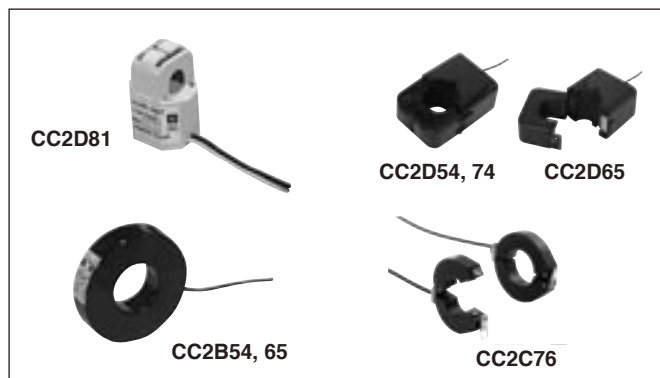
### Current transformers

#### ■ Features

- Since split CT can be mounted without removing existing cables, the CT best suits electric energy measurement and monitoring of existing circuits.
- For electric energy measurement and monitoring of new circuits, through type CTs are available as a low-price version.

#### ■ Specifications

- CTs are dedicated CTs. General-purpose CTs (secondary rated current 5A or 1A) cannot directly be connected because there is a risk of damage.



#### CT for F-MPC04P (type number UM02), and F-MPC04S (type number UM03)

Model	Compact split		Square split		Toroidal	
Type	CC2D81-0057	CC2D81-0506	CC2D65-2008	CC2D54-4009	CC2B65-2008	CC2B54-4009
Dimesions	Fig.1	Fig.1	Fig.2	Fig.3	Fig.4	Fig.5
Rated primary current	5A	50A	200A	400A	200A	400A
Linear output limit	Depends on the measurement range of the main unit.					
Rated secondary current	7.34mA	73.4mA	66.67mA	133.33mA	66.67mA	133.33mA
Through hole diameter	ø10		ø24	ø36	ø24	ø36
Rated frequency	50 to 60Hz		50 to 60Hz			
Overcurrent strength	10In continuous	1.0In continuous	1.0In continuous			
Ratio error	±1%/In ±1.5%/0.2In					
Phase difference	150'±90'/In, 180'±120'/0.2In		±60'/In, ±90'/0.2In			
Rated burden	0.2693mVA (5Ω load resistance)		44.4mVA (10Ω load resistance)	0.18VA (10Ω load resistance)	44.4mVA (load resistance of 10Ω or less)	177.8mVA (load resistance of 10Ω or less)
Insulation resistance	500VDC/100MΩ or more (between sensor core and output lead wire)			500VDC/100MΩ or more (between through hole and output lead wire)		500VDC/100MΩ or more (between through hole and output terminal)
Dielectric strength	2000VAC/min (between sensor core and output lead wire)			2,500VAC/min (between through hole and output lead wire)		2,500VAC/min (between through hole and output terminal)
Output protection	—		3Vp built-in clamp diode	±3Vp built-in clamp diode	—	
Operating conditions	-20 to 50°C, 80%RH or lower (No condensation)		-20 to 50°C, 80%RH or lower (No condensation)			
Split portion securing method	Clamp		Clamp		—	
Mounting method	Hanger		Hanger			
Connection	Heat-resistant IV cable 0.3mm <sup>2</sup> x 1,000mm		Heat-resistant IV cable AWG18, 1,000mm		PVC cable 0.3mm <sup>2</sup> x 1,000 mm	M3 screw terminal
Mass	45g		200g	300g	60g	180g

#### CT for F-MPC04 (type number UM01)

Model	Compact split	Square split			Toroidal split	
Type	CC2D81-0057	CC2D74-1001	CC2D74-2001	CC2D74-4001	CC2C76-8001	CC2C76-12X1
Dimesions	Fig.1	Fig.3			Fig.6	
Rated primary current	5A	100A	200A	400A	800A	1,200A
Linear output limit	Depends on the measurement range of the main unit.					
Rated secondary current	7.34mA	1A				
Through hole diameter	ø10	ø36			ø60	
Rated frequency	50 to 60Hz					
Overcurrent strength	10In continuous	1.0In continuous				
Ratio error	±1%/In ±1.5%/0.2In				±1%/In ±1.5%/0.2In ±3%/0.05In	
Phase difference	2.5°±90'/In, 3°±120'/0.2In	90±90'/In	60±60'/In	±80'/In	±80'/In, ±100'/0.2In	
Rated burden	0.2693mVA (5Ω load resistance)	0.5VA (0.5Ω load resistance)				
Insulation resistance	500VDC/100MΩ or more (between sensor core and output lead wire)	500VDC/100MΩ or more (between sensor core and output lead wire)			500VDC/100MΩ or more (between through hole and output)	
Dielectric strength	2000VAC/min (between sensor core and output lead wire)	2000VAC/min (between sensor core and output lead wire)			2500VAC/min (between through hole and output)	
Output protection	—	±1.4Vp with built-in clamp diode				
Operating conditions	-20 to 50°C, 80%RH or lower (No condensation)	-20 to 50°C, 80%RH or lower (No condensation)				
Split portion securing method	Clamp	Clamp				
Mounting method	Hanger	Hanger				
Connection	Heat-resistant IV cable 0.3mm <sup>2</sup> x 1,000mm	Heat-resistant IV cable AWG18, 1,000mm			Vinyl cabtire cable 0.75mm <sup>2</sup> x 1,000mm 2-core	
Mass	45g	300			500g	
Combination CT-BOX	UM01X-0	UM01X-1			UM01X-1	

Note: • Type number CC2D81-0057 is used as a single unit or, if there are existing general-purpose CTs (10A to 7500A/5A), used together with the secondary wire. Select the CT primary rated current from 10 to 7500A through setup.

- To cope with extension of CT output wire, CT with connector and relay cable are available.
- For CTs without built-in output protection diode, be sure to draw a primary current after connecting a rated load. Drawing a primary current without connecting the rated load is dangerous because high voltage appears at the output terminal.
- CT-BOX to be used together with general-purpose CT (10 to 7500A/5A) is the UM01X-5.

■ **Dimensions, mm**

Fig1 CC2D81

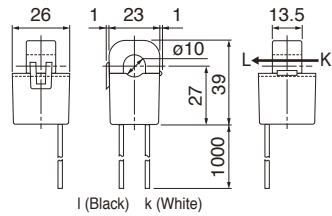


Fig2 CC2D65

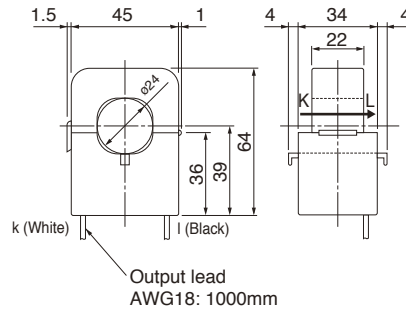


Fig3 CC2D54, CC2D74

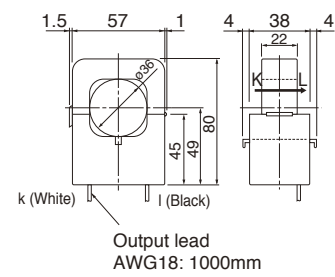


Fig4 CC2B65

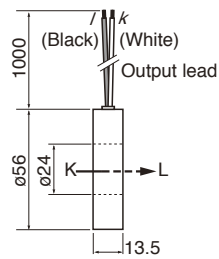


Fig5 CC2B54

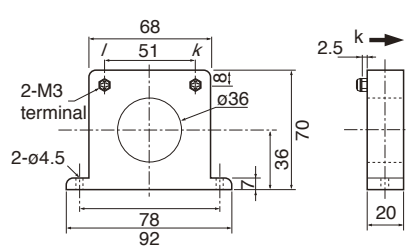
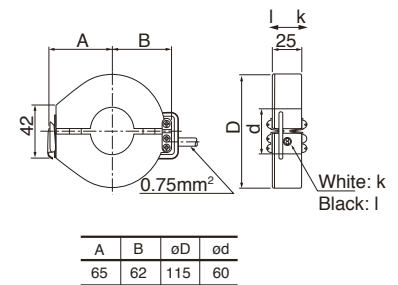


Fig6 CC2C76



A	B	$\phi D$	$\phi d$
65	62	115	60

# F-MPC04 series

## Related products

### Zero-phase current transformers

#### ■ Features

- Combining with F-MPC04 or F-MPC04S allows you to measure leakage current.



#### ● Specifications

Model (for low voltage)			Rated current [A]	Through hole dia. [ø]	Through wire			Case color	Mass [kg]
Type	Ordering code	1-phase 2-wire			1-phase 3-wire, 3-phase 3-wire	3-phase 4-wire			
Round hole through-type	EW-ZB-30M05	EW0P30K	50	30	IV 14mm²	IV 8mm²	IV 8mm²	Black (phenol)	0.22
	EW-ZB-30M1	EW0P30L	100	30	IV 60mm²	IV 50mm²	IV 38mm²	Black (phenol)	0.32
	EW-ZB-58M2	EW0P58	200	58	IV 125mm²	IV 100mm²	IV 80mm²	Black (phenol)	0.6
	EW-Z70A4	EW0P70A4	400	70	IV 400mm²	IV 325mm²	IV 250mm²	Black (phenol)	1.1
	EW-Z70A6	EW0P70A6	600	70	IV 400mm²	IV 325mm²	IV 250mm²	Black (phenol)	1.1
	EW-Z90	EW0P90	800	90	IV 500mm²	IV 500mm²	IV 500mm²	Black (phenol)	3.1
	EW-Z115	EW0P115	1,200	115	—	—	—	Gray (epoxy)	4.8
	EW-Z160	EW0P160	2,000	160	—	—	—	Gray (epoxy)	10
Split through-type	EW-Z250	EW0P250	3,000	250	—	—	—	Gray (epoxy)	28.5
	EW-ZD30	EW0D30	100	30	IV 60mm²	IV 50mm²	IV 38mm²	Black (phenol)	0.55
	EW-ZD45	EW0D45	200	45	IV 125mm²	IV 100mm²	IV 80mm²	Black (phenol)	0.89
	EW-ZD65	EW0D65	400	65	IV 325mm²	IV 250mm²	IV 200mm²	Black (phenol)	1.15
	Model (for low voltage)			Rated current [A]	Through hole dia. [ø]	Through wire		Case color	Mass [kg]
Type	Ordering code	3-phase 3-wire	3-phase 4-wire						
With conductors, 3-pole	EW-Z3B40	EW3Z40	400	70	5×40mm	—	Black (phenol)	2.8	
	EW-Z3B50	EW3Z50	500	70	6×40mm	—	Black (phenol)	3.1	
	EW-Z3B60	EW3Z60	600	90	6×50mm	—	Black (phenol)	7.6	
	EW-Z3B80	EW3Z80	800	90	8×50mm	—	Black (phenol)	8.8	
	EW-Z3B100	EW3Z100	1,000	90	12×50mm	—	Black (phenol)	11.5	
	EW-Z3B120	EW3Z120	1,200	115	10×75mm	—	Gray (epoxy)	15.2	
	EW-Z3B160	EW3Z160	1,600	160	12×100mm	—	Gray (epoxy)	30.5	
	EW-Z3B200	EW3Z200	2,000	160	6×100mm×2	—	Gray (epoxy)	30.5	
	EW-Z3B300	EW3Z300	3,000	250	8×150mm×2	—	Gray (epoxy)	68.6	
With conductors, 4-pole	EW-Z4B40	EW4Z40	400	90	—	5×40mm	Black (phenol)	6.4	
	EW-Z4B50	EW4Z50	500	90	—	6×40mm	Black (phenol)	6.9	
	EW-Z4B60	EW4Z60	600	90	—	6×50mm	Black (phenol)	11.5	
	EW-Z4B80	EW4Z80	800	90	—	8×50mm	Black (phenol)	14.1	
	EW-Z4B100	EW4Z100	1,000	115	—	12×50mm	Gray (epoxy)	15.5	
	EW-Z4B120	EW4Z120	1,200	115	—	10×75mm	Gray (epoxy)	24.9	
	EW-Z4B160	EW4Z160	1,600	160	—	12×100mm	Gray (epoxy)	36.4	
	EW-Z4B200	EW4Z200	2,000	160	—	6×100mm×2	Gray (epoxy)	36.4	
EW-Z4B300	EW4Z300	3,000	250	—	8×150mm×2	Gray (epoxy)	80.3		

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



## Terminal relay, cable with connector

### ■ Features

- Enables current pre-alarm, leakage pre-alarm, and leakage breaking outputs when used together with a F-MPC04.

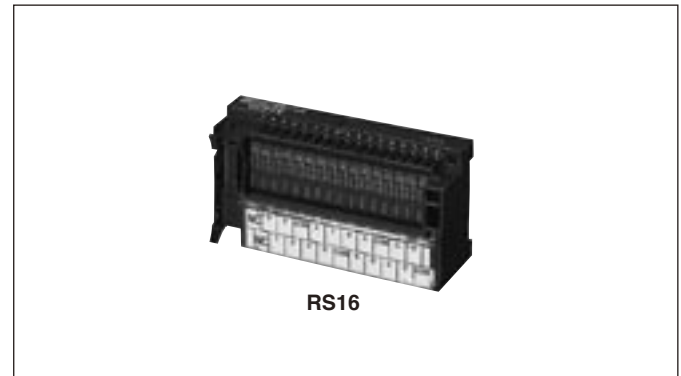
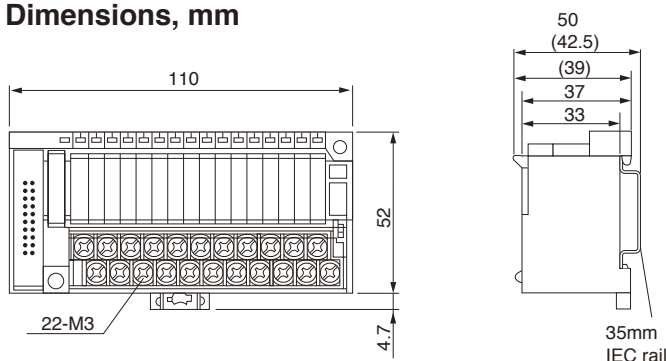
### ■ Models

Product name	Specification	Type	Ordering code
Terminal relay	For 5 circuits	RS16-DE04H	RS16-DE04H
Cable with connector (For CT-BOX/terminal relay/relay connector terminal board)	1m	AUX014-201	LP914-201
	2m	AUX014-202	LP914-202
	3m	AUX014-203	LP914-203

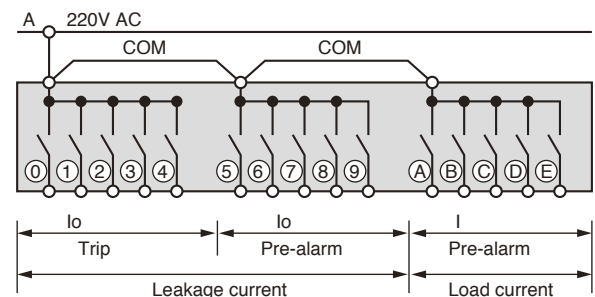
### ■ Specifications

Item	Performance
Operating time	10 ms or less
Recovery time	10 ms or less
Vibration resistance	Malfunction 10 to 55Hz, double amplitude of 1.0mm (0.61 N max.)
	Durability 10 to 55Hz, double amplitude of 1.0mm (0.61 N max.) 3 times in each of the X, Y, and Z directions, 18 times in total
Shock resistance	Malfunction 100m/s <sup>2</sup>
	Durability 200m/s <sup>2</sup> , 2 hours in each of the X, Y, and Z directions, 6 hours in total
Operating temperature	-25 to +55°C (without condensation or freezing)
Operating humidity	35 to 85%RH
Terminal screw size	M3
External connection tightening torque	0.5 to 0.7 N·m (approx. 5 to 7 kgf·cm)
Attachment method	Rail mounting (Screw mounting is also possible.)
Applicable round shaped solderless terminal	R1.25 to 3 (maximum width of 6mm)
Connectable wire	Max. $\phi$ 1.4
LED display color	Operation color: Red Power supply display: Green
Coil surge absorption element	Diode
No. of attachments/detachments	50 times
Insulation resistance (initial value)	100M $\Omega$ or more (with a 500VDC megger)
Dielectric strength	between contact coils 2,000VAC for 1 minute
	between homopolar contacts 1,000VAC for 1 minute
	between heteropolar contacts 2,000VAC for 1 minute
	between heteropolar coils 500VAC for 1 minute
Mass	200g

### ■ Dimensions, mm



### ■ Terminal arrangements



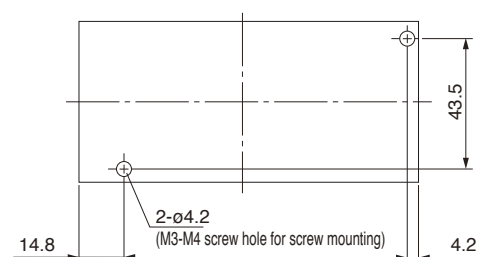
#### Three-phase three-wire (3 $\phi$ 3W)

- ① : Io trip(No.1 or 6)
- ② : Io Trip(No.2 or 7)
- ③ : Io Trip(No.3 or 8)
- ④ : Io Trip(No.4 or 9)
- ⑤ : Io Trip(No.5 or 0)
- ⑥ : Io pre-alarm(No.1 or 6)
- ⑦ : Io pre-alarm(No.2 or 7)
- ⑧ : Io pre-alarm(No.3 or 8)
- ⑨ : Io pre-alarm(No.4 or 9)
- ⑩ : Io pre-alarm(No.5 or 0)
- A : I pre-alarm(No.1 or 6)
- B : I pre-alarm(No.2 or 7)
- C : I pre-alarm(No.3 or 8)
- D : I pre-alarm(No.4 or 9)
- E : I pre-alarm(No.5 or 0)
- F : Not use

#### Three-phase four-wire (3 $\phi$ 4W)

- Io Trip(No.1 or 4)
- Io Trip(No.2 or 5)
- Io Trip(No.3 or 6)
- Not use
- Not use
- Io pre-alarm(No.1 or 4)
- Io pre-alarm(No.2 or 5)
- Io pre-alarm(No.3 or 6)
- Not use
- Not use
- I pre-alarm(No.1 or 4)
- I pre-alarm(No.2 or 5)
- I pre-alarm(No.3 or 6)
- Not use
- Not use
- Not use

#### Pannel drilling



Mounting method: Screw mounting or mounting  
by IEC/DIN standard rail (35mm width)

F-MPC04 series  
Related products

Connector termial block

■ Features

- Enables kWh pulse output when used together with a F-MPC04.



■ Models

No. of poles of terminal board	No. of connectors	Rating (connector)	Performance	Type	Ordering code
21	20	Insulation voltage 60V AC/DC Continuous current 1A (at 40°C)	Insulation resistance 100MΩ or more Dielectric strength 500V for 1 minute Allowable ambient temperature -5 to +40°C Allowable ambient humidity 45 to 85%RH Flame resistance UL94-V1	AU-CW21B1-04	LP1W-21BA4
				AU-CW21B1-04-R * <sup>1</sup>	LP1W-21BA4R

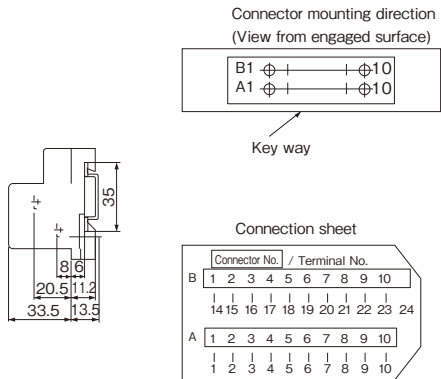
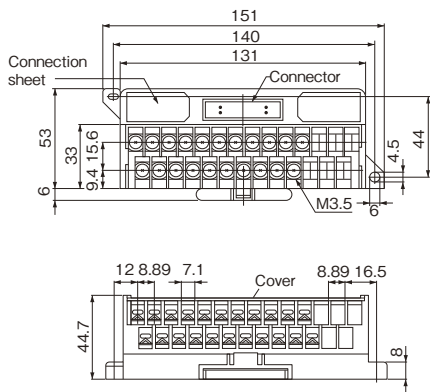
Note: Connection on rear panel

■ Terminal arrangements

Terminal No.		Pulse output circuit No.	Remarks
	23	Circuit 1 pulse output	For three-phase four-wire type, only circuit 1-6 pulse outputs are effective.
	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 terminal (-)	

■ Dimensions, mm

AU-CW21B1-04



Mounting method: Screw or IEC/DIN rail mounting (35mm)



## **Safety Considerations**

- For safe operation, before using the product read the instruction manual or user manual that comes with the product carefully or consult the Fuji sales representative from which you purchased the product.
- Products introduced in this catalog have not been designed or manufactured for such applications in a system or equipment that will affect human bodies or lives.
- Customers, who want to use the products introduced in this catalog for special systems or devices such as for atomic-energy control, aerospace use, medical use, passenger vehicle, and traffic control, are requested to consult the Fuji sales division.
- Customers are requested to prepare safety measures when they apply the products introduced in this catalog to such systems or facilities that will affect human lives or cause severe damage to property if the products become faulty.
- For safe operation, wiring should be conducted only by qualified engineers who have sufficient technical knowledge about electrical work or wiring.

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