

# MITSUBISHI Numerical Protection Relay MELPRO™-D Series



**New Release**

## Multi-function

- The MELPRO D series relay is suitable for feeder protection, motor protection and transformer protection applications.
- Easily configurable, the relay offers multiple step time grading for over-current protection co-ordination
- Two settings groups offer flexibility for testing purposes or the ability to accommodate different load conditions.
- Remote communications options include IEC 61850 Ethernet communications or Modbus (RS485)
- IEC 61850 communications can be achieved using 1 electrical port or 2 optical ports
- If 2 optical ports are used, HSR (High-availability Seamless Redundancy) or PRP (Parallel Redundancy Protocol) can be selected through the user interface.
- Up to 5 disturbance recorder fault records can be stored (24 samples/cycle). These fault records can be analysed using PC Tool software.
- Circuit breakers can be controlled via the HMI or remotely

## Advanced User Interface

- VFD (Vacuum Florescent Display) adopted for better visibility than LCD.
- Relay Software tool enables simple relays setting changes, status indications, CB control, sequence of events (SOE) and data digital fault recorder (DFR) data acquisition
- PLC (Programmable Logic Control) functionality enables easy customisation of logic for user

## Reliability

- Self- diagnosis function monitors the main hardware and issues alarm for failure
- 2 out of 3 relay configuration (option) can keep continuous protection even if one relay fails

## Easy Replacement

- Panel cutout size is the same as the existing version of MELPRO-D so easy to replace.

## Compliance standards

- IEC 60255- series for EMC and protection functional elements
- CE marking

# Features

## PROTECTION

### <Feeder Protection>

- Phase and Earth (ground) OC
- Directional Earth (ground) OC (DOC) (Note 1)
- 2<sup>nd</sup> harmonic blocking is available to block OC/DOC under inrush current.
- Overvoltage (OV), undervoltage (UV), change of voltage, and zero sequence OV elements
- Phase unbalance (Negative sequence OC) element
- Undercurrent element
- Breaker failure protection
- Trip coil supervision (Option)

### <Motor Protection>

- Phase and Earth (ground) OC
- Directional Earth (ground) OC (DOC) (Note 1)
- Overvoltage (OV), undervoltage (UV), change of voltage, and zero sequence OV elements
- Phase unbalance current element (With Loss of single phase detection)
- Start/hour, Time between start
- Thermal overload element
- Breaker failure protection
- Undercurrent element
- 3ch RTD (resistance temp. device) (Option) (Note 2)
- Trip coil supervision (Option) (Note 2)
- Motor run time monitoring

### <Transformer Protection>

- Biased current differential (87T) with 2<sup>nd</sup> and 5<sup>th</sup> harmonics blocking to prevent the unwanted operation under transformer inrush current and over-excitation current.
- High set current differential (87TH)
- CT matching and phase compensation (Note 3)
- Overcurrent (OC) and unbalance OC elements at HV and LV sides
- Thermal element at LV side
- Restricted earth fault element (Note 4)
- Breaker failure protection (50BF)
- Trip coil supervision (Option)

(Note 1) When sensitive earth fault/sensitive directional earth fault using ZCT is required, please select at ordering.

(Note 2) Selection of RTD and Trip coil supervision is not available simultaneously.

(Note 3) Y connection for both CT is available by setting according to the transformer winding type.

(Note 4) The zero-seq. current differential protection is available using CT current on the transformer neutral line of Y winding.

## METERING

The relay provides real time metering of input voltages (phase,  $V_0$ ,  $V_1$ ,  $V_2$ ), input currents (phase,  $I_0$ ,  $I_1$ ,  $I_2$ ), angles, real power (P), reactive power (Q), apparent power (W), power factor (PF) and frequency.

It is available to display the watt-hour meters of accumulating +P, -P, +Q and -Q.

## CONTROL

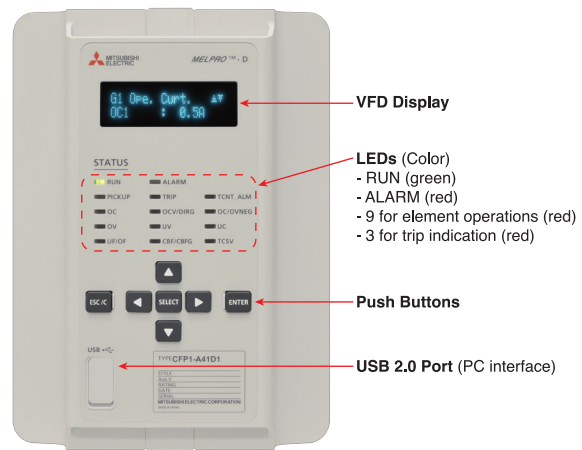
- Control function for CB operation via front HMI or remote communication
- Time synchronization selectable to GPS (IRIG-B) or SNTP.

## USER INTERFACE

- VFD of 18 characters x 2 lines (1 line display is available for easy reading for metering values)



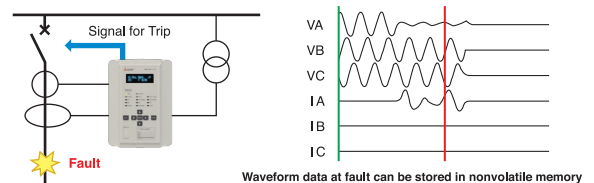
- Settable password for front panel operation.
- Remote communication by Modbus interface (RS485) or IEC61850 (TCP/IP)



## MONITORING AND RECORDING

### • Disturbance recording

- PC Tool software provides access to Disturbance recorder offering waveform data for analogue inputs, DI/DO (binary inputs/outputs) and the self-monitoring signals of the relay.
- Waveform capture (24 samples/cycle) is triggered by a trip signal, relay element operations or an external input. (configurable)
- The record-time is total 5s and 1~5s per fault (settable). The pre-fault time is settable.



### • Event, Alarm and Access recording

- The relay stores 512 Event log records (DI/DO and element status changes), up to 200 Alarm logs (self-supervision alarms) and up to 512 Access logs (front panel, local PC or remote access for any operation of the relay)

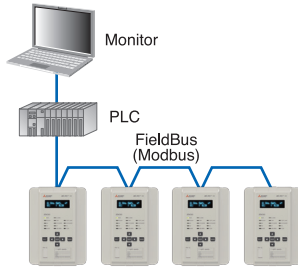
## SELF SUPERVISION

Self-diagnostic monitor continuously checks the hardware. When detecting any abnormality, the relay issues an instantaneous alarm.

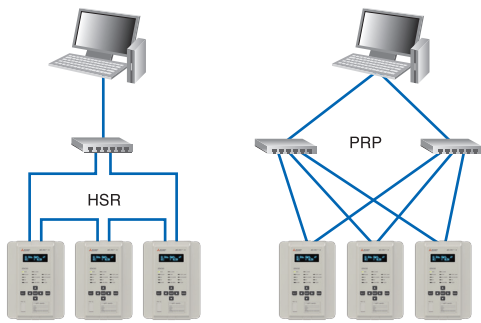
This functionality reduces the requirement for regular checking of the relay and extends the periodical test interval time.

## COMMUNICATION

- **Direct PC communication**  
Direct PC connection via USB 2.0 port on the front panel. Used for setting, monitoring, and review of relay records using the PC tool software.
- **Remote communication**  
- Modbus interface (option) is provided for remote communication using a RS-485 port on the rear of the relay. Settings changes and monitoring can be done using a PC.



- Station bus communication using IEC61850 (option) over Ethernet is possible using the port on the rear of the relay. Goose message between relays is also enabled.



## PC TOOL FUNCTION

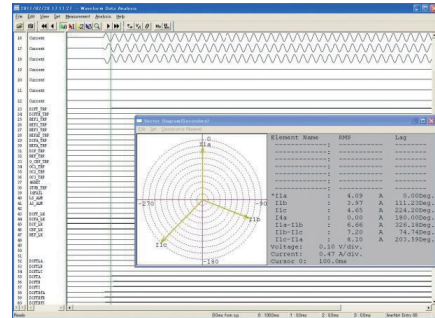
- **Password security**  
Password access provides for operation and setting operation as a security function.
- **Monitoring**  
Monitoring of Input voltage/current, DI/DO (binary input/output), relay's setting list is available. Event, Access and Alarm logs can be viewed.

Category	Item	Value	Unit	Min	Max	Default	Group
Disturbance Record	Disturbance Record	1	101.0	0.0	100.0	100.0	100.0
	Alarm Record	2	101.0	0.0	100.0	100.0	100.0
	Access Record	3	101.0	0.0	100.0	100.0	100.0
Setting	Setting	4	101.0	0.0	100.0	100.0	100.0
	Setting	5	101.0	0.0	100.0	100.0	100.0

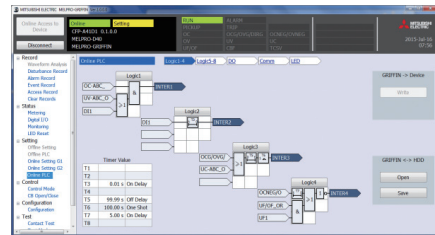
- **Setting**  
Settings changes can be made using settings files which have been prepared in advance.

Category	Item	Value	Unit	Min	Max	Default	Group
Disturbance Record	Disturbance Record	1	101.0	0.0	100.0	100.0	100.0
	Alarm Record	2	101.0	0.0	100.0	100.0	100.0
Setting	Setting	4	101.0	0.0	100.0	100.0	100.0
	Setting	5	101.0	0.0	100.0	100.0	100.0

- **Control**  
CB control via PC tool is available in addition to front panel operation. Output contacts can be forced to assist with relay testing.
- **Analysis of disturbance record data**  
Disturbance record in the relay can be transferred and stored on a PC in COMTRADE format. The waveform can be analyzed using the PC tool analysis software. The disturbance record in the relay retained in the event of a loss of DC supply.



- **PLC (Programmable logic) function**  
Selected functionality can be assigned the protection relay outputs and internal logic can be easily configured by the user.

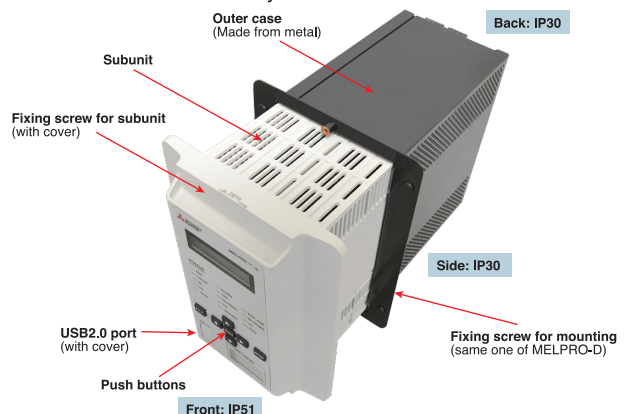


## INPUT AND OUTPUT CONFIGURATION

- **DI (Binary input to the relay)**  
The relay offers DIs as an option. DI card with 8 DIs or 15 DIs can be selected, and the option of 15 DIs also provides an additional DI for trip coil supervision function.
- **DO (Relays' outputs)**  
9 DOs (4 x 1a contacts for trip duty, 4 x 1a contacts for annunciation duty and 1 x 1b contact for alarm (fixed)).

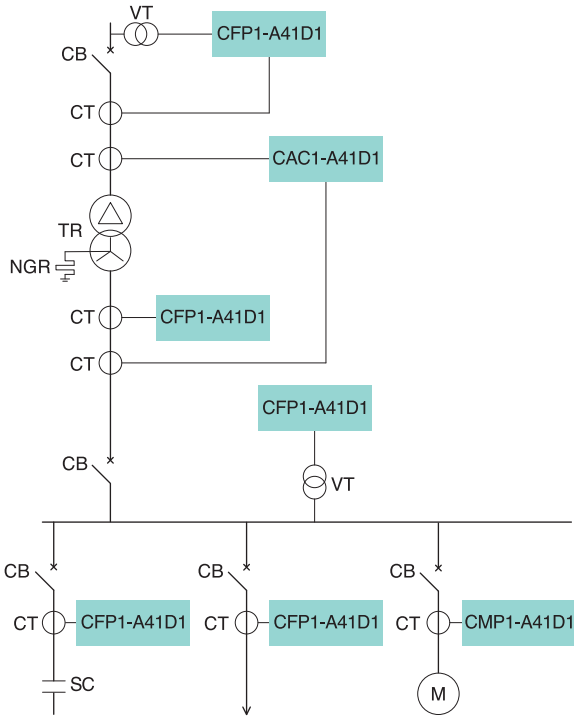
## PRODUCT APPEARANCE

A draw-out design has been adopted for the easy installation and replacement work. The fixing screws for mounting are the same as for the earlier MELPRO-D relay.

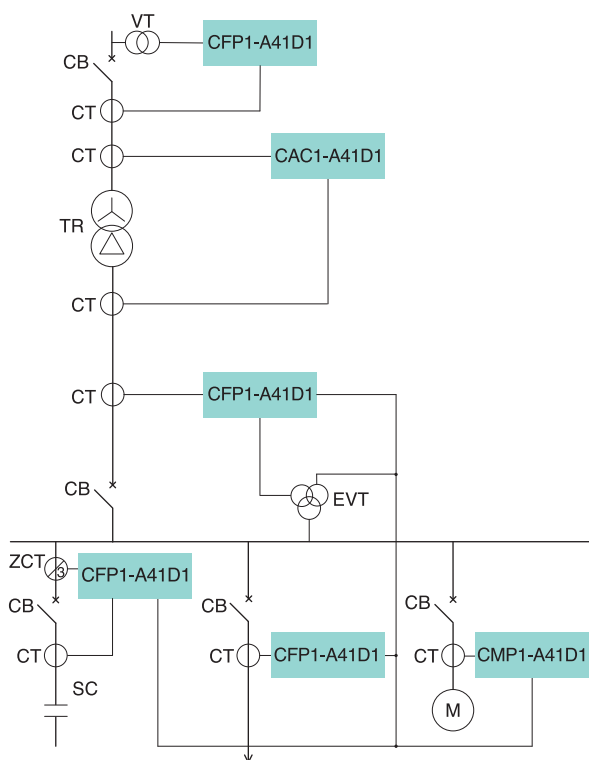


# Example of application/Connection

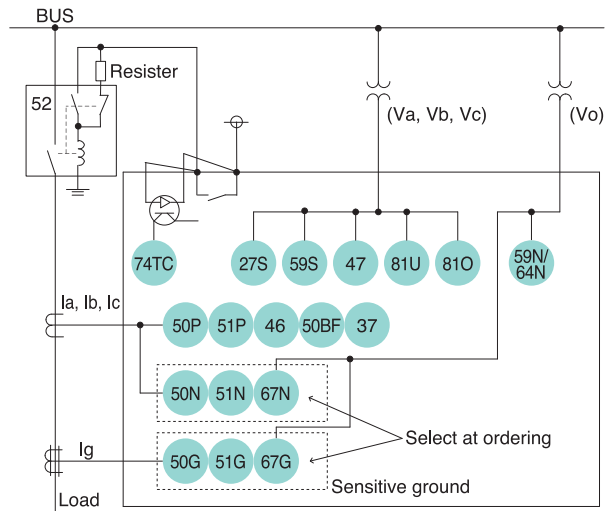
## Resistance grounded neutral system



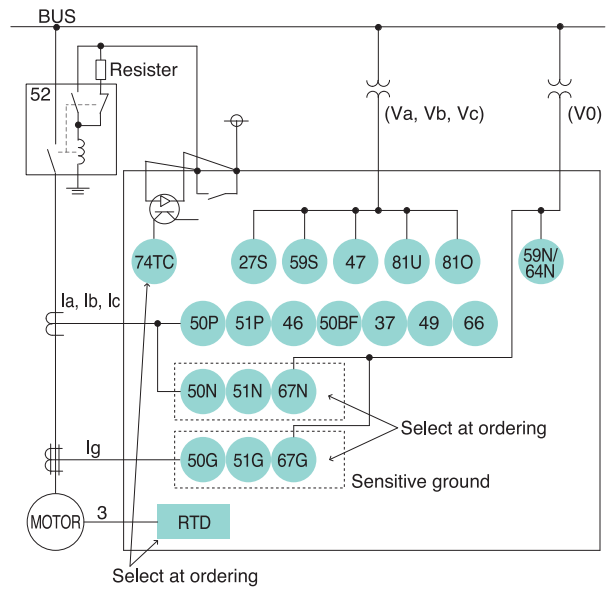
## Isolated neutral system



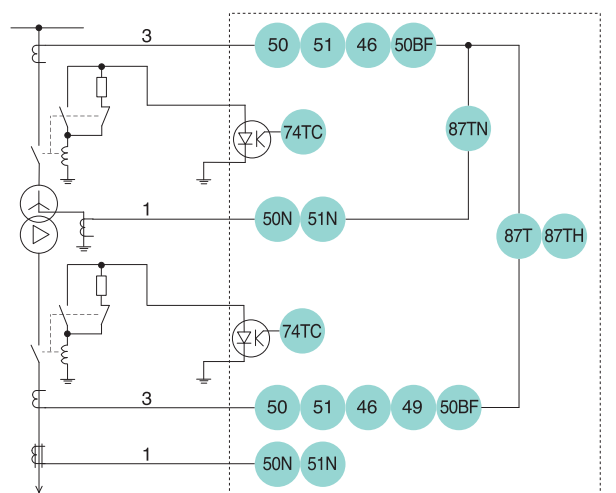
## Type: CFP1-A41D1



## Type: CMP1-A41D1



## Type: CAC1-A41D1 TYPE 1 (Y-D Transformer)



# Selection guide by application

Type		CFP1-A41D1 Feeder Protection				CMP1-A41D1 Motor Protection				CAC1-A41D1 Transformer Protection			
		None		■		None		■		None		■	
Option	IEC61850 Communication	Fiber 2ch		None	■	None	■	None	■	None	■	None	■
	DI Card	None	None	■	■	None	None	■	■	None	None	■	■
Protection Element	50P (Instantaneous Overcurrent)	■3	■3	■3	■3	■	■	■	■	■3	■3	■3	■3
	51P (Time-delayed Overcurrent)	■	■	■	■	■2	■2	■2	■2	■	■	■	■
	50N·50G (Earth Fault Instantaneous Overcurrent)	■3	■3	■3	■3	■2	■2	■2	■2	■3	■3	■3	■3
	51N·51G (Earth Fault Time-delayed Overcurrent)	■	■	■	■					■	■	■	■
	46 (Phase balance current)	■2	■2	■2	■2	■2	■2	■2	■2	■4	■4	■4	■4
	46 (Single phase open)					■	■	■	■				
	67N·67G (Directional Earth Fault Overcurrent)	■4	■4	■4	■4	■2	■2	■2	■2				
	50BF (CB Failure protection)	■	■	■	■	■	■	■	■	■	■	■	■
	37 (Undercurrent)	■2	■2	■2	■2	■2	■2	■2	■2				
	27S (Undervoltage)	■2	■2	■2	■2	■2	■2	■2	■2				
	59S (Overvoltage)	■2	■2	■2	■2	■2	■2	■2	■2				
	64N (Earth Fault Overvoltage)	■2	■2	■2	■2	■2	■2	■2	■2				
	47 (Phase balance voltage)	■2	■2	■2	■2	■2	■2	■2	■2				
	81U (Underfrequency)	■3	■3	■3	■3	■3	■3	■3	■3				
	81O (Overfrequency)	■3	■3	■3	■3	■3	■3	■3	■3				
	49 (Thermal Overload)					■	■	■	■	■	■	■	■
	66 (Starts per Hour)					■	■	■	■				
	87T (Transformer Differential)									■	■	■	■
	87TH (Differential Overcurrent)									■	■	■	■
87TN (Restricted Ground Fault)									■2	■2	■2	■2	
74TC (Trip circuit supervision)			■(*3)	■(*3)			■(*3)	■(*3)			■(*3)	■(*3)	
38 (RTD)					■(*4)	■(*4)	■(*4)	■(*4)					
CB Control		■	■	■	■	■	■	■	■	■	■	■	■
PLC		■	■	■	■	■	■	■	■	■	■	■	■
Disturbance Record		■	■	■	■	■	■	■	■	■	■	■	■
Event Record		■	■	■	■	■	■	■	■	■	■	■	■
Metering	Current	■	■	■	■	■	■	■	■	■	■	■	■
	Voltage	■	■	■	■	■	■	■	■	■	■	■	■
	Phase	■	■	■	■	■	■	■	■	■	■	■	■
	I0 / I1 / I2	■	■	■	■	■	■	■	■	■	■	■	■
	V0 / V1 / V2	■	■	■	■	■	■	■	■				
	Active / Reactive Power	■	■	■	■	■	■	■	■				
Frequency	■	■	■	■	■	■	■	■					
CLOCK	IRIG-B	■	■	■	■	■	■	■	■	■	■	■	■
	SNTP		■	■	■		■	■	■		■	■	■
Communication	IEC61850		■	■	■		■	■	■		■	■	■
	Modbus			■	■			■	■			■	■
Number of Analogue Input		8	8	8	8	8	8	8	8	8	8	8	8
Number of Digital Input		0	0	8or15	8or15	0	0	8or15	8or15	0	0	8or15	8or15
Number of Digital Output (*5)		8	8	8	8	8	8	8	8	8	8	8	8

(\*1) The number of side of check (■) means the number of step of protection element.

for 50P, 51P, 50N/50G, 51N/51G and 46 of CAC-A41D1, these elements are provided at both of primary and secondary sides of transformer.

(\*2) The protection elements of 50P, 51P, 27S and 59 are 3 phase-inputs type.

(\*3) Only the option of 15 DIs can provide an additional DI for trip coil supervision function.

(\*4) The optional RTD (Resistance temperature device) is required. The another optionnal 15 DIs cannot be incorporated with RTD.

(\*5) 8 Digital Output contacts of 4 outputs for trip duty and 4 outputs for control or monitor duty.

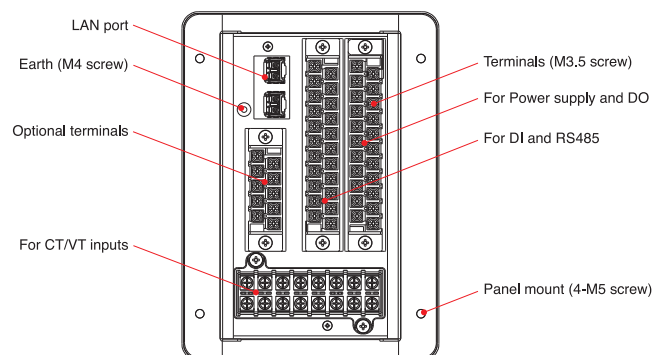
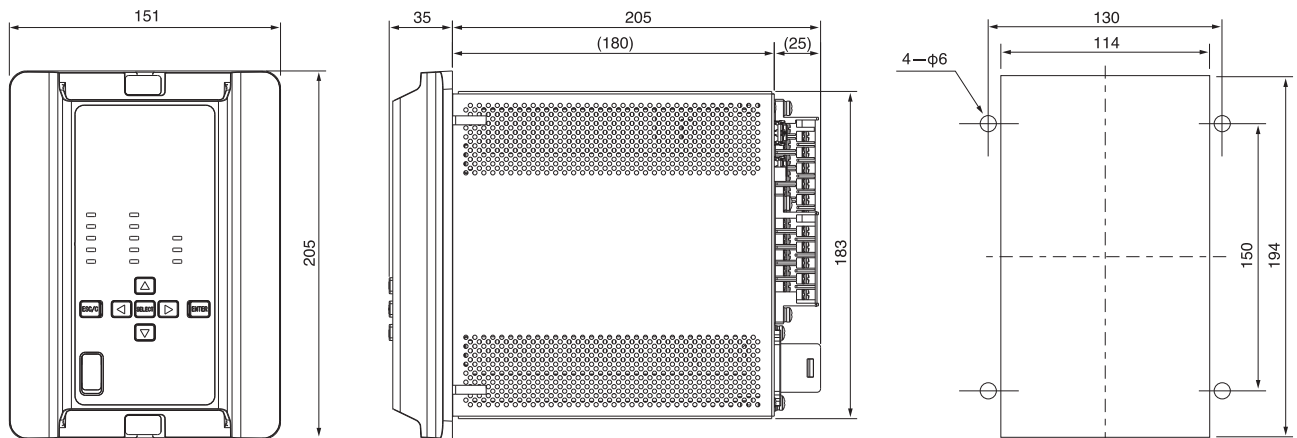
# Technical Data

**Ratings** | AC: 1A or 5A, 100V~125V (phase-to-phase), 50 or 60Hz  
 DC supply: 24/48V or 110~250V, AC supply: 100 ~ 240V  
 (Note) These ratings are selected when the order is placed.

Item	Guaranteed conditions				Compliance standard
Common conditions of use	Operating condition: Temperature: -40~+60 deg C Relative humidity: 5~95%				IEC 60870-2-2 (Class C2)
	Storage condition: Temperature: -40~85deg C (non condensing)				IEC 60870-2-2 (Class Ct2)
	Pollution Degree II: To be free of corrosive gases, dew, dust and rain.				IEC 60664-1 (PD II)
	To be free of solar radiation. Altitude: Less than 2,000m				
Power supply	For DC24/48V DC+30 ~ -20% (19.2 ~ 62.4V)				IEC 60255-1
	For DC110 ~ 250V DC+20 ~ -20% (DC 88 ~ 300V)				IEC 60255-1
	For AC 100 ~ 240V AC+10 ~ -15% (AC 85 ~ 264V)				IEC 60255-1
Contact capacity	Trip contact		Annunciation contact		IEEE C37.90 (Trip contact)
	Make	Break	Make	Break	
	DC250V: 30A 0.2s L/R=0	DC250V: 0.2A L/R=40ms	DC250V: 0.2A L/R=7ms	DC250V: 0.2A L/R=7ms	
Withstand overload	CT	In x 40 2sec (2 times at 1min intervals) In x 3 continuously			IEC 60255-27 In: Rating current
	VT	Phase voltage 150V continuation Zero phase voltage 217V continuation (247V 5sec)			
Insulation resistance	DC500V Megger	Between all terminals and earth (Except for serial communication terminal)		More than 100M ohm	IEC 60255-1
		Between all independent electrical circuits. (Except for serial communication terminal)		More than 100M ohm	
Dielectric	AC2000V, 1min	-Between all terminals and earth. -Between independent circuits. (Except for serial communication terminal)			IEC 60255-27
	AC1000V, 1min	Across normally open contacts.			
Impulse voltage withstand	Three positive and three negative impulse of 1.2/50us	5kV	-Between all terminals and earth -Between CT/VT circuits -Between CT/VT circuit and DI circuit (Except for serial communication terminal)		IEC 60255-27
		3kV	-Between terminals of CT/VT circuit -Between terminals of power circuit (Except for serial communication terminal)		
Power voltage disturbance	Withstand power voltage disturbance of open/close of power supply, voltage dip and slow voltage change				IEC 60255-26 IEC 61000-4-11
Electrostatic discharge	8kV: At discharging in contact 15kV: At discharging in the air				IEC 60255-26 IEC 61000-4-2 Level 4
Power frequency disturbance	-300V for 10sec applied to ports in common mode -150V for 10sec applied to ports in differential mode				IEC 60255-26 Zone A
High frequency disturbance	1MHz 2.5kV -Between all CT/VT circuits and earth. -Between power circuit and earth. -Between terminals of power circuit				IEC 60255-26
Fast transient disturbance	4.0kV, 5.0kHz (A) -Between power circuit and earth -Between all CT/VT circuits and earth -Between all DI circuits and earth				IEC 60255-26 Zone A IEC 61000-4-4 Level 4
Surge immunity	1.2/50us surge -Between terminals of power circuit: 0.5, 1, 2kV -Between power circuit and earth: 0.5, 1, 2, 4kV -Between all DI circuits and earth: 0.5, 2, 4kV -Between terminals of CT/VT circuit: 0.5, 1, 2kV -Between all CT/VT and earth: 0.5, 1, 2, 4kV				IEC 60255-26 Zone A IEC 61000-4-5 Level 4
Power frequency magnetic field immunity	Magnetic field intensity: 30A/m continuously 300A/m 1sec				IEC 60255-26 IEC 61000-4-8 Level 4
RF electromagnetic field immunity	150kHz~80MHz, 27,68MHz, 10V				IEC 60255-26 IEC 61000-4-6 Level 3
Radiated electromagnetic field immunity	80MHz~1GHz, 1.4GHz~2.7GHz 80, 160, 380, 450, 900, 1850, 2150MHz Field strength: 10V/m				IEC 60255-26 IEC 61000-4-3 Level 3

Item	Guaranteed conditions	Compliance standard
Conducted emission	0.15~0.5MHz: 79dBuV (Peak), 66dBuV (Mean)	IEC 60255-26
	0.5~30MHz: 73dBuV (Peak), 60dBuV (Mean)	
Radiated emission	CE (CISPR22-A)	IEC 60255-26 IEC 61000-6-4
	30~230MHz: 40dBuV 230~1000MHz: 47 dBuV	
Vibration	Vibration response: 10~150Hz (1 octave/min)	IEC 60255-21-1 Class1
	Vibration endurance: 10~150Hz (1 octave/min), 9.8m/s <sup>2</sup>	
Shock	Shock response: 5G (49m/s <sup>2</sup> ), Pulse width 11ms, 18 times	IEC 60255-21-2 Class1
	Shock withstand: 15G (147m/s <sup>2</sup> ), Pulse width 11ms, 18 times Bump endurance: 10G (98m/s <sup>2</sup> ), Pulse width 16ms, 6000 times	
Seismic	1~8Hz X: 3.5mm, Y: 1.5mm 8~35Hz X: 1.0G (9.8m/s <sup>2</sup> ), Y: 0.5G (4.9m/s <sup>2</sup> )	IEC 60255-21-3 Class1
Dry heat	Operating temperature: 60°C, 16 hours Storage temperature: 85°C, 16 hours	IEC 60068-2-2
Low temperature	Operating temperature: -40°C, 16 hours Storage temperature: -40°C, 16 hours	IEC 60068-2-1
Damp heat cycle	Cycle of 40°C/95%RH and 25°C/95%RH 1 cycle: 24 hours Number of cycle: 56	IEC 60068-2-30 (JIS-C60068-2-30)
Damp heat cycle	Cycle of 65°C/93%RH, 25°C/93%RH and -10°C/80%RH 1 cycle: 24 hours Number of cycle: 5 Power supply and CT/VT inputs: Rating value	IEC 60068-2-38
Damp heat test	Temperature: 40°C/93%RH Period: 56 days	IEC 60068-2-78
Burden	CT: Less than 0.6VA (5A rating) Less than 0.1VA (1A rating) VT: Less than 0.1VA Less than 0.1VA (For Vn) DC power supply: Less than 20W	
Mass	Less than 4 kg	
Enclosure protection	IP51 (Front panel side), IP30 (Rear side)	IEC 60529

## Dimensions



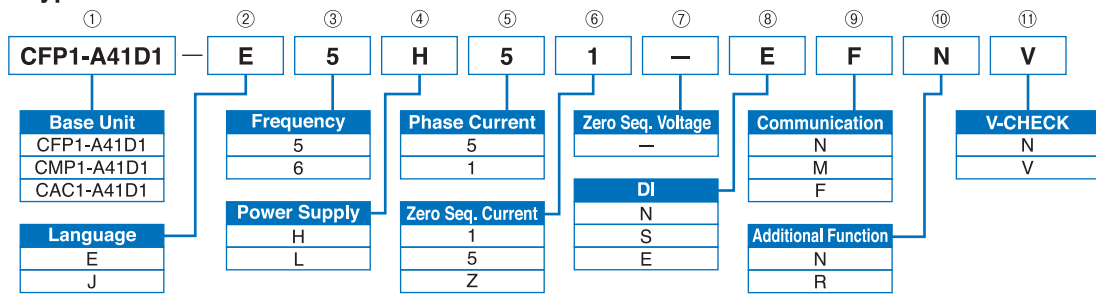
For panel mount  
(4 - M5 screw, relay side)

## Ordering

The specification outlined in this leaflet is subject to change without prior notice owing to product improvements or cease of production. Please contact the nearest branch office of Mitsubishi Electric for further information.

Please specify the type name and code in the table below when ordering.

### Type Code



No.	Item	Remarks
Basic specification	① Base Unit	<b>CFP1-A41D1</b> : Feeder Protection <b>CAC1-A41D1</b> : Transformer Protection <b>CMP1-A41D1</b> : Motor Protection
	② Language	<b>E</b> : English <b>J</b> : Japanese
	③ Frequency	<b>5</b> : 50Hz <b>6</b> : 60Hz
	④ Power Supply	<b>H</b> : AC/DC110-220V <b>L</b> : DC 24-48V
	⑤ Phase Current(See Note 1 below)	<b>5</b> : 5A <b>1</b> : 1A
	⑥ Zero Sequence Current (See Note 1 below)	<b>1</b> : 1A <b>Z</b> : ZCT <b>5</b> : 5A
	⑦ Zero Sequence Voltage	- : for overseas
Optional specification	⑧ DI (See Note 2~5 below)	<b>N</b> : No need <b>E</b> : 8ch(DC110 or 220V)+7ch(DC110V only, under development) <b>S</b> : 8ch(DC110 or 220V)
	⑨ Communication (See Note 2 below)	<b>N</b> : No need <b>F</b> : IEC 61850 (Fiber 2ch) <b>M</b> : Modbus
	⑩ Additional Function(See Note 2 below)	<b>N</b> : No need <b>R</b> : RTD (under development)(See Note 3 below)
	⑪ Authentication	<b>N</b> : No need <b>V</b> : Korean Certification

(Note 1) In case of selecting phase current of 1A, either 1A or ZCT can be selected (5A is not available) for Zero sequence current.

(Note 2) The optional communication card and DI card are mounted at factory and need to be selected when ordering.

Please note that relay functionality is not guaranteed if the user installs any optional cards.

If optional cards are required, please return the relay unit to Mitsubishi Electric factory.

(Note 3) It is not available to select R(additional function) together with E for DI.

(Note 4) In case of selecting E for DI, an additional DI for 74TC dedicated to DC110V is provided.

(Note 5) In case of selecting M for communication, 8 DIs are provide regardless of DI selection of N.



**for a greener tomorrow**

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.



## MITSUBISHI ELECTRIC CORPORATION

www.MitsubishiElectric.com

### CAUTION

TO PREVENT IT FROM THE RISK OF DAMAGE AND MAL FUNCTION, BE SURE TO READ OPERATING AND MAINTENANCE (SERVICING) INSTRUCTIONS BEFORE USING.

HEAD OFFICE : 7-3 MARUNOUCHI 2-CHOME, CHIYODA-KU  
TOKYO, 100-8310, JAPAN

We are waiting your technical contacts by FAX.  
ATTN. Protective relay technical service  
FAX NO. JAPAN +81-78-682-8051