Changes for the Better

MITSUBISHI ELECTRIC

MITSUBISHI Energy Measuring Unit

Visible, Energy Management

Fine energy measurement contributes to energy saving -cost saving

EcoMonitor Pro

Fine energy measurement contributes

Don't overlook waste of energy !

■ Measuring energy enables to visualize waste and loss of energy, and it supports energy saving activities.

1) For monthly result management
2) For departmental control of energy usage
3) For recording and managing energy data

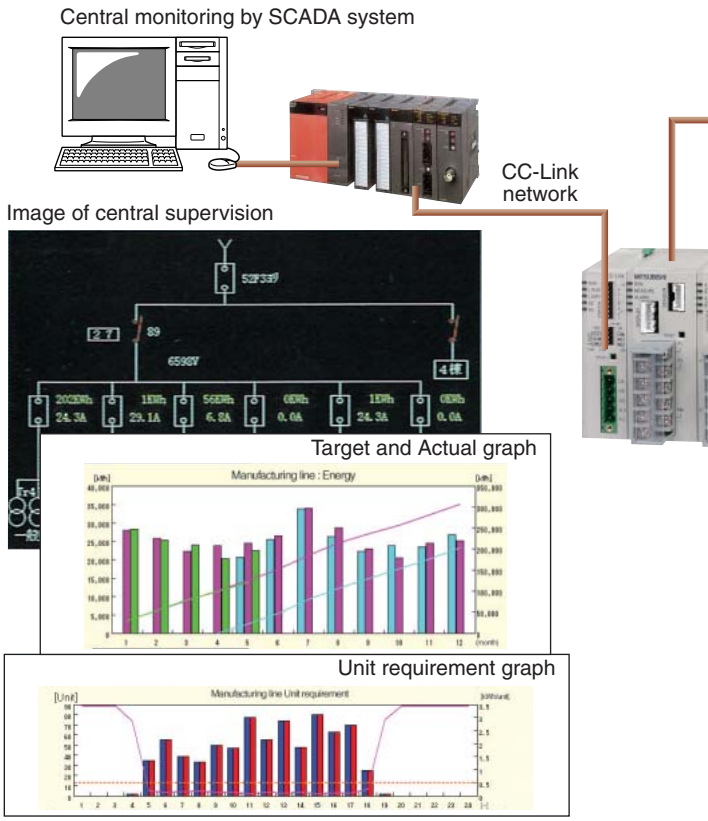
■ Double logging

Online Logging	Remote supervision by central supervisory system through CC-Link network

● CC-Link communication specification

Item	Specification
Transmission speed	10M/5M/2.5M/625k/156kbps
Communication system	Polling method
Synchronization system	Frame synchronization system
Encode system	NRZI
Transmission format	HDLC conformity
Number of occupied stations	1 (Remote device station)
Maximum connection numbers	Max.42 units*
Remote station number	1 to 64
CC-Link version	CC-Link Ver. 1.10
Connection cable	CC-Link Ver. 1.10 exclusive cable

*When the system consists only of Energy Measuring Units.



■ Product List

Product name	Model name		Note
Energy Measuring Unit	EMU2-RD3-F	3 circuits *1	For 1P2W or 3P3W Non communication
	EMU2-RD5-F	5 circuits *1	
	EMU2-RD7-F	7 circuits *1	
	EMU2-RD3-C	3 circuits *1	For 1P2W or 3P3W CC-Link communication
	EMU2-RD5-C	5 circuits *1	
	EMU2-RD7-C	7 circuits *1	
	EMU2-RD2-F-4W	2 circuits *2	For 3P4W Non communication
	EMU2-RD4-F-4W	4 circuits *3	
	EMU2-RD2-C-4W	2 circuits *2	For 3P4W CC-Link communication
	EMU2-RD4-C-4W	4 circuits *3	

*1 : Each circuits has its own voltage
*2 : Common voltage for 2 circuits
*3 : Common voltage for every 2 circuits

■ Peripheral equipment

Product name	Model
Display Unit	EMU2-D65
Logging Display Unit	EMU2-D65-M
Data collection computer kit	EMU2-PK3
Split type current sensor	EMU2-CT5
	EMU-CT100
	EMU-CT400
Current sensor cable	EMU2-CB1-DR
Extension cable	EMU2-CB-T1M
	EMU2-CB-T10M
	EMU2-CB-T1MS
	EMU2-CB-T10MS

to energy saving - cost saving

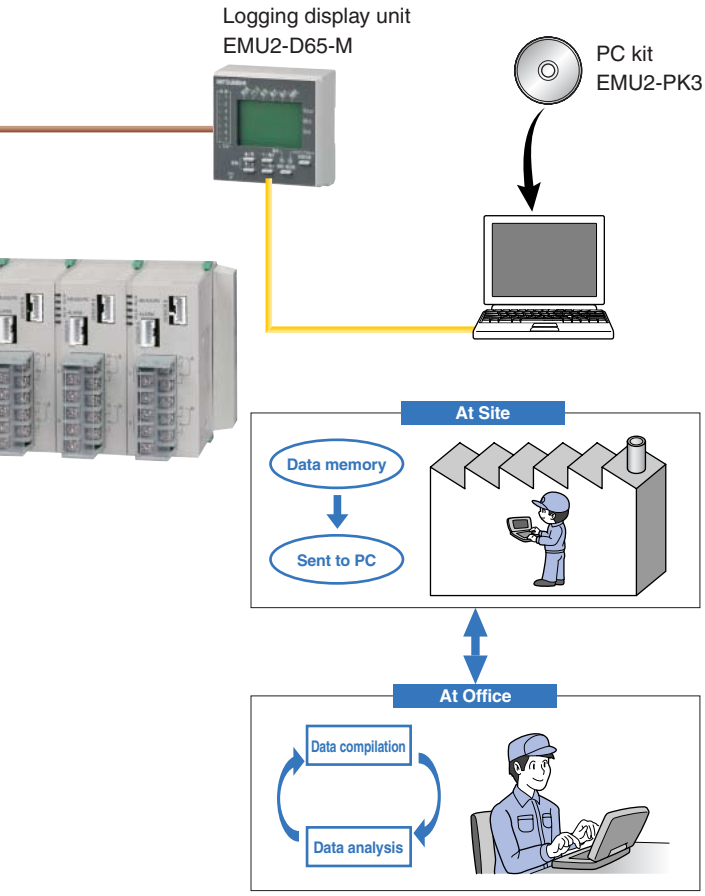
Unit control helps to improve productivity.

■ Obtain a basic unit by using energy usage and production quantity in a production line and facilities, and analyze it as a productivity index;

1) Analyze energy waste and loss in production line
2) Be aware of facility operation
3) Analyze for operation improvement, such as production process improvement and efficient operating condition

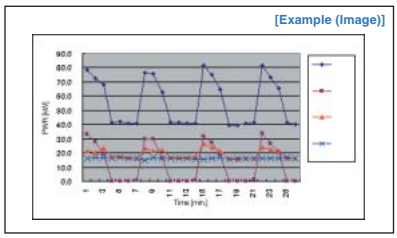
Offline Logging

Recording and saving data in logging display unit enables easy analysis for improving energy saving

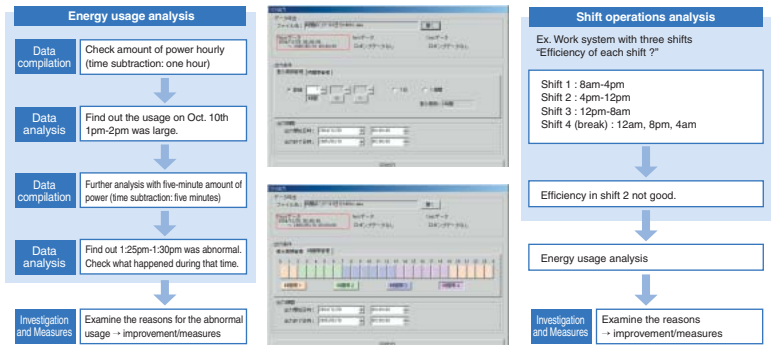


● Logging function (Logging display unit)

Logging cycle	1second, 1minute, 1hour		
Logging period	1second cycle	12hours	EMU2-RD3-*, EMU2-RD2-*-4W
		4hours	EMU2-RD5-*, EMU2-RD4-*-4W
		2hours	EMU2-RD7-*
	1minute cycle	10days	All product
	1hour cycle	131days	All product
Logging data	Wh + 3 optional data		



For example (Screen sample)

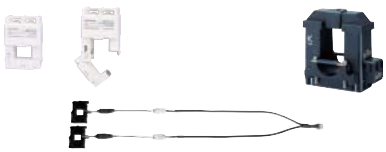


name	Note
	With Back light LCD, Panel mounting Logging : max 131days' hourly data
	For data analysis
EMU-CT50	Easy installation to existing facilities
EMU-CT250	
EMU-CT600	
EMU2-CB1-DR-4W	EMU2-CB1-DR-4W : For 3 phase 4 wires
EMU2-CB-T5M	
EMU2-CB-T20M	
EMU2-CB-T5MS	For 3 phase 4 wires

Display unit

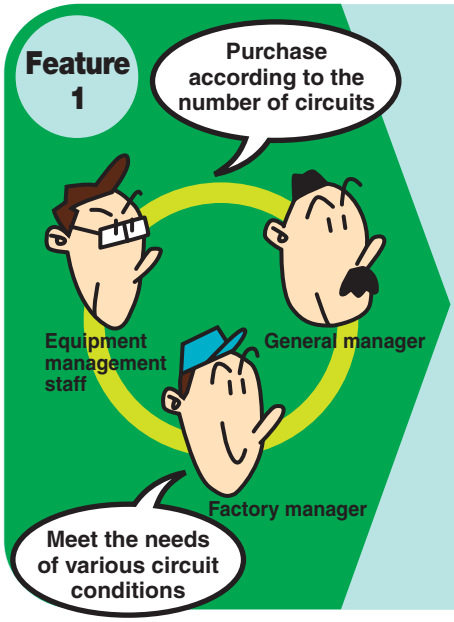
Logging display unit

Split-type current sensor



Wider range of product line-up con

Feature 1

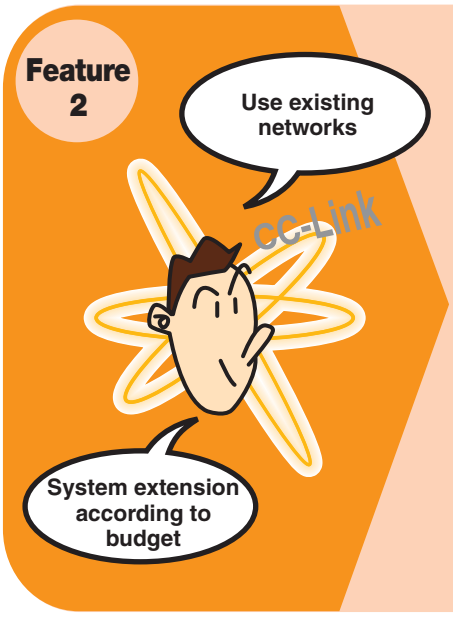


(1) Wide selection to suite the number of circuits

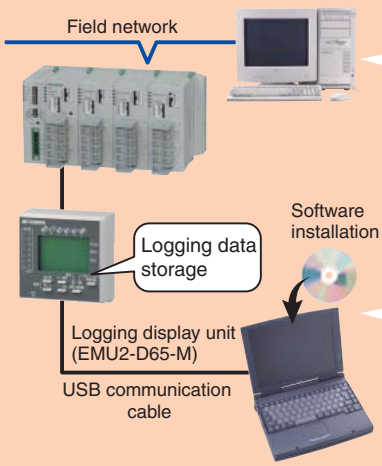
3P3W/1P2W

3P4W

Feature 2



(1) Central surveillance & energy saving analysis



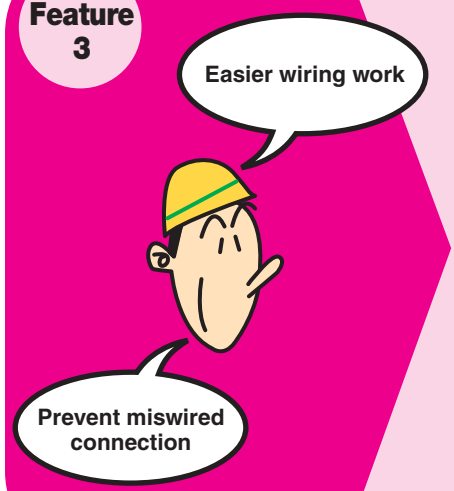
1. On-line logging (central surveillance)

- Constructing networks such as power energy management systems and sequencer networks

2. Off-line logging (energy saving analysis)

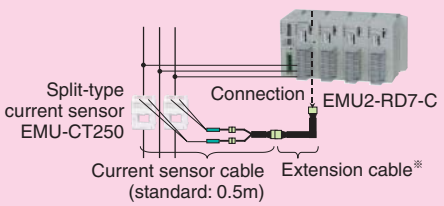
- Stored logging data collectable with a logging display unit and a PC kit (optional)

Feature 3



(1) Sensor cable

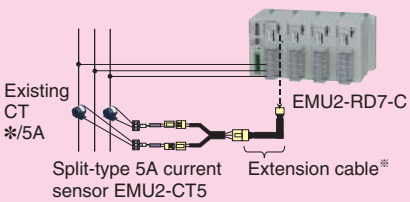
- **Adjustable to appropriate length**

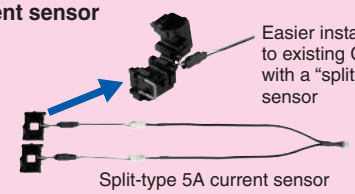


※ Max. 10m extension with an extension cable (1, 5, 10m)

(2) Split-type 5A current sensor

- **Easier installation by a split-type 5A current sensor**



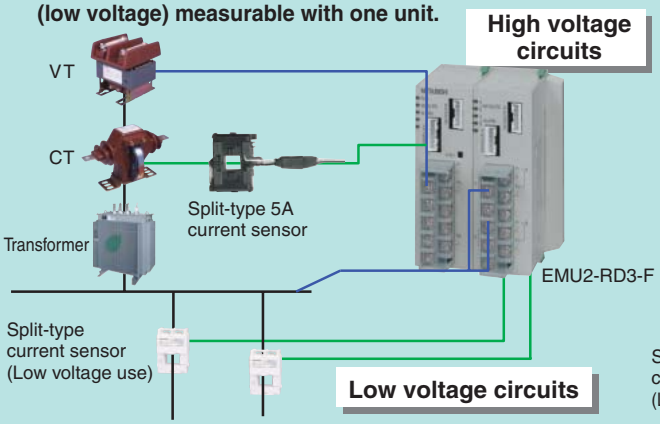


※ Max. 10m extension with an extension cable

tributes to active energy saving activities

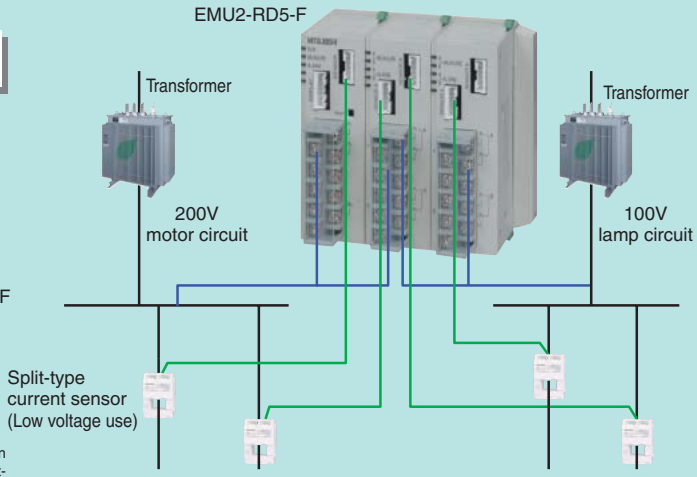
(2) Low voltage to high voltage

● **Low voltage use & high-low voltage common use – Measure incoming circuits (high voltage) and distribution circuits (low voltage) measurable with one unit.**



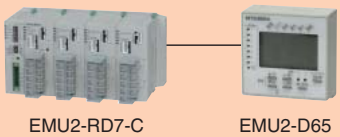
● When measuring high-voltage circuits, use Split-type 5A current sensor (EMU2-CT5) in combination with VT and CT. At this time, pass the secondary side of the CT through the split-type 5A current sensor.

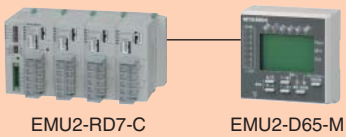
(3) Multiple transformer systems (different voltage, phase, wiring) measurable with one unit.



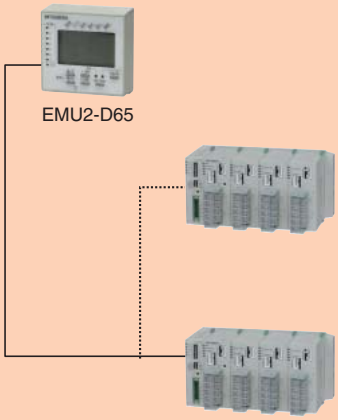
(2) Multiple circuits displayed with one display unit

● **Measuring data on multiple circuits displayable with one unit**





● **Display unit sharable**

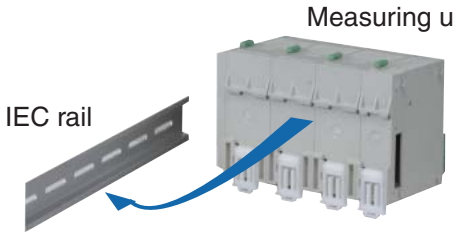


(3) Cassette-type communication modules

● **System extension possible by adding communication modules. (network compatible)**

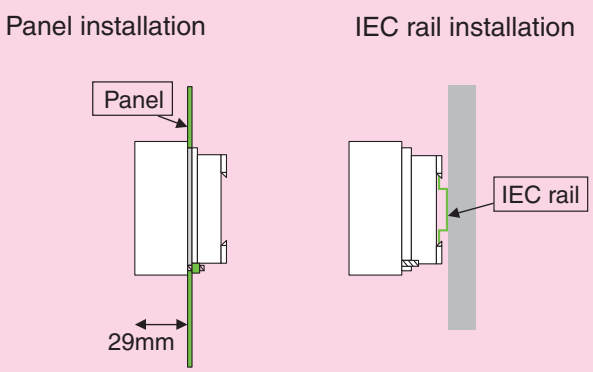
(3) IEC rail mounting

● **Simple construction by mounting on an IEC rail**



(4) Installation to a panel board

● **A display unit can be installed on an IEC rail or a panel board.** (Display unit / Logging display unit)



2. Product line-up

Measuring unit

Series	Model name	Outline	Number of circuits	Circuits		Communication	Upper/lower limit monitoring	Current					
								Instantaneous value	Demand	Demand (max/min)	Demand max/min occurence time	Instantaneous value	
1P2W/ 3P3W	EMU2-RD3-F		3	High/low voltage	1P2W 3P3W	None	●	●	●	●	●	●	
	EMU2-RD5-F		5										
	EMU2-RD7-F		7										
3P4W	EMU2-RD2-F-4W		2		3P4W								
	EMU2-RD4-F-4W		4										
1P2W/ 3P3W	EMU2-RD3-C		3		1P2W 3P3W	CC-Link							
	EMU2-RD5-C		5										
	EMU2-RD7-C		7										
3P4W	EMU2-RD2-C-4W		2		3P4W								
	EMU2-RD4-C-4W		4										

Accesories

(1) Split-type current sensor (for low-voltage circuit)

	Specifications				
Model	EMU-CT50	EMU-CT100	EMU-CT250	EMU-CT400	EMU-CT600
Rated primary current	50A	100A	250A	400A	600A

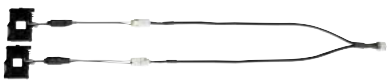
	Specifications	
Model	EMU2-CT5	EMU2-CT5-4W
Phase wire system	1P2W/3P3W	3P4W
Rated primary current	5A	

[Split-type current sensor]

50A, 100A, 250A

Split-state

400A, 600A



5A Current sensor (EMU2-CT5)

5A Current sensor (EMU2-CT5-4W)

Split-state

(2) Display unit

Model	Accessory
EMU2-D65	Connection cable (1m)

(3) Logging display unit

Model	Accessory
EMU2-D65-M	Connection cable (1m)

(4) Communication module

Model	Communication
EMU2-CM-C	CC-Link

Measuring items																Outline dimensions
Voltage			Active power				Reactive power	Active energy	Reactive energy	Power factor			Frequency	Harmonics current	Harmonics voltage	
	max/min	max/min occurence time	Instantaneous value	Demand	Demand (max/min)	Demand max/min occurence time				Instantaneous value	max/min	max/min occurence time				
	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Figure 1 (See P11)
																Figure 2 (See P11)

(5) Current sensor cable

Model	Length
EMU2-CB1-DR	0.5m
EMU2-CB1-DR-4W	0.5m (3P4W)

(EMU2-CB1-DR)

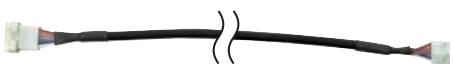
(EMU2-CB1-DR-4W)

(6) Extension cable

(Standard)

Model	Length
EMU2-CB-T1M	1m
EMU2-CB-T5M	5m
EMU2-CB-T10M	10m
EMU2-CB-T20M	20m

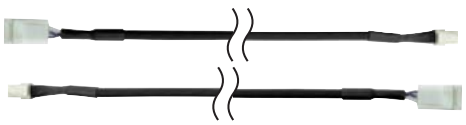
*Applicable to Display unit as Extension cable



(For 1, 5, 10, 20m)

(Separate type)

Model	Length
EMU2-CB-T1MS	1m (2 cables)
EMU2-CB-T5MS	5m (2 cables)
EMU2-CB-T10MS	10m (2 cables)



(For 1, 5, 10m)

(7) Data collection PC kit

	Specifications
Model	EMU2-PK3-EN
Contents	Data collection software (CD-ROM) USB communication cable (3m)

*Mitsubishi data collection computer kit for energy measuring unit (EMU2-PK3-EN)
Used in combination with logging display unit (EMU2-D65-M)

3. Specifications

Energy Measuring Unit

● ··· measurable (inel. max/min)　○ ··· measurable　— ··· unmeasurable

Items		Specifications									
Models		EMU2-RD3-F	EMU2-RD3-C	EMU2-RD5-F	EMU2-RD5-C	EMU2-RD7-F	EMU2-RD7-C	EMU2-RD2-F-4W	EMU2-RD2-C-4W	EMU2-RD4-F-4W	EMU2-RD4-C-4W
Measuring Elements	Active Energy	○						○			
	Reactive Energy	○						○			
	Current/Current Demand	●						●			
	Reactive Power	●						●			
	Power Factor	●						●			
	Frequency	○						○			
	Harmonic Current	●						●			
	Harmonic Voltage	○						○			
Upper/lower limit Monitoring	Demand Current	○						○			
	Voltage	○						○			
	Power Demand	○						○			
	Power Factor	○						○			
Phase wire		3-phase 3-wire Single-phase 2-wire						3-phase 4-wire			
Rating input	Voltage circuit (1P2W)	110/220V (*1)						—			
	Voltage circuit (3P3W)	110/220V (*2)						—			
	Voltage circuit (3P4W)	—						63.5/110V, 110/190V, 120/208V, 220/380V, 240/415V(*4)			
	Current circuit	50A, 100A, 250A, 400A, 600A (*5)									
		5A (with 5A current sensor) (*6)									
	Frequency	50Hz/60Hz (frequency auto-detect)									
Auxiliary power supply rating		100V-220V AC (+10%, -15%) 50Hz/60Hz									
Tolerance (*7)	Current/Voltage/Active Power/ Reactive Power/Frequency	±1.0% (to rating input)									
	Power Factor	±3.0%									
	Active Energy/Reactive Energy	±2.0% (5-100% of rating, power factor)									
	Harmonic current/Harmonic Voltage	±2.5% (to rating input)									
Data updating cycle		500ms									
		Wh value constantly accumulated (following short-cycle load fluctuations)									
Demand time limit setting		0, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1-15 min (per min), 20 min, 25 min, 30 min									
Power failure compensation	Wh/max.min values/Upper&lower limit values/Setting data	Stored in EEPROM (nonvolatile memory)									
	Clock	168 hours continuous operating at 25°C (*8)									
Clock accuracy		±1 min/month									
Connection to Terminal block	Auxiliary power terminal Voltage input terminal	Appropriate wire: 1.25 mm Appropriate crimp-type terminal:M3.5 use/up to ø 7.2 mm (eg. R1.25-3.5 bare round type)									
Conncection to Current sensor	Sensor cable	Dedicated cable used (optional)									
	Wiring length to Current sensor	Split type sensor : max. 50m Split type 5A sensor: max. 10m									
Consumed VA	Voltage circuit	0.1 VA/phase (110V AC) 0.2VA/phase (220V AC)									
	Current circuit	0.1 VA (on primary side of current sensor)									
	Auxiliary power supply circuit										
	100V AC	6.5 (8.0) VA	7.5 (9.0) VA	8.0 (9.5) VA	9.0 (10.5) VA	9.5 (11.0) VA	10.5 (12.0) VA	6.5 (8.0) VA	7.5 (9.0) VA	8.0 (9.5) VA	9.0 (10.5) VA
	220V AC	8.0 (9.5) VA	9.0 (10.5) VA	9.5 (11.0) VA	10.5 (12.0) VA	11.0 (12.5) VA	12.0 (13.5) VA	8.0 (9.5) VA	9.0 (10.5) VA	9.5 (11.0) VA	10.5 (12.0) VA
CC-Link communication	Number of occupied stations	—	1 station (Remote device)	—	1 station (Remote device)	—	1 station (Remote device)	—	1 station (Remote device)	—	1 station (Remote device)
	CC-Link version	—	1.10	—	1.10	—	1.10	—	1.10	—	1.10
Mounting		IEC rail mounting									
Working temparature		-5°C to 55°C									
Working humidity		30%-85% RH (no condensation)									
Storage temparature		-10°C to 60°C									
Withstand voltage		All electric circuits-outside box: 1500V AC/min									
		All current circuits (current sensor primary side)/Voltage circuits - Auxiliary power supply :1500V AC/min									
		All current circuits (current sensor primary side)/Voltage circuits - All output :1500V AC/min									
		All voltage circuits - All voltage circuits :1500V AC/min									
Insulation resistance		10MΩor more(same places shown above)									
Weight		0.6kg		0.8kg		1.0kg		0.5kg		0.7kg	

*1: Settable primary voltage:110V/220V/440V/3300V/6600V (for over 440V, VT necessary outside)
*2: Settable primary voltage:110V/220V/440V/3300V/6600V/22000V/33000V/66000V/77000V (for over 440V, VT necessary outside)
*3: Set primary voltage to 110V.
*4: Settable primary voltage:63.5/110V, 110/190V/, 120/208V, 220/380V, 240/415V, 254/440V (for 254/440V, $\frac{440}{\sqrt{3}}/\frac{110}{\sqrt{3}}$ V VT necessary)
*5: Current value of current sensor primary side when a split current sensor used. EMU-CT50/100/250/400/600 for low voltage only (circuit voltage under 440 V). Non usable for high voltage circuits
*6: 5A sensor used in combination with CT. Primary current settable: 5A/ 6A/ 7.5A/ 8A/ 10A/ 12A/ 15A/ 20A/ 25A/ 30A/ 40A/ 50A/ 60A/ 75A/ 80A/ 100A/ 120A/ 150A/ 200A/ 250A/ 300A/ 400A/ 500A/ 600A/ 750A/ 800A/ 1000A/ 1200A/ 1500A/ 1600A/ 2000A/ 2500A/ 3000A/ 4000A/ 5000A/ 6000A/ 7500A/ 8000A/ 10000A/ 12000A/ 20000A/ 25000A/ 30000A
*7: Current value indicated "0" for below 0.5% of rated current. Electric energy calculated with load more than 0.4% of all load power. Electric energy value indicated "0" for below 0.4% of all load power. Power factor indicated "1.000", when indicated voltage value 0 V or indicated current value 0 A.
*8: 168 hours is the compensation time for continuously energized condition for over 1 hour.

- Occurrence time of max /min value & simple demand value can be checked on a display unit (EMU2-D65/EMU2-D65-M), not retrievable through transmission (communication).
- Total current: For 1P2W circuit, Total current = Phase R current. For 3P3W/1P3W circuit, Total current = (Phase R current + Phase T current) /2
- Total voltage: For 1P2W circuit, Total voltage = R-S V, For 3P3W/1P3W circuit, Total current = (R-S V+S-T V) /2
- Max.current value: For a 3P3W circuit, largest value of R, S and T. For a 1P3W circuit, larger value of R and T.
- Min.current value: For a 3P3W circuit, largest value of R, S and T. For a 1P3W circuit, larger value of R and T.
- Max voltage value: For a 3P3W circuit, largest value of R-S, S-T and T-R. For a 1P3W circuit, larger value of R-S and S-T.
- Min. voltage value: For 3P3W circuit, largest value of R-S, S-T and T-R. For a 1P3W circuit, larger value of R-S and S-T.
- Harmonic current and harmonic voltage: RMS value and rate of harmonic content of 1st/3rd/5th/7th/9th/11th/13th measurable.
- When measuring mode set to high frequency details, max/min/occurrence time, upper/lower limit/ occurrence time not displayable.

*9: Please see programming manual about CC-link communication.

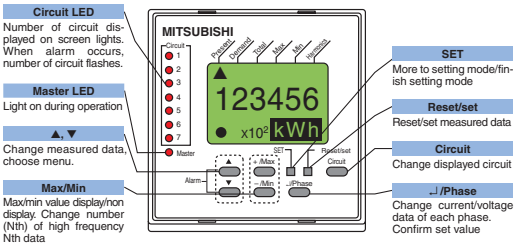
Accessories

Display unit/Logging display unit

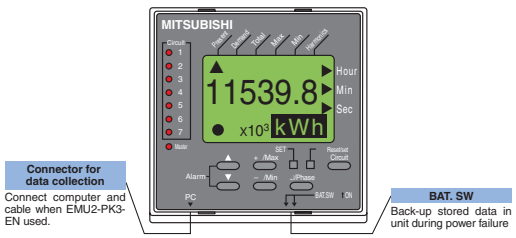
Specifications

Item			Specifications	
Model			Display unit EMU2-D65	Logging display unit EMU2-D65-M
Rating			9V DC	
Auxiliary power supply			—	
Consumed VA			—	
Display			LCD with backlight	
Renewal cycle of display			500ms	
Measuring value display	Wh + A + 4 items		electrical energy, current, 4 selected items	
	High frequency details		all measured data	
Alarm display	Alarm status		upper/lower limit alarm, voltage sag alarm status, relay output status	
	Alarm value		upper/lower limit alarm value/time upon occurrence, voltage sag alarm voltage value, time upon occurrence, length	
Settings	EMU setting		phase wire, primary vltage, primary current, sensor, demand time limit, pulse unit, measuring mode	
	Logging setting		—	logging items/logging operation
	clock setting		set built-in clock	set built-in clock in main body and display unit
	alarm setting		upper/lower limit alarm value, voltage sag level, voltage sag length	
	display setting		LCD contrast, backlight lighting	
Data reset			Max, min value/ upper,lower limit alarm value/voltage sag alarm value/ electrical energy, reactive energy, logging data	
Data preset			electrical energy/reactive energy	
Logging	logging cycle		—	1sec/ 1min/ 1hour
	logging period	1 sec data	—	1 circuit — 48 hours; 2 circuits/3 circuits — 12 hours; 4 circuits/5 circuits — 4 hours; 7 circuits — 2 hours
		1 min data	—	10 days
		1 hour data	—	131 days
	logging data		—	store logging data
			—	Wh + selected 3 items
Connection to energy measuring unit			with dedicated cable (included). max cable length: 10m	
Installation			IEC rail mounting/Panel mounting	
Working temparature			-5°C to 55°C	
Working humidity			30 to 80% RH (no condensation allowed)	
Storage temparture			-10°C to 60°C	
Weight			0.1kg	

Display unit



Logging display unit



CC-Link Communication

Item	Specifications
Transmission speed	10M/ 5M/ 2.5M/ 625k/ 156kbps
Communication system	Broadcast polling system
Synchronization system	Frame synchronization system
Transmission format	HDLC conformity
Number of occupied stations	1 (remote device station)
Number of units connected	Max 64 stations when constructed only with energy measuring units; the following conditions must be met 1: (1×a) + (2×b) + (3×c) + (4×d) ≤ 64 a: Number of units that occupy one station, b: Number of units that occupies two stations, c: Number of units that occupy three stations, d: Number of units that occupy four stations 2: (16×A) + (54×B) + (88×C) ≤ 2304 A: Number of Remote I/O station units ··· Max. 64 units A: Number of Remote device station units ··· Max. 42 units A: Number of Remote local stations, stand by master stations, intelligent device station units ··· Max 26 units

Item	Specifications
Remote station number	1-64
CC-Link version	CC-Link Ver. 1.10
Max. overall cable extension/ cable interstation cable length	Master station; Remote I/O Station or Remote Device Station; Remote I/O Station or Remote Device Station; Local station or Intelligent Device Station; Local station or Intelligent Device Station Inter-station cable leugth Max. overall cable extension leugth.
Connection cable	CC-Link Ver. 1.10 compatible cable (shielded 3 core twisted pair cable) *Mixture of cables from different manufacturers is possible, only when they are all Ver. 1.10 compatible cables.

CC-Link Ver.1.10 compatible cables(Using 110 Ω terminators)

Communication speed	156kbps	625kbps	2.5Mbps	5Mbps	10Mbps
Inter-station cable leugth	Over 20cm				
Max. overall cable extension leugth	1200m	900m	400m	160m	100m

*Refer to CC-Link organization website for more details.

Current sensor

(1)Split-type current sensor

Item	Specifications				
Model	EMU-CT50	EMU-CT100	EMU-CT250	EMU-CT400	EMU-CT600
Rated primary current	50A	100A	250A	400A	600A
Rate secondary current	16.66mA	33.33mA	66.66mA	66.66mA	66.66mA
Rated load	0.1VA				
Error ratio	±1% (5-100% of rating)				
Max. voltage	460V				
Rated overcurrent intensity	×40 of rated primary current (1sec)				
Weight	0.1kg			0.7kg	

(2) 5Acurrent sensor

Item	Specifications	
Model	EMU2-CT5	EMU2-CT5-4W
Appropriate circuit	1P2W/1P3W/3P3W	3P4W
Rated primary current	100A	250A
Rate secondary current	33.33mA	66.66mA
Rated load	0.1VA	
Error ratio	±3% (5-100% of rating)	
Max. voltage	460 V	
Rated overcurrent intensity	×40 of rated primary current (1 sec)	
Weight	0.3 kg	

Double-Logging

On-line logging (Central monitoring)

● **Setting up a network system**

Central supervisory possible by Double-Logging (off-line/on-line)

Off-line logging (Energy saving analysis)

● **Easy logging**

Measured data can be stored by connecting a logging display unit (optional) to an EcoMonitorPro.
Second/minute/hour-scale cycle data stored immediately.
Logging data can be collected with a PC kit (optional).

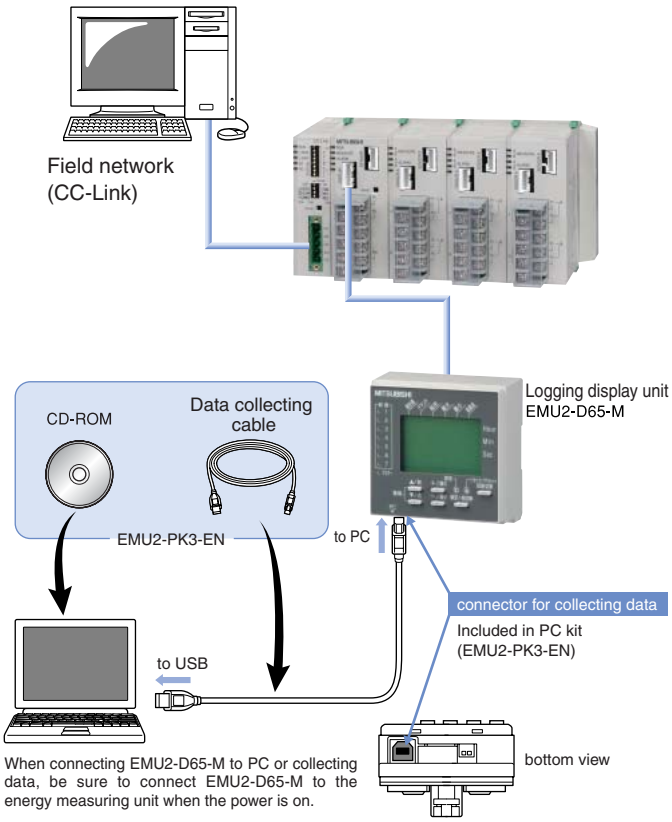
● **One-touch simple connection**

Directly connected to a PC without a network connection

● **Data collection**

Collect stored data on a PC and store them in the specified folder. Stored data (CSV file format) can be analyzed and processed.

*PC kit (EMU2-PK3-EN) required.



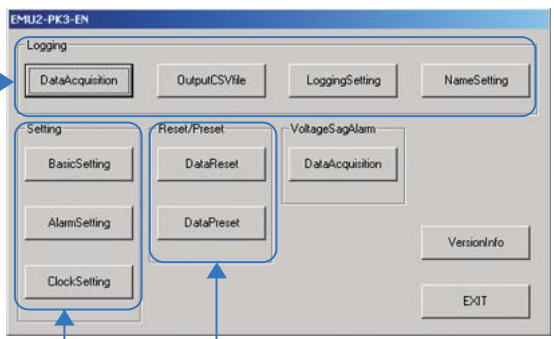
[Off-line logging]

■Maximum 3 items displayed (current/ voltage/ electrical power/ reactive power/ reactive energy/ power factor/ frequency/ harmonic current/ harmonic voltage), in addition to electric energy (fixed).

■Easy energy saving measurement & analysis by collecting logging data with a PC kit.

[Functions of PC kit]

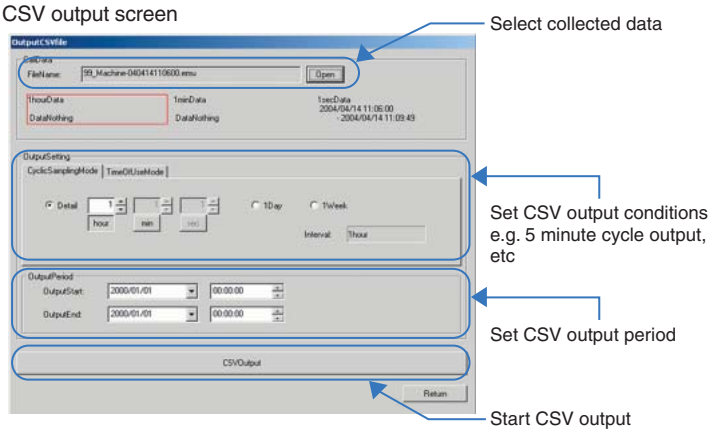
<Logging functions>
■Collect logging data stored by a logging display unit.
■Output collected data with CSV file format, edit and analyze with spreadsheet software such as Microsoft® Excel.



<Setting>
■Set energy measuring display unit.
■Retrieve setting information from energy measuring unit

<Reset/Preset>
■Reset logging data, max/min value, alarm value, electric energy and reactive power energy in a logging display unit.
■Preset electrical energy and reactive energy.

CSV output screen



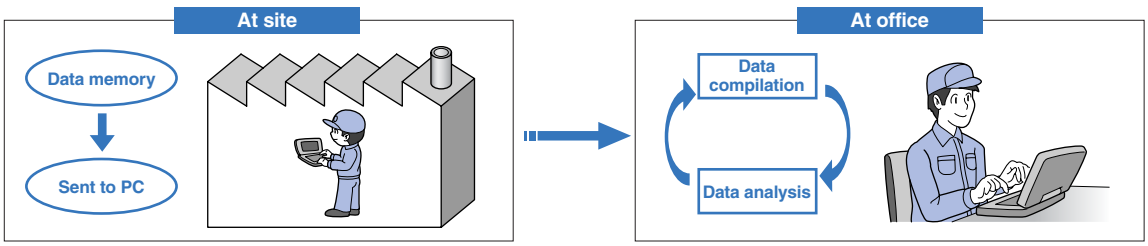
[PC kit hardware requirements]

Model	EMU2-PK3-EN
OS	Windows® 2000 Professional Windows® XP Professional Windows® XP Home Edition
CPU	Pentium®400MHz or higher
Memory	128MB or higher (256MB or higher recommended)
Connection with logging display unit	Connect with packaged dedicated cable (3m)

ment by Double-Logging (Off-line/On-line)

EcoMonitor Pro

Off-line logging

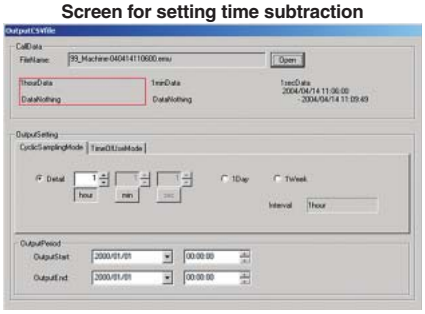


Example of use

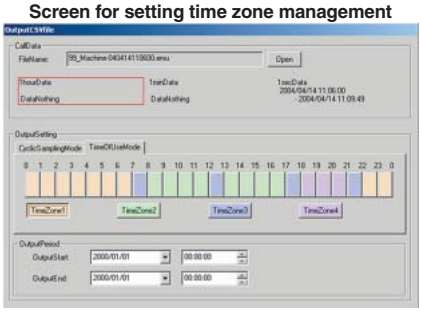
Energy usage analysis

Data compilation	Check amount of power hourly (time subtraction: one hour)
Data analysis	Find out the usage on Oct. 10th 1pm - 2pm was large.
Data compilation	Further analysis with five minute amount of power (time subtraction: five minutes)
Data analysis	Find out 1:25pm - 1:30pm was abnormal. Check what happened during that time.
Investigation/ measures	Examine the reasons for the abnormal usage → improvement/measures

Screen for setting time subtraction



Screen for setting time zone management



Shift operation analysis

e.g. Work system with three shifts
"Efficiency of each shift?"

Shift 1	: 8am - 4pm
Shift 2	: 4pm - 12pm
Shift 3	: 12pm - 8am
Shift 4 (Break)	: 12am, 8pm, 4am

→ Efficiency in Shift 2 not good.

→ Energy usage analysis

Investigation/ measures → Examine the reasons → improvement/measures

Data compilation & analysis with PC kit

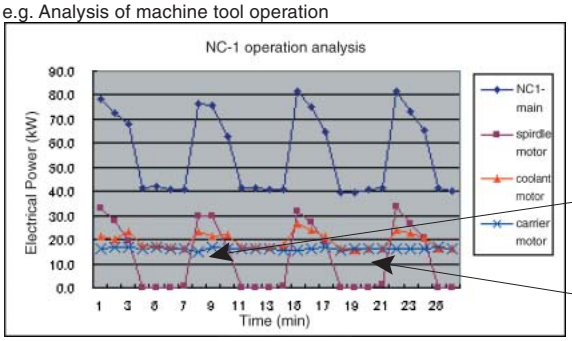
●Energy usage analysis Daily/ weekly/ monthly report: hourly usage
Detailed analysis: usage on every 5 mins/ every min.

As a weekly report [Example (image)]
■Use 1 hour data
■Period: 9/6/03 0:00 - 15/6/03 23:00
■Time subtraction: 1 hour

		Production line 1				Production line 2				Production line 3			
		Wh	Ar	Wh	cosθ	Wh	Vrms	cosθ	HA	Wh	Ar	As	Ar
		kWh	A	kW	—	kWh	V	—	A	kWh	A	A	A
2003/06/09	00:00:00	100.3	53.2	12.3	0.985	100.3	101.3	0.985	13.2	100.3	53.2	0	53.2
2003/06/09	01:00:00	122.2	62.3	12.3	0.985	122.2	101.3	0.985	0	122.2	62.3	2.4	62.3
2003/06/09	02:00:00	135.6	80.3	12.3	0.99	135.6	101.5	0.99	8.7	135.6	80.3	0.8	80.3
2003/06/09	03:00:00	111.3	77.3	12.3	0.985	111.3	101.2	0.985	9.3	111.3	77.3	1.2	77.3
2003/06/09	04:00:00	99.3	30.2	12.3	0.985	99.3	101.3	0.985	2.4	99.3	30.2	3	30.2
2003/06/09	05:00:00	32.3	20.5	12.3	0.985	32.3	101.6	0.985	0.9	32.3	20.5	0	20.5
2003/06/09	06:00:00	30.8	11.3	12.3	0.985	30.8	101.4	0.985	2.6	30.8	11.3	0.2	11.3
2003/06/15	23:00:00	10.5	9.5	12.3	0.987	3.8	101.4	0.987	2.6	2.6	2.1	0.2	11.3

●Facility operation analysis (investigation of process improvement) Every 10 sec/ every sec current change

As an investigation of process improvement (energy saving improvement) [Example (image)]
e.g. Analysis of machine tool operation



●Time zone analysis Analysis based on working shift
As a time-of-a-day operation

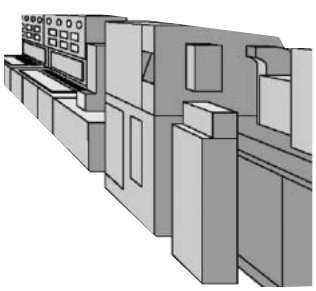
Day/night shift management & multi time zone management [Example (image)]
■Use hourly data
■Period: 9/10/03 - 24/10/03
■Time subtraction: specified time (Zone 1: 8:00 - 18:00, Zone 2: 19:00 - 7:00)

	1F lighting		2F lighting		3F lighting	
Time zone	1	2	1	2	1	2
	kWh	kWh	kWh	kWh	kWh	kWh
2003/10/09	100.3	53.2	100.3	101.3	100.3	53.2
2003/10/10	122.2	62.3	122.2	101.3	122.2	62.3
2003/10/11	135.6	80.3	135.6	101.5	135.6	80.3
2003/10/12	111.3	77.3	111.3	101.2	111.3	77.3
2003/10/13	99.3	30.2	99.3	101.3	99.3	30.2
2003/10/14	32.3	20.5	32.3	101.6	32.3	20.5
2003/10/15	30.8	11.3	30.8	101.4	30.8	11.3
2003/10/16	99.3	30.2	99.3	30.2	99.3	30.2
2003/10/17	32.3	20.5	32.3	20.5	32.3	20.5
2003/10/18	30.3	11.3	30.8	11.3	30.8	11.3
2003/10/19	99.3	30.2	99.3	30.2	99.3	30.2
2003/10/20	32.3	20.5	32.3	20.5	32.3	20.5
2003/10/21	30.8	11.3	30.8	11.3	30.8	11.3
2003/10/22	99.3	30.2	99.3	30.2	99.3	30.2
2003/10/23	32.3	20.5	32.3	20.5	32.3	20.5
2003/10/24	30.8	11.3	30.8	11.3	30.8	11.3

* Output electric power data only for time zone management

•Average power for carrier & coolant motor bigger than spindle motor
→Energy saving

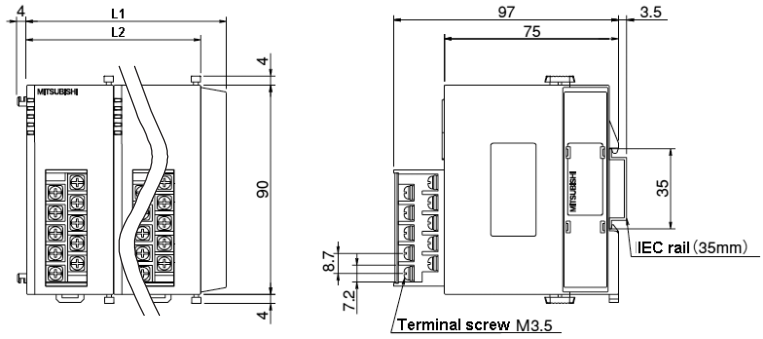
•Carrier motor always working
•Coolant solution running while not cutting



5. Outline dimensions

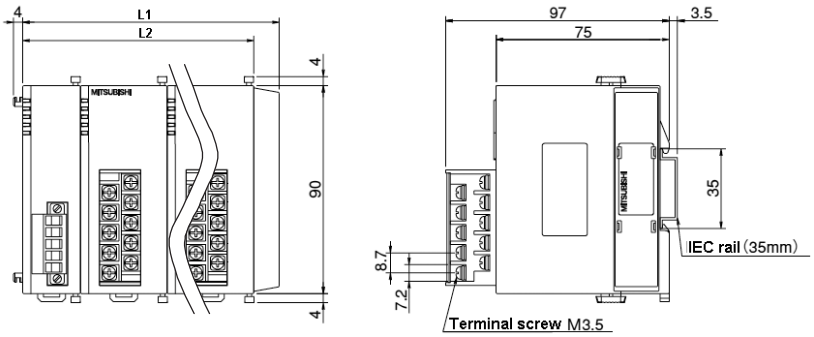
Measuring Unit

Model : EMU2-RD*-F
EMU2-RD*-F-4W



Model name	L1	L2
EMU2-RD3-F EMU2-RD2-F-4W	86	75
EMU2-RD5-F EMU2-RD4-F-4W	123.5	112.5
EMU2-RD7-F	161	150

Model : EMU2-RD*-F
EMU2-RD*-F-4W



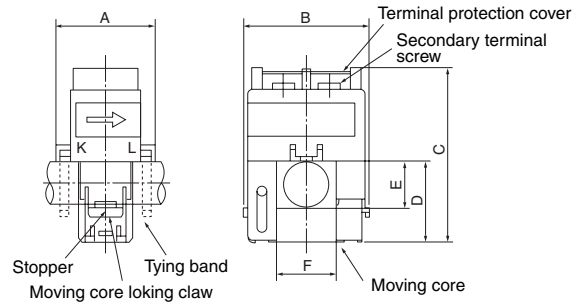
Model name	L1	L2
EMU2-RD3-C EMU2-RD2-C-4W	111	100
EMU2-RD5-C EMU2-RD4-C-4W	148.5	137.5
EMU2-RD7-C	186	175

Unit : mm

Accessories

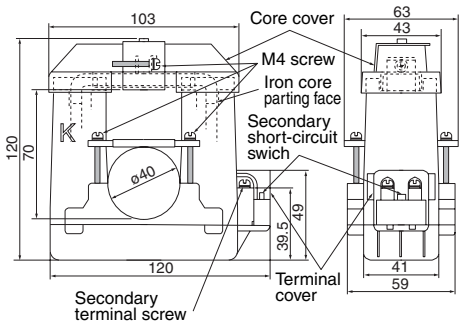
① Split-type current sensor (for low voltage circuit use only)

50A,100A,250A current sensor
Model : EMU-CT50,EMU-CT100,EMU-CT250

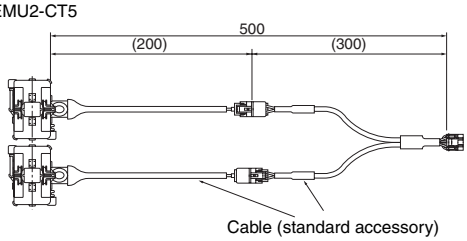


Model	A	B	C	D	E	F
EMU-CT50/CT100	31.5	39.6	55.2	25.7	15.2	18.8
EMU-CT250	36.5	44.8	66	32.5	22	24

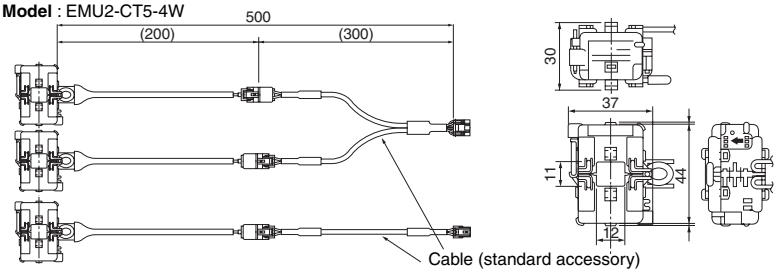
400A,600A current sensor
Model : EMU-CT400,EMU-CT600



5A Current sensor
Model : EMU2-CT5

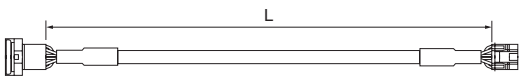


Model : EMU2-CT5-4W



② Extension cable

Standard type
Model : EMU2-CB-T1M,EMU2-CB-T5M,EMU2-CB-T10M,EMU2-CB-T20M



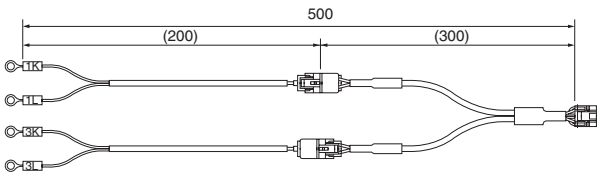
Model	Length	Model	Length
EMU2-CB-T1M	1m	EMU2-CB-T10M	10m
EMU2-CB-T5M	5m	EMU2-CB-T20M	20m

Separate type
Model : EMU2-CB-T1MS,EMU2-CB-T5MS,EMU2-CB-T10MS

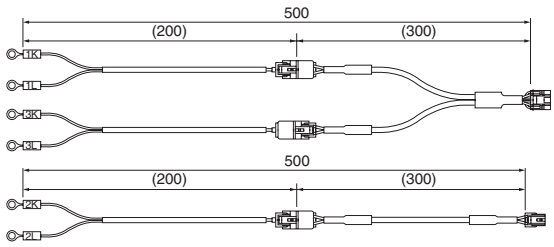
Model	Length	Model	Length
EMU2-CB-T1MS	1m	EMU2-CB-T10MS	10m
EMU2-CB-T5MS	5m		

③ Current sensor cable

Split-type current sensor cable
Model : EMU2-CB1-DR

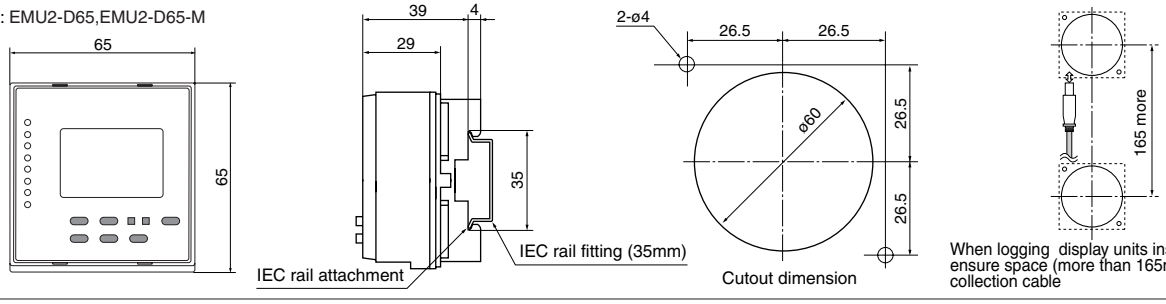


Split-type current sensor cable (3P4W)
Model : EMU2-CB1-DR-4W



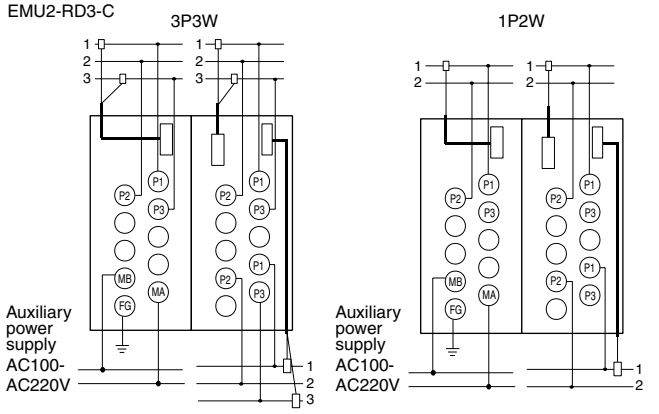
④ Display unit/Logging display unit

Model : EMU2-D65,EMU2-D65-M

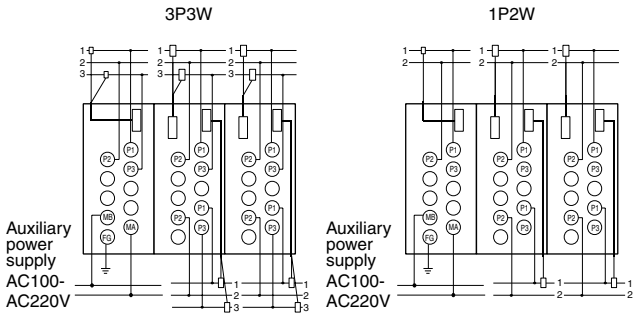


6. Terminal arrangement/ connection diagram

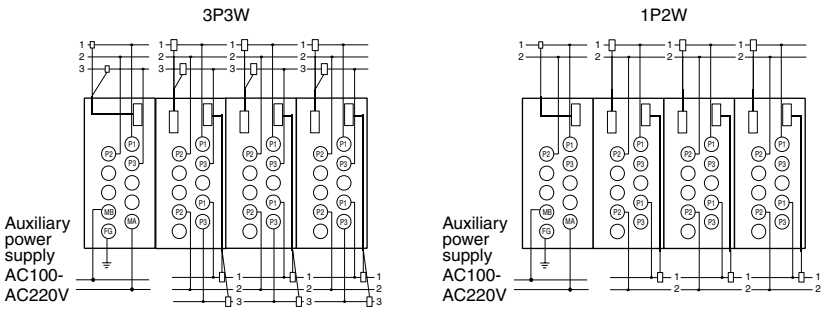
EMU2-RD3-F
EMU2-RD3-C



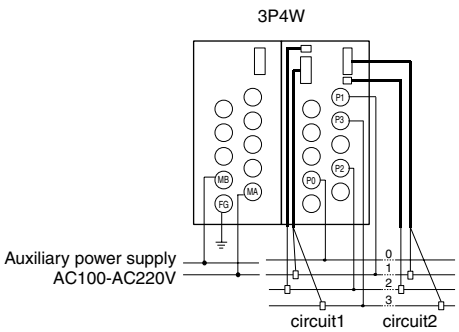
EMU2-RD5-F
EMU2-RD5-C



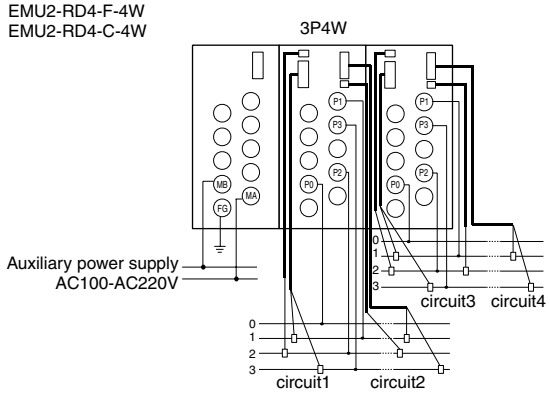
EMU2-RD7-F
EMU2-RD7-C



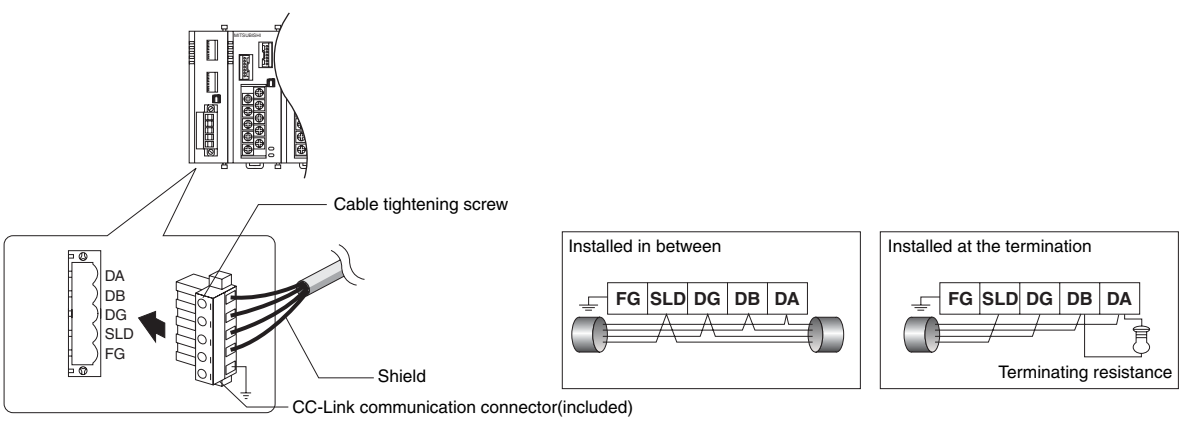
EMU2-RD2-F-4W
EMU2-RD2-C-4W



EMU2-RD4-F-4W
EMU2-RD4-C-4W



[CC-Link communication]



Safety precantions

Before installing the unit, read the instruction manual thoroughly and use the unit properly. Be sure to deliver the instruction manual to the end user.

(1) Working environment and working conditions

Do not use the unit in any of the following places. Doing so may cause malfunctions or a reduction in service life.

- Places where the ambient temperature exceeds the temperature range (-5°C to 55°C)
- Places where the daily average temperature exceeds 35°C
- Places where the humidity exceeds the humidity range (30% to 80%RH) or where condensation occurs
- Places with a lot of dust, corrosive gas, salt or oily smoke
- Places with a lot of vibration or impacts
- Places where the unit may be exposed to rain or drops of water
- Places exposed to direct sunlight
- Places where metal pieces or inductive substances are laying around
- Places with strong electromagnetic field or much outside noise
- Places higher than 1000 m above sea level

(2) Preparation before use

- Ensure that the working environment and working conditions in the installation location conform to the specifications.
- When constructing a network with transmission and communication connection, it is necessary to set the address. Set the phase and wire system, primary voltage and primary current.

When setting, it is necessary to use the optional small display unit (EMU2-D65), large display unit (EMU2-D110), logging display unit (EMU2-D65-M) or small setting unit (EMU2-S50)

(3) Installation and connection

Before installing and connecting the unit, read the instruction manual without fail. For safety, the unit must be installed and connected by experts in electrical work.

⚠ Caution

[Precautions for work]

- Perform wiring work with current off and do not perform live wire operations. Doing so can cause electric shocks, ground faults, unit failures and fires.
- When threading and wiring, take utmost care that cuttings and wire pieces do not enter the unit.
- Connect the wires carefully, checking the wiring diagram. Incorrect wiring can cause unit failures, fires and electric shocks.
- To prevent noise, do not lay the transmission signal lines and input/output signal lines close to any power line or high-voltage line, and do not attach to these lines.
- Keep the dust-prevention sheet on the unit while wiring. After the completion of wiring, be sure to remove the sheet.
- When opening and closing the terminal cover, take care not to put excessive stress on the cover.

[Connection of terminal block]

- Use appropriate size of electric wire (1.25 mm^2). Use of improper sized wire can cause fires due to heat generation.
- Use crimp-type terminals appropriate to the wire size (bare round terminals for M3.5, with overall size not exceeding 7.2 mm). Use of improper terminals can cause unit malfunctions, failures, burnouts and fires due to wire breaking and contact failure.
- Tighten the M3.5 screws to the specified torque (0.49 to 0.78 N·m). Excessive tightening can damage the terminals and screws.
- After tightening, be sure to check that all screws have been tightened. Failure to tighten any screw can cause unit malfunctions, fires and electric shocks.

[Connection with current sensor]

- Be sure to use this product in combination with the dedicated current sensor.

EMU-CT50/100/250/400/600 units are designed for low-voltage circuits (maximum voltage of 460 V). These models are not suitable for high-voltage circuits. When using EMU2-CT5, pass the secondary side (5 A) of the current transformer through the sensor. The sensor can be connected directly to circuits of up to 200V (maximum voltage 260 V). Connecting to a high-voltage circuit by mistake may cause burnout of the unit or fire, resulting in a hazardous situation.

- The current sensor is bi-polar (directionality). When installing, check the polarity.
- When the unit is used for a single-phase 3-wire circuit or a 3-phase 3-wire circuit, two current sensors are necessary.
- One dedicated current sensor cable can connect two current sensors.
- Connect the unit and current sensor(s) with the dedicated cable.

[Connection of FG terminal]

- For practical use, ground the FG terminal.
- Do not connect the FG terminal when performing insulation resistance test or withstand voltage test.
- If high-voltage is applied between MA and FG and between MB and FG by withstand voltage test etc., the protective element device will be destroyed and short-circuit MA-FG, and MB - FG.

(4) Instructions for use

- This product should not be used for the purpose of trading or certification of electric energy regulated by the Measurement Law.
- This unit has a built-in clock. Set the clock (current date and time) prior to use. The accuracy of the clock is ±1min/month.
- Before operating the unit, check carefully that there are no bare electric wires in a live state around the unit. If there are bare wires around the unit, immediately stop operation and take proper measures, such as insulation protection.
- If the clock or any other parameter is set, or any setting is changed, the consistency with the currently retained data on time of occurrence of maximum and minimum values, values upon occurrence of alarms and time of occurrence of alarms may not be ensured. In this case, reset the maximum value, and clear the time of occurrence of maximum value.
- If a power failure occurs during setting from the display unit or the transmission line to the main body, values cannot be set correctly. Set the values again after power is restored.

⚠ Caution

- Do not disassemble or modify this product. Doing so can cause failure, electric shocks or fires.
- Use the unit within the rated range stated here. Using the unit out of the rated range may cause not only malfunctions or unit failure, but also fires or burnout.
- A protective current with the open secondary terminal is fitted on the secondary side of Models EMU2-CT5 and EMU-CT50/100/250. Opening the terminal during wiring work will cause no problems. However, for safety, do not continuously apply current with the terminal in the open state.
- Though EMU-CT400/600 current sensors dedicated for this unit and CW-5SL split-type current transformers for measuring meters have similar outline dimensions, their characteristics are totally different. Be sure to use the appropriate dedicated current sensor. If CW-5SL is connected directly to this unit, unit failure, burnouts or fires may occur.

(5) Instructions for maintenance

- Wipe the dirt from the surface with soft dry cloth. Do not keep wipe in contact with the surface or use benzene or thinner.
- Check the following points to ensure proper long-term operation of the unit.
  ① Check the product for damage.
  ② Check for abnormal indication on LED lamps.
  ③ Check for abnormal noise, odors and heat generation.
  ④ Check for loose fittings and loose wires on the terminal block.
  (Perform the check ④ in the power off. Failure to do so can cause electric shocks, unit failure or fires)

(6) Instructions for storage

When storing the unit, turn off power, disconnect cables and wires, and put them in vinyl bags or the like.

When storing the unit for a long time, avoid keeping it in the places shown below. Doing so may result in failure or a decrease in service life.

- Places where the ambient temperature is out of the range from -10°C to 60°C.
- Places where the humidity exceeds the humidity range (30% to 80%RH) or where condensation occurs
- Places with a lot of dust, corrosive gas, salt or oily smoke
- Places where the unit is exposed directly to rain, water droplets or sunlight
- Places where the daily average temperature exceeds 35°C
- Places with a lot of vibration or impact
- Places where metallic particles or inductive substances are laying around

(7) Packing materials and instruction manual

To reduce the effect on the environment, a cardboard box is used for packing, and the instruction manual is printed on recycled paper.

Attention

- This document and this unit are delivered after strict quality control and product inspection. If the unit or instruction manual should have any defect caused by inadequate manufacture, it will be replaced with a new one. Contact the store where the unit was bought. However, failure or damage caused by act of providence or incorrect usage shall not be covered by the warranty.
- Understand that we are not liable for any problems of the system caused by the customer or any third party, legal problems, failure or damage caused by improper use or during use of the unit and damage caused by other nonconformance.
- The product is warranted without charge for a year after the day of purchase or delivery to the designated place or within 18 months after the day of shipment from our plant (reckoned from the date of manufacture), whichever comes first.
- The term of free warranty will not be renewed for a repaired product.
- It is prohibited to reprint or copy part or all of this document in any form without our permission.
- The contents of this document will be updated to follow revisions to software and hardware, however under unavoidable circumstances it maybe not be synchronized.

Mitsubishi Energy Measuring Unit

Service network

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Vietnam	Sa Giang Techno Co., Ltd.	207/4 Nguyen Van Thu St., Dist 1, Ho Chi Minh City, Vietnam	848-821-6453

Safety Tips : Be sure to read the instruction manual fully before using this product.

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