

MITSUBISHI Numerical Protection Relay MELPRO™-D Series



Multi-function

- The MELPRO D series relay is suitable for feeder protection, motor protection and transformer protection applications.
- 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 to different load conditions.
- Remote communication options include IEC 61850 Ethernet communications or Modbus (RS485).
- HSR (High-availability Seamless Redundancy) or PRP (Parallel Redundancy Protocol) is available for IEC 61850 using 2 optical ports.
- Disturbance fault record function (up to 5 records, 24 samples/cycle) is provided. These fault records can be analysed using PC Tool software.
- Circuit breakers can be controlled via the HMI or remote communication.

Advanced User Interface

- VFD (Vacuum Florescent Display) is adopted for better visibility than LCD.
- Relay Software tool enables setting changes, status indications, CB control, data acquisition of sequence of events (SOE) and digital fault recorder (DFR).
- 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.

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)
- 2nd 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

<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
- Motor run time monitoring

<Transformer Protection>

- Biased current differential (87T) with 2nd and 5th 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 2)
- Overcurrent (OC) and unbalance OC elements at HV and LV sides
- Thermal element at LV side
- Restricted earth fault element (Note 3)
- Breaker failure protection (50BF)

(Note 1) When Sensitive Earth OC/Sensitive Directional Earth OC using ZCT is required, please select ZCT type for Zero sequence current at ordering. Especially, only the sensitive type using ZCT is available for DOC element.

(Note 2) Y connection for both CT is available by setting according to the transformer winding type.

(Note 3) 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

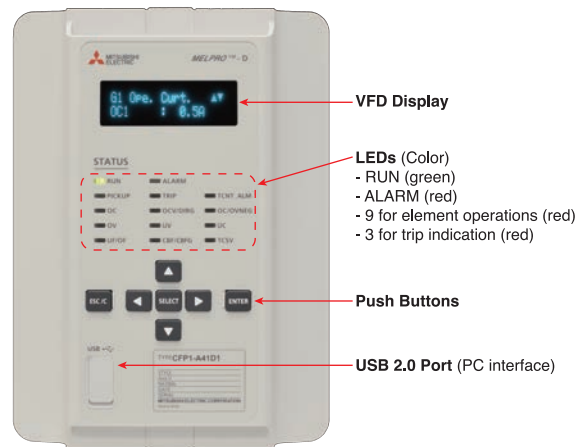
- Control function for CB operation via front HMI or remote communication
- Time synchronization selectable to GPS (IRIG-B) or SNTP.

USER INTERFACE

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



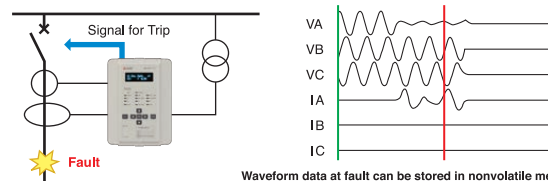
- Settable password for front panel operation.
- Remote communication by Modbus interface (RS485) or IEC61850 (TCP/IP)



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.



Waveform data at fault can be stored in nonvolatile memory

• 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.

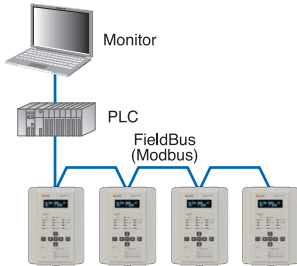
COMMUNICATION

- **Direct PC communication**

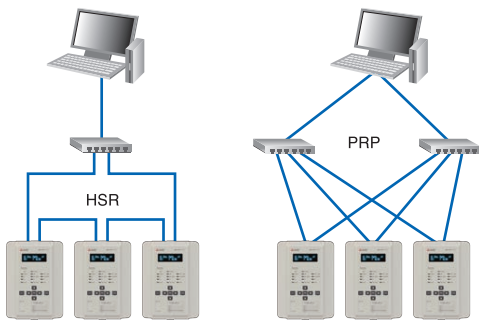
Direct PC connection via USB 2.0 port on the front panel. Used for setting, monitoring, and review of relay records using the PC tool software.

- **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.



- **Setting**

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



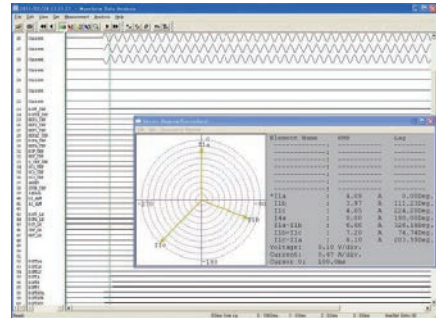
- **Control**

CB control via PC tool is available in addition to front panel operation.

Output contacts can be forced to assist with relay testing.

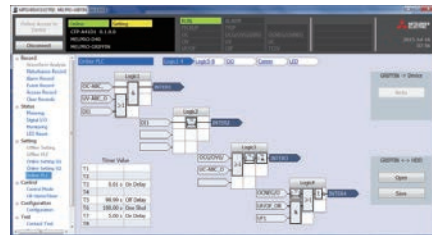
- **Analysis of disturbance record data**

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.

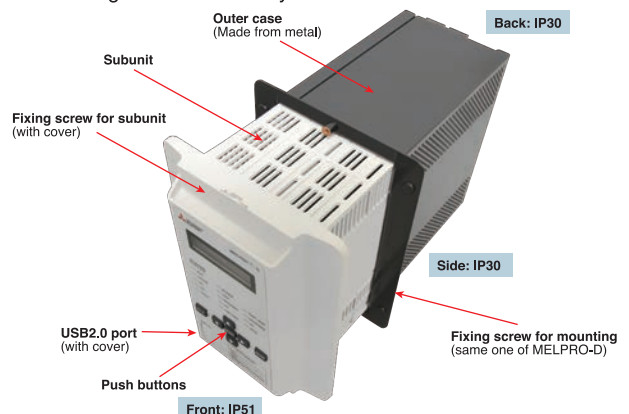
- **DO (Relays' outputs)**

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

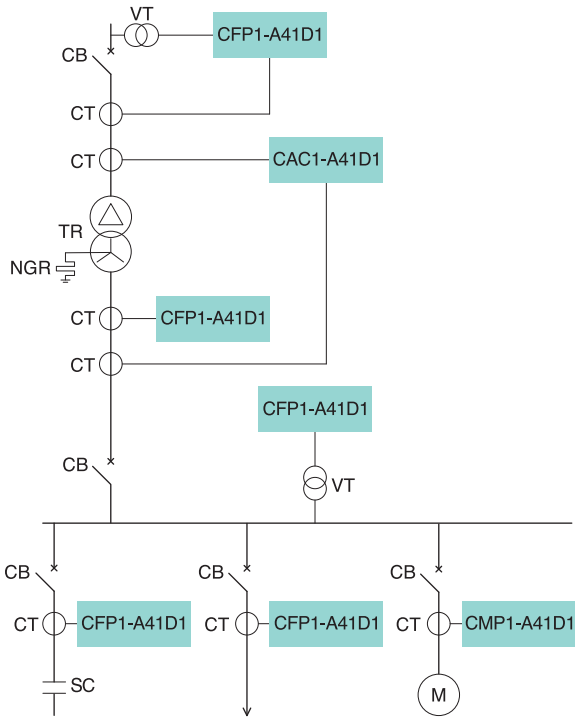
A draw-out design has been adopted for the easy installation and replacement work.

The fixing screws for mounting are the same as for the existing MELPRO-D relay.

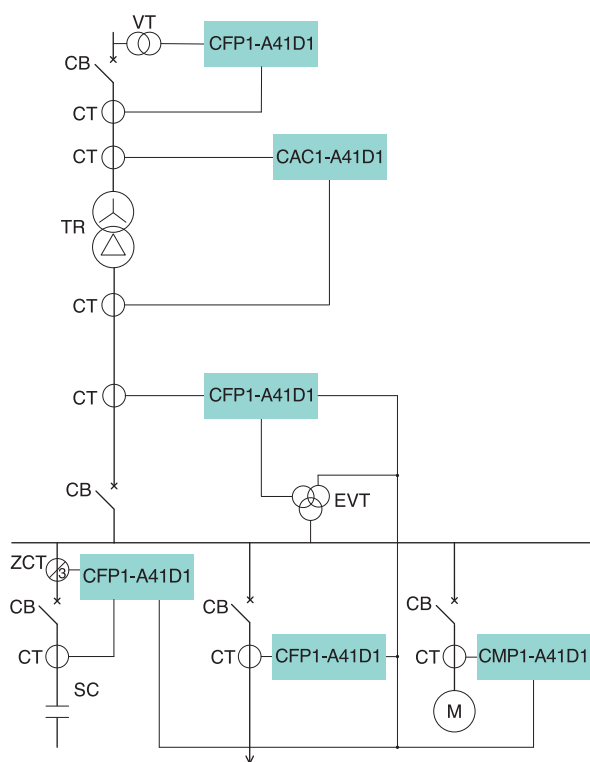


Example of application/Connection

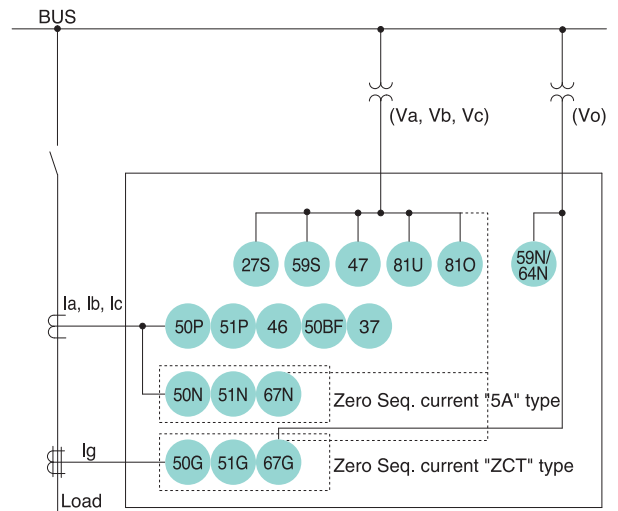
Resistance grounded neutral system



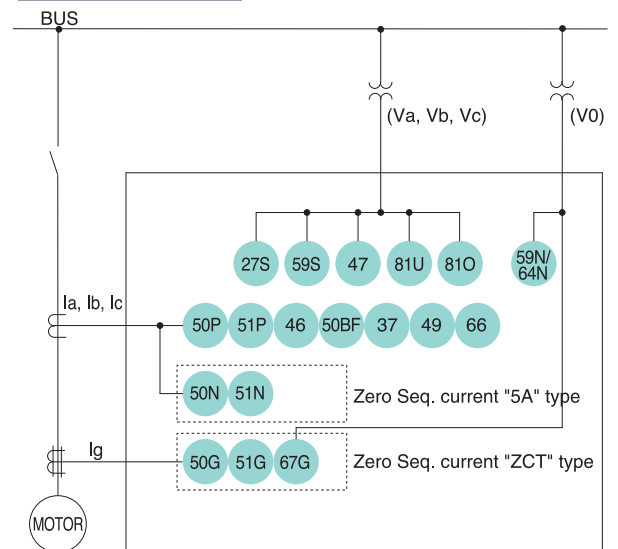
Isolated neutral system



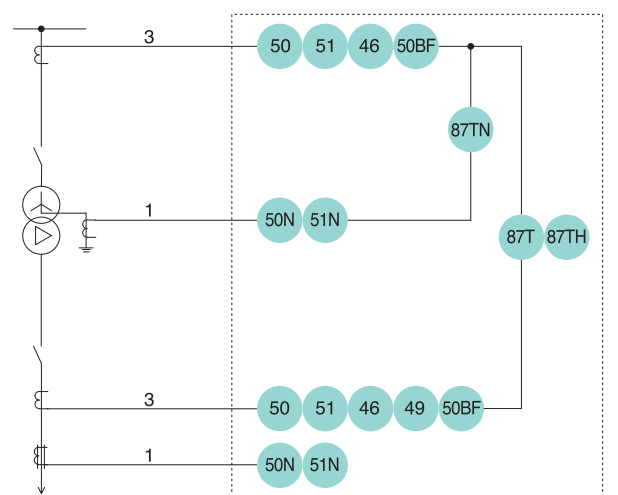
Type: CFP1-A41D1



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			
Option	IEC61850 Communication 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-51N or 50G-51G (Earth Fault Inst. / Definite Time Overcurrent)	■3	■3	■3	■3	■2	■2	■2	■2	■3	■3	■3	■3
	50N-51N or 50G-51G (Earth Fault IDMT Overcurrent)	■	■	■	■					■	■	■	■
	46 (Phase balance current)	■2	■2	■2	■2	■2	■2	■2	■2	■4	■4	■4	■4
	46 (Single phase open)					■	■	■	■				
	67N or 67G (Directional Earth Fault Overcurrent) (*4)	■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	
CB Control		■	■	■	■	■	■	■	■	■	■	■	■
PLC		■	■	■	■	■	■	■	■	■	■	■	■
Disturbance Record		■	■	■	■	■	■	■	■	■	■	■	■
Event Record		■	■	■	■	■	■	■	■	■	■	■	■
Metering	Current		■	■	■	■	■	■	■	■	■	■	■
	Volgate		■	■	■	■	■	■	■				
	Phase		■	■	■	■	■	■	■	■	■	■	■
	I0 / I1 / I2		■	■	■	■	■	■	■	■	■	■	■
	V0 / V1 / V2		■	■	■	■	■	■	■				
	Active / Reactive Power		■	■	■	■	■	■	■				
	Frequency		■	■	■	■	■	■	■				
Time Sync.	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	8	8	0	0	8	8	0	0	8	8
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-51N, 50G-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) 50N-51N is for Zero sequence current "5A" type, and 50G-51G is for "ZCT" type. Zero sequence current type can be selected at ordering.

(*4) CFP1-A41D1 has 67N for Zero sequence current "5A" type or 67G for "ZCT" type. CMP1-A41D1 has only 67G for "ZCT" type (67N for "5A" type is not available).

Zero sequence current type can be selected at ordering.

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

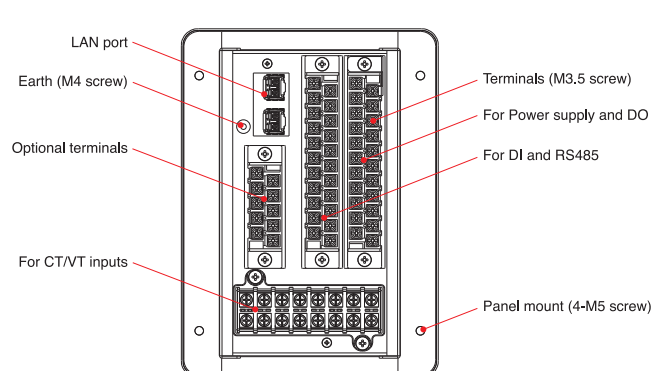
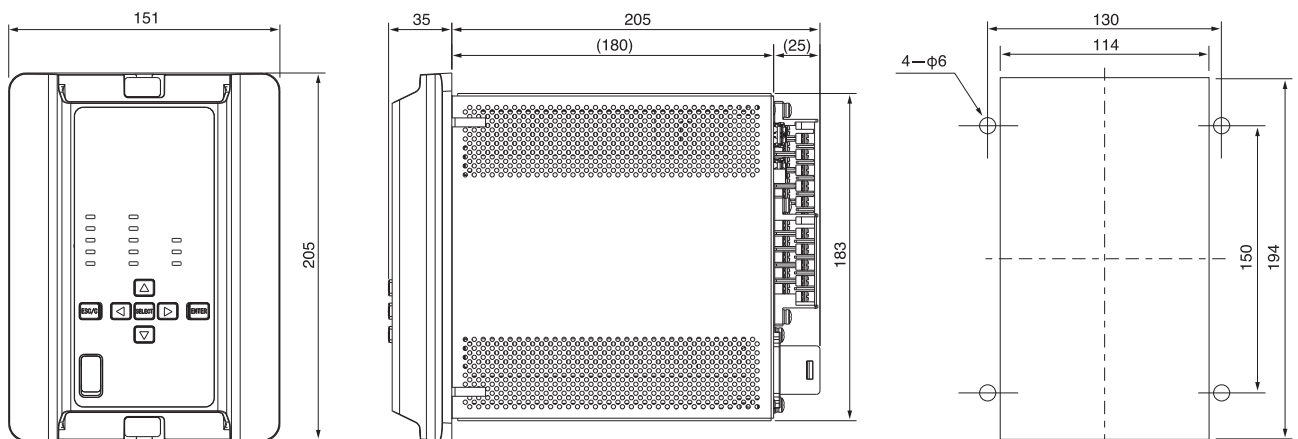
Technical Data

Ratings | AC: 1A or 5A, 100V~125V (phase-to-phase), 50 or 60Hz
 DC supply: 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°C Relative humidity: 5~95%				IEC 60870-2-2 (Class C2)
	Storage condition: Temperature: -40~+85°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 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 and voltage dip				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 ²	
Shock	Shock response: 5G (49m/s ²), Pulse width 11ms, 18 times	IEC 60255-21-2 Class1
	Shock withstand: 15G (147m/s ²), Pulse width 11ms, 18 times Bump endurance: 10G (98m/s ²), Pulse width 16ms, 6000 times	
Seismic	1~8Hz X: 3.5mm, Y: 1.5mm 8~35Hz X: 1.0G (9.8m/s ²), Y: 0.5G (4.9m/s ²)	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



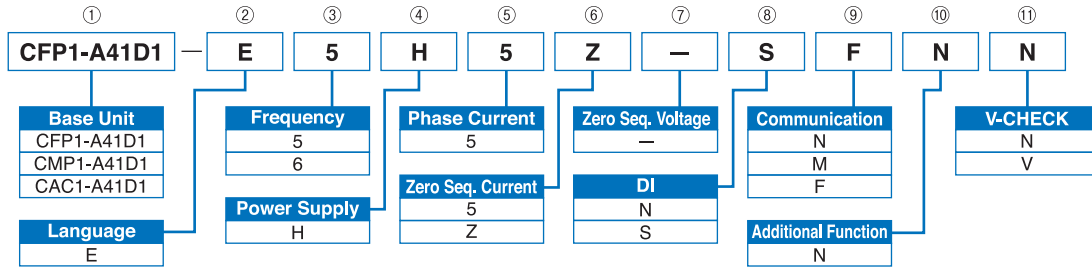
For panel mount
(4 – M5 screw, relay side)

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	CFP1-A41D1 : Feeder Protection CAC1-A41D1 : Transformer Protection CMP1-A41D1 : Motor Protection
	② Language	E : English
	③ Frequency	5 : 50Hz 6 : 60Hz
	④ Power Supply	H : AC/DC110-220V
	⑤ Phase Current(See Note 1 below)	5 : 5A
	⑥ Zero Sequence Current (See Note 1 below)	Z : ZCT 5 : 5A
	⑦ Zero Sequence Voltage	- :
Optional specification	⑧ DI (See Note 2~5 below)	N : No need S : 8ch(DC110 or 220V)
	⑨ Communication (See Note 2 below)	N : No need M : Modbus F : IEC 61850 (100Base FX, LC conector, 2ch, multi-mode)
	⑩ Additional Function	N : No need
	⑪ Authentication	N : No need V : Korean Certification

(Note 1) Available combination of Phase current and Zero sequence current (for selection of No. ⑤ and ⑥) is as follows.

Base Unit	⑤Phase current	⑥Zero sequence current
CFP1-A41DI	5A	5A
	5A	ZCT
CMP1-A41DI	5A	5A
	5A	ZCT
CAC1-A41DI	5A	5A

(Note 2) Available combination of DI (No. ⑧) and communication (No. ⑨) is as follows.

Function	⑧DI(Digital Input)	⑨Communication
No Communication Function	N	N
Modbus Function	S	M
IEC61850 Function	S	F

(Note 3) 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 4) In case of selecting M for communication, 8 DIs are provide regardless of DI selection provided of N.

(Note 5) In case of selecting S in DI option (No.⑧), IIRIG-B is enabled as time synchronization.

(Note 6) Please contact the local agency about communication option (No.⑨) for IEC 61850 (2ch, RJ45 type).

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