



BRANCH CIRCUIT POWER METER

ISOIST Wi-GEM



Wireless Green Energy Meter

USER MANUAL



J&D SMART SENSING

◆ **Thank you for purchasing this product.**

1. First of all, be sure to read this manual for correct use of the product.
2. If you find any missing contents or error, please inform us.
3. J&D electronics assumes no responsibility for any direct or indirect loss or damage which may occur through use of this product, regardless of any failure to perform on the part of this product.

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■ General Information

1. Certification related

This product has been designed to comply with the following standards and directives :

- IEC 61010_1 : 2001 (Safety Specification)
- FCC Part 15, Class B
- FCC Part 15, Class C



For more details, see this manual.

2. Labeling

The label including the model name, identification number and etc. is placed on the back cover, The identification number of each device is placed on the bottom center of the back cover.

3. Glossary

- Wi-GEM (Wireless Green Energy Meter) : Product name that consists of EMU, EMC, and EMR.
- EMU (Energy Meter Unit) : Energy meter that collects the required electrical parameters.
- EMC (Energy Meter Coordinator) : The network gateway.
- EMR (Energy Meter Router) : Router between EMU and EMC.
- RTC (Real Time Clock)
- Modbus : Communication protocol.
- L1/L2/L3/N : In case of 3phase 4wires, L1/L2/L3/N indicates the phases of power source. In case of 3phase 3wires(2CT), only L1/L2/L3 exist. In this manual, we use L1, L2, L3, and N.

4. Safety instructions



DANGER

If you do not follow the instructions in this manual, it may cause serious accidents.

- Only qualified persons from the manufacturer or agent must handle the inside components of the product.
 - Owners, maintenance and service personnel, managers, operators, setters, programmers, foremen, mechanics, and all personnel related to these products must read and strictly follow the safety instructions in this manual.
-

Please read the following warnings and cautions to prevent injury or damage to the product.



DANGER

This symbol alerts that ignoring an instruction or incorrect action may cause a death or serious injury.



WARNING

This symbol alerts that ignoring an instruction or incorrect action may cause minor injury or damage to the product.



CAUTION

This symbol alerts that ignoring an instruction or incorrect action may cause a Product malfunction or data or property loss.



CAUTION

This symbol risk of electric shock.



This symbol means protective conductor terminal.



This symbol means alternating current.



This symbol means both direct and alternating current.



This symbol means direct current.

5. General description

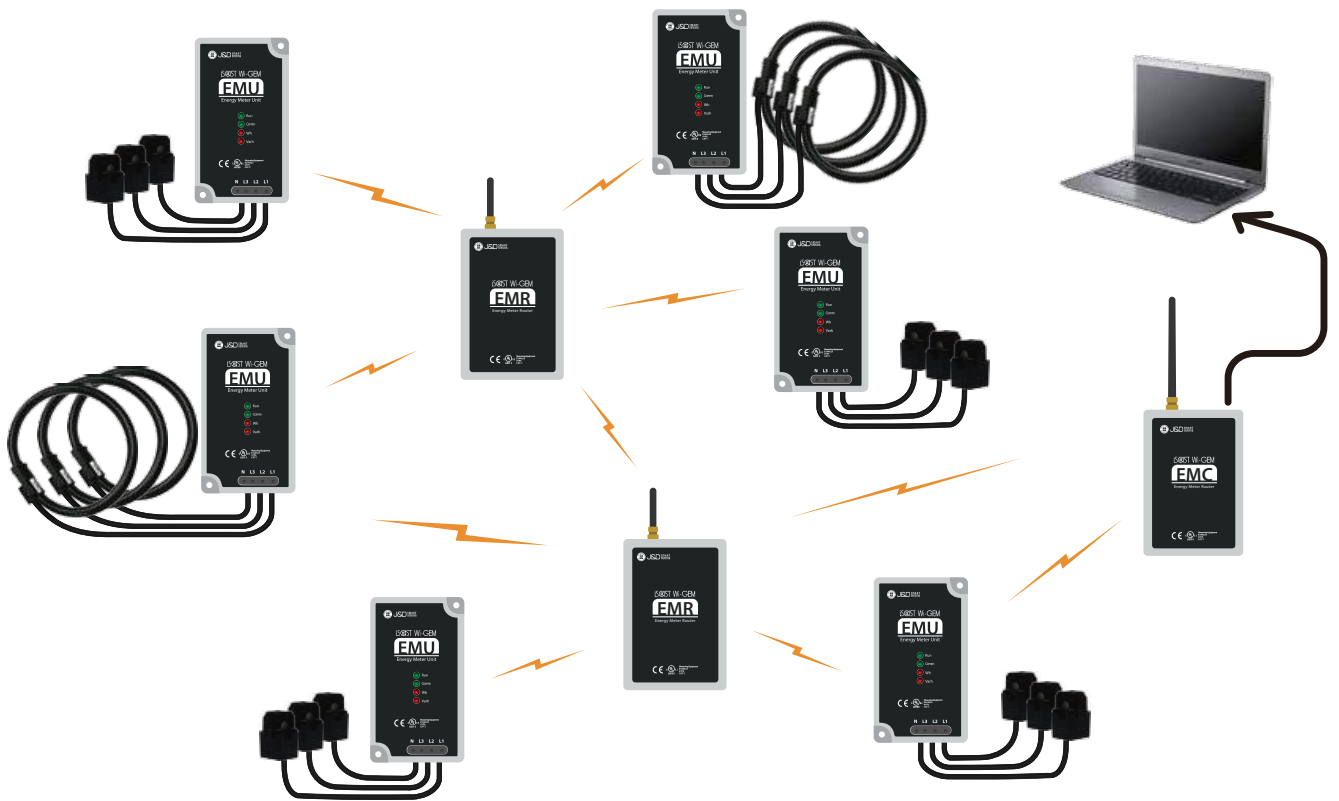


Figure 1.1 Communication Concept Diagram

To reduce power consumption or carbon emission, detailed power measurement for each process, line, and device is required.

By installing Wi-GEM, detailed power measurement is enabled. Wi-GEM also can perform the following :

- Measurement of voltage, current, active/reactive power, apparent power, power factor, and frequency
- Measurement of peak power
- Simultaneous event monitoring and storing for instantaneous low-voltage and over-current

Because we open the Modbus protocol and register map for measurement, you can easily build your own system.

5.1 EMU (Energy Meter Unit)

EMU is the energy meter that collects the required electrical parameters at the specific interval after its sensors are fixed on the power cable. A single EMU can also be connected to a computer for analysis.

An EMU can have 2 sensors that measure the electrical parameters for 3phase 3wires(L1/L2/L3).

An EMU can have 3 sensors that measure the electrical parameters for 3phase 4wires(L1/L2/L3/N).

It can support wirings for single phase, 3phase 3wires, and 3phase 4wires.

Communication is possible by a single EMU or multiple EMUs.

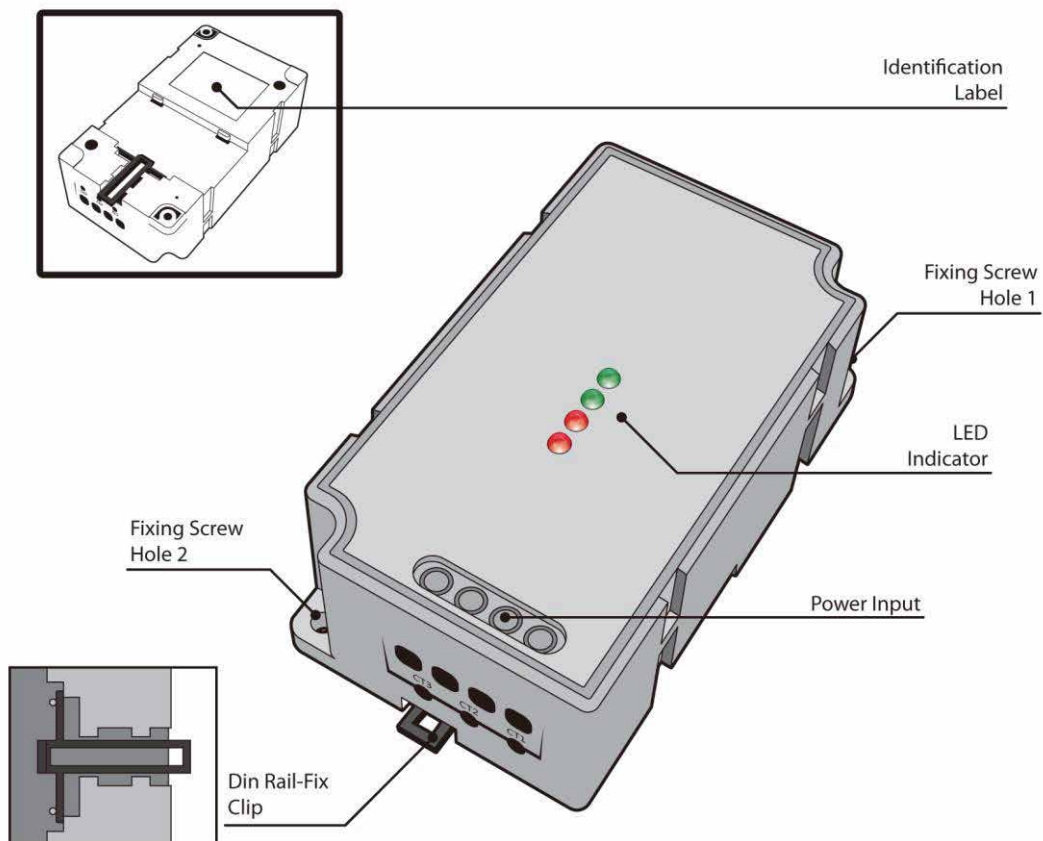
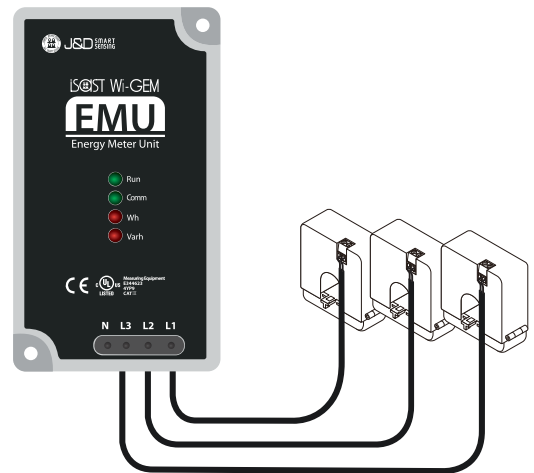


Figure 1.2 EMU Parts

NAME	DESCRIPTION
DIN Rail Fix Clip	To fix EMU onto a DIN rail, use this clip on back cover.
Fixing Screw Hole 1&2	To fix EMU on a wall of the distribution panel, insert screws in these holes and fasten them.
Product Label	The product label is placed here.
Identification Label	The label is attached on the back cover. The ID can be set using the DIP switches or using a program. in case of using Dip switches, the maximum number of IDs is 63. With the program, maximum 255 IDs can be set while all DIP switches are off.
LED Indicator	It displays the current status. It can display various statuses.
Power Inputs	For 3phase 4wires, Connect power input sources (L1, L2, L3, and N) For single phase, connect power input sources (L1, N) For 3phase 3wires(2CT), connect power input sources (L1, L2, L3)
Zigbee	If EMU needs to be directly connected to a PC, use the RS485 connection port. Connect P+ and N- of EMU with the USB port on a PC via the connector. It supports Zigbee or RS485 communication.

Main features of EMU are as follows :

- Measuring instantaneous values for voltage, current, active power, reactive power, and apparent power of each phase
- Measuring accumulative values for active energy and reactive energy, apparent energy of each phase, and the total of each phase.
- Measurement of frequency : 50/60Hz
- Wide operating voltage : phase voltage 100 to 250 V~, L1-N
- Measurement of wide input voltages : Max. 250V Vrms, 3~, CAT III
- Measurement of input currents using the split core CT : 5A ~ 2500A
- Measurement of input currents using Rogowski coil : 250A ~ 5000A
- Power consumption : 2W
- Isolation : Isolation class II, IEC61010-1 CAT III Vrms

- Measurement category : CAT III
- Environment : Indoor use
- Ambient operating temperature : -10 to +55 °C
- Ambient storage temperature: -25 to + 85 °C
- Mass : 160g
- Maximum altitude : 2000m
- Pollution degree : 2
- Degree of protection : IP20
- 2.4 GHz wireless ZigBee module
- Data logging into a PC
- Time stamps for each transmission data
- Logging interval: 1, 2, 3, 5, 6, 10, 15, 30, 60 minutes
- Easy installation and DIN rail mounting
- Modbus protocol
- Economic price
- A management program to be developed at user's taste
- Voltage THD & Current THD
- Voltage & Current Individual Harmonics 2nd~ 63rd
- IEC62053-21 Class 1.0, IEC62053-22 Class 0.5

5.2 EMC (Energy Meter Coordinator)

EMC (Energy Meter Coordinator) is the gateway that controls the wireless network and periodically gathers the collected data from EMUs. It can be accessed by an application program for data analysis. The program shows the power-related values such as voltage, current, frequency, etc. It is connected with PC via the USB cable.

EMC has the following parts :

NAME	FUNCTION
Fixing Screw Hole 1&2	To fix EMC on a wall, insert screws in these holes and fasten them.
Antenna	Used for wireless communication.
DC Jack	5V DC
RJ45 Connector	Used to connect EMC with a PC. EMR does not have this port.
Product Label	The product label is placed.



Figure 1.3 EMC

5.3 EMR (Energy Meter Router)

EMR is the router that relays the data between EMU and EMC. It is automatically detected by an EMC. An EMC can connect EMRs up to 255 logically.

EMR has the same shape as EMC except for USB connection port to a PC. EMR has no connection port. The adapter that is used to supply power must have been evaluated by UL. The DC power to EMR can use the DC adapter for 5 to 9 V.



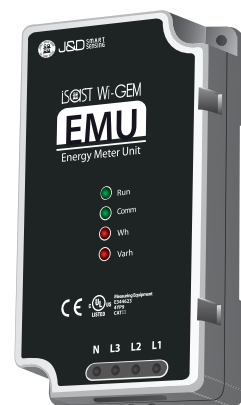
5.4 Handling multiple EMUs using Zigbee

If multiple EMUs need to be monitored and controlled, the collected data can be transferred to a wireless EMR via the wireless Energy Meter routers (EMR) as shown in Figure 1.1. Otherwise, an EMR is directly connected to an EMU.

Each individual EMU has its own unique ID that can be set using the DIP switches inside EMU. Otherwise, users can use the factory default settings.

The network communication has been implemented following the ZigBee specification. The communication features are:

- RF wireless frequency : 2.4 GHz
- IEEE 802.15.4 compliant radio
- RF Data rate : 250 kbps
- Indoor Range : up to 60m
- Outdoor RF line-of-sight Range : up to 1500m
- Transmit output power : 10mW
- Receiver Sensitivity : -102dBm



Available network configurations are :

- Single path network topology : EMC is connected to an EMR (with an EMU) that is connected to another EMR (with an EMU).
- Star-network topology : EMC is connected to multiple EMUs.
- Mesh network topology

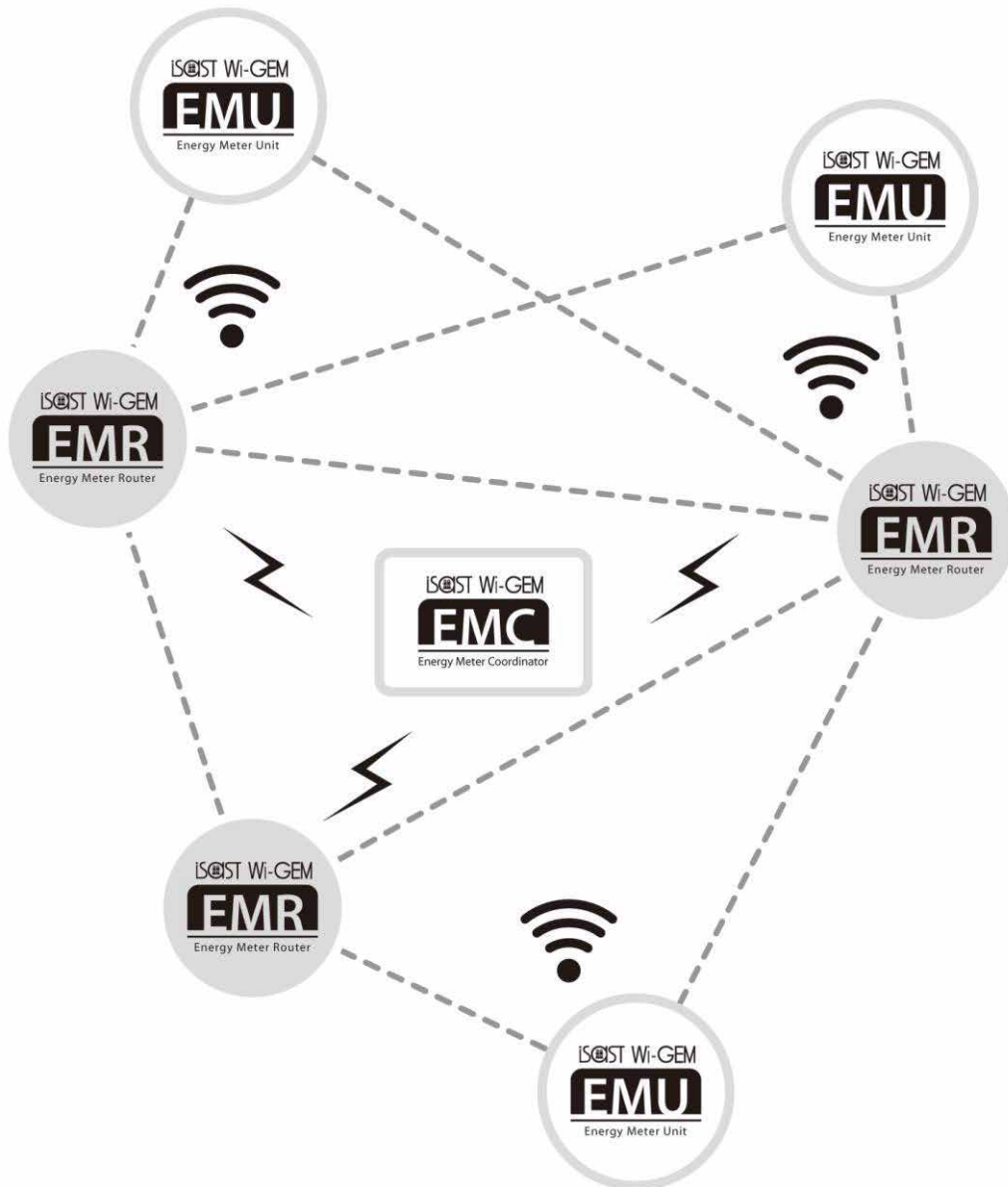


Figure 1.4 An Example of Mesh Network Topology

■ Installing and Configuring Hardware

1. Before installation



DANGER

Electrical shock or fire! This product can cause serious injury or death to persons if the instructions are not cautiously kept.



CAUTION

Follow the standard specifications and safety requirements.



CAUTION

Do not cut or forcibly pull the cables.



WARNING

Only qualified persons must install the product.

First of all, be sure to familiar with this manual.

Perform the following suggestions for correct installation.

- If multiple EMUs are required to be installed, plan the layout of EMUs. For this purpose, think over the network topology and fixing method.
- Check whether any other interference generating devices exist or not. If so, relocate the installation location.
- Check whether the rated voltage and current on the label are correct.
- Install the product to the place that is not affected by strong magnetic field for correct operation and precision.
- The temperature must be within the operation temperature range. Do not install the product outdoors.
- The upper or lower clamp must be kept clean for correct operation and precision.
- Install the product following the instructions in this manual. An arbitrary installation may cause damage to the product or personal injury.
- Do not keep four side locks and power input terminal blocked for ventilation flow.

2. Installing EMU



DANGER

During EMU installation, be sure to turn off the power.



CAUTION

Do not apply physical damage to the product. If the clamp is separated or its insulation tube is stripped, it may cause injury or death.



CAUTION

Only qualified personnel must install EMU.



WARNING

Be sure to install EMU in the distribution panel with an additional lock. The EMU must be installed in a suitable rated UL Listed fire/electrical distribution panel(enclosure).Only the qualified personnel who follow standard safety precautions during all procedures must access the distribution panel. Those personnel should have appropriate training and experience with high voltage devices. Appropriate safety gloves, safety gassed and protective clothing are recommended.



CAUTION

Be sure to follow the instruction in this manual during installation. Keep the specified specifications and regulations.

2.1 Detailed Description

Data from the meter is sent to the gateway for user access periodically.

The meter data is split into three sections :

- **Energy Meter :** Active, reactive and apparent energy per phase and sum with a time-stamp.
- **Recording interval meter :** Active, reactive and apparent energy per phase and sum with a time-stamp of the end of the recording interval; minimum voltage per phase and maximum current per phase during recording interval; frequency
- **Meter Identification and Configuration :** Meter configuration and version; recording interval time setup, command and status word.

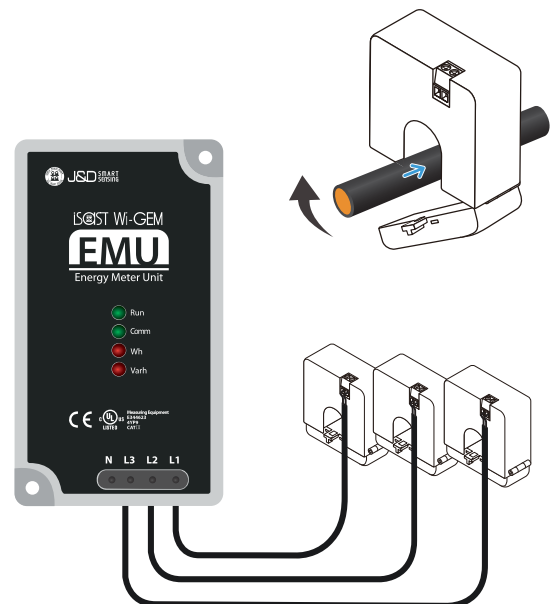


Figure 1.5 Energy Meter Node built with CT

2.2 Models Description

1) Basic guidelines

To obtain the best effectiveness of the network, apply the following recommendations.

- Do not install EMU in front of or close to metallic parts. That may reduce the efficiency of the embedded antenna.
- Avoid proximity of Electromagnetic Induction.
- Respect the illustrated layout to insure an optimized orientation of the antenna.

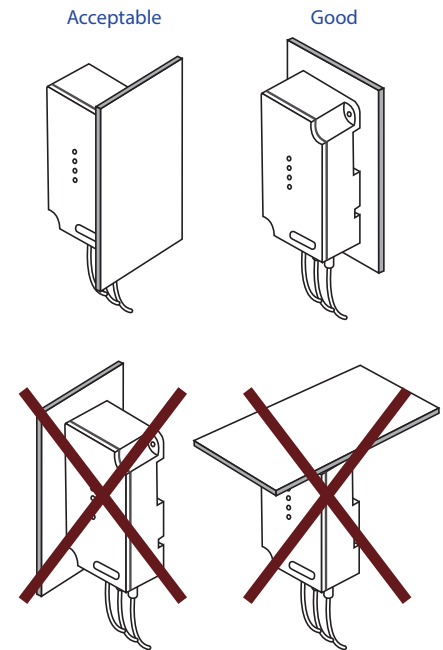


Figure 1.6 Avoid the proximity of the antenna with metal parts

2) Inside a metallic cabinet

When EMU has to be placed inside a metallic cabinet, its location is even more important.

The cabinets are never completely sealed thanks to small open spaces and allow certain radio communication, but significantly reduce signal strength. To get the best effectiveness, apply the following recommendations :

- Do not install EMU in the centre of the cabinet where most electrical cables are located.
- Put EMU on one side, in front of any door slit or any window (If existing).
- If there is mount hole on bottom or top of the cabinet for cables pathways, put EMU in front of it.
- Add systematically a Mesh Node in the vicinity of the cabinet (1m) to ensure robust communications.

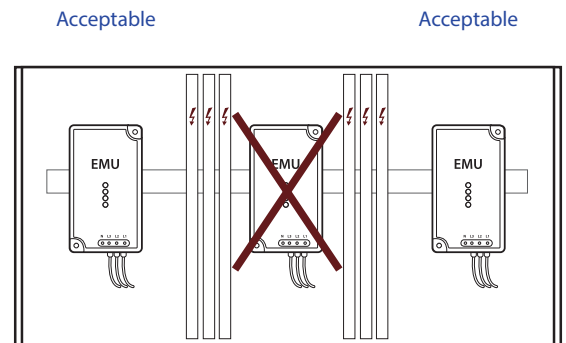


Figure 1.7 EMU Location inside a metallic cabinet

3) Mesh Node location and connection

Orientation of the nodes in relation to other devices on the network impacts radio signal strength.

- Avoid placing Mesh Node right under an EMU.



WARNING

TAKE CARE IF FIXING MESH NODE HORIZONTALLY ON A METALLIC PLANE TO LET A MINIMUM FREE INTERVAL (3-5MM) BETWEEN BOTH AREAS IN REGARDS.

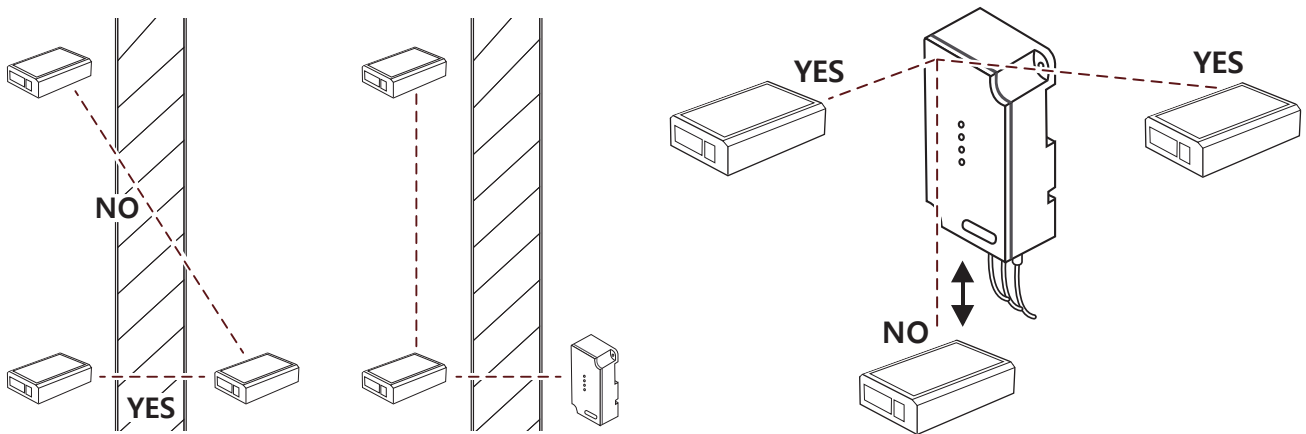


Figure 1.8 Location advising

Best radio signal is observed when all Mesh Node devices are positioned horizontally :

Good radio signal is also observed when one device is positioned horizontally and other vertically :

Radio signal is weaker, when all devices are positioned vertically :

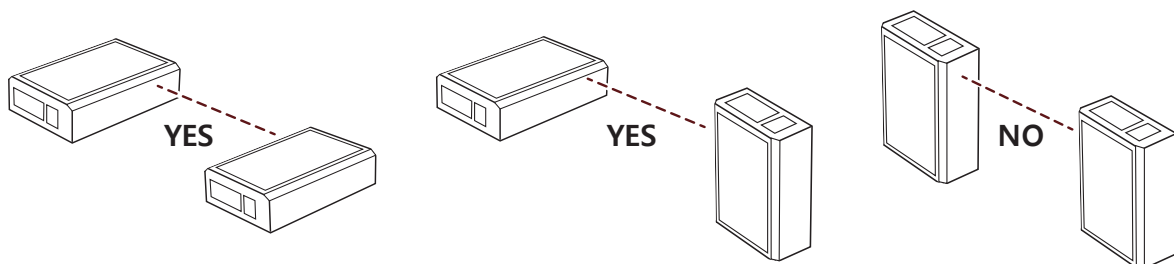


Figure 1.9 Devices position

2.3 Installing the EMU body

To keep effective wireless network communication, do not install EMU in front of interference generating materials or metal surfaces. If the embedded antenna is close to the material, it can decrease the efficiency of the embedded antenna.

To mount the EMU on the wall, perform the following steps :

1. Prepare two screws.
2. Insert screws in the holes shown in Figure 1.2 and fasten them with a screw driver.

To mount the EMU onto a DIN rail, perform the following steps :

1. Insert the EMU onto the DIN rail and move it to a desired position.
2. Pull up the fix clip to fix the EMU.

The Following figure shows an example of correct installation.

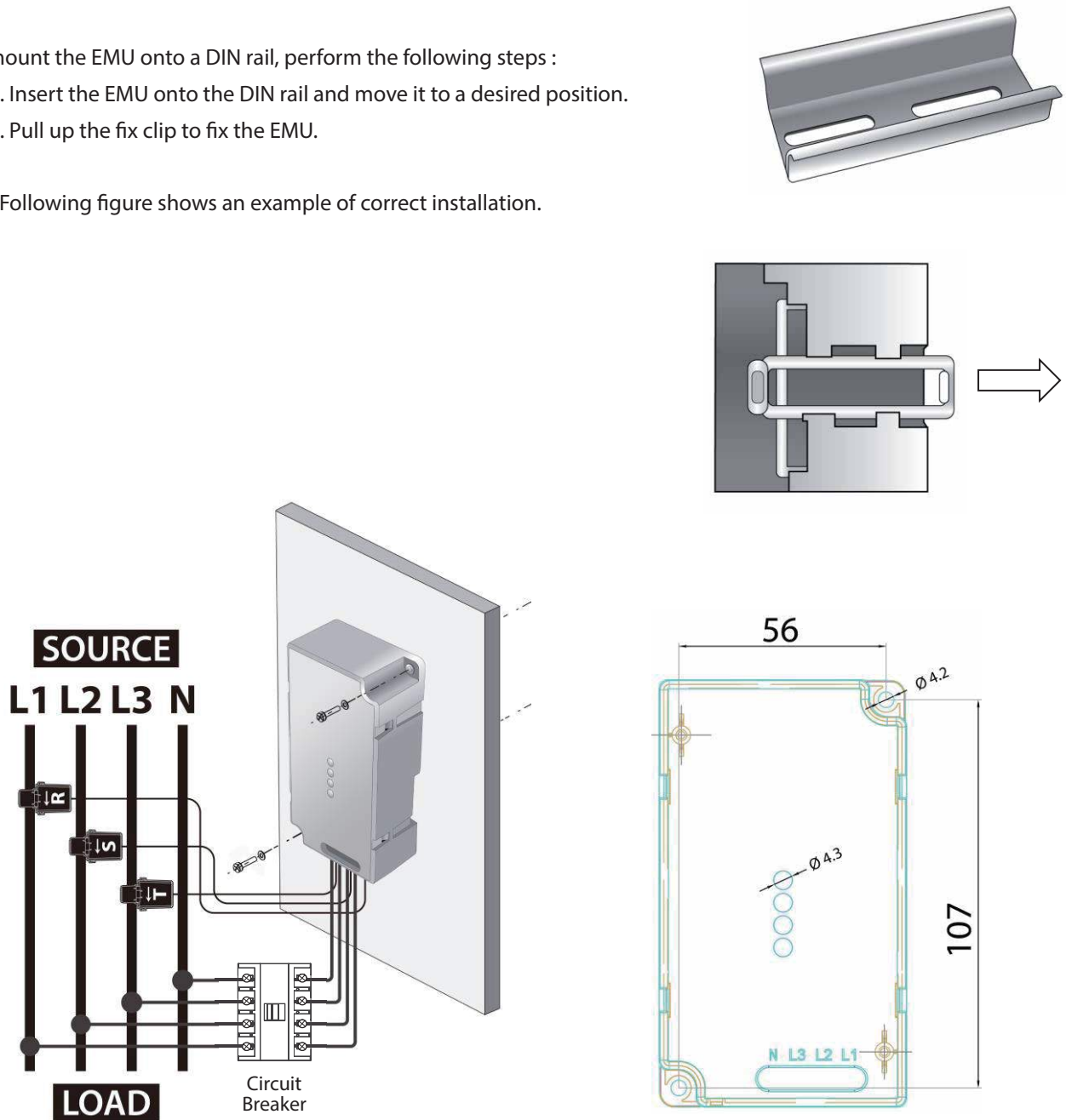


Figure 1.10 Correct EMU Installation

2.4 LED display of EMU

EMU has an LED lamp to display the current status as explained below :

STATUS	DESCRIPTION
Run LED	EMU operates in normal mode(fast flashing)
Comm. LED	EMU is performing the TX/RX communication
Wh LED	Active Energy Pulse
Varh LED	Reactive Energy Pulse



CAUTION

If the green lamp does not blink after power supply, see 5. Troubleshooting and take a specified action.

2.5 Setting EMU ID and Baud rate



DANGER

Only the qualified personnel from the manufacturer or agent must set the EMU ID and baud rate.

2.6 Mounting sensors

The sensor that measure electrical parameters are connected to an EMU. The sensors are fixed on power cables. so please keep the following cautions :



DANGER

The clamp must be attached to the wire with 300 V insulation capability.



CAUTION

Before installing a sensor, please check no current flows into the cable.



CAUTION

Clean the surface of the cable. Otherwise, foreign materials can cause a malfunction or incorrect measurement.



CAUTION

If phase allocation is wrong, incorrect energy data will be collected.

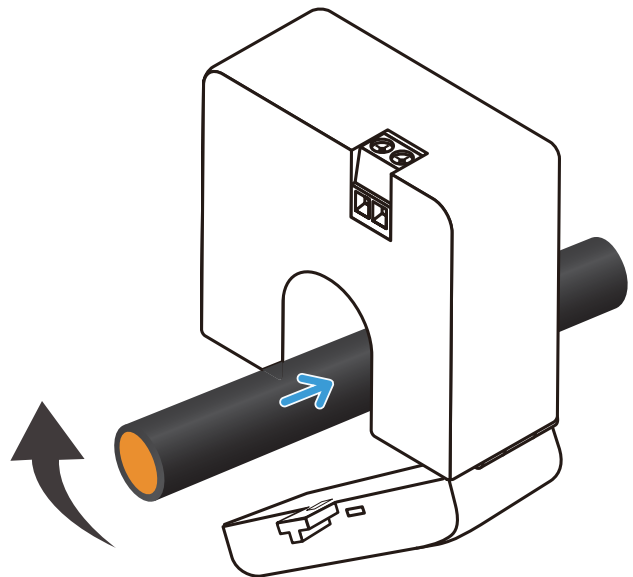


CAUTION

The allowable number of clamp openings is 50 times or below. Frequent clamp openings may shorten the life of clamp.

To mount a sensor on the target cable, perform the following steps :

1. Place the sensor on the target cable according to the specified phase.
2. Keep the direction of the arrow sign on the sensor same as the current flow direction.
3. Close the sensor clamp over the cable.
4. To fix the sensor on the cable, use the cable tie.



2.7 Connecting Voltage wires

Now, connect the wires to the power input points (L1, L2, L3, N) at the bottom panel of EMU.



CAUTION

Before connection, be sure to check no current flows into the wires.



CAUTION

The wire must have been covered by the tube with 300 V insulation capability. The size of the conductor must be within the range of 1.0 to 6.0 mm² (17 AWG to 10 AWG).



CAUTION

For supply connection, use wiring materials suitable for at least 75 °C.



CAUTION

Make sure that connection of power supply should have provision for connection of one of the wiring system in accordance with the National Electrical Code, ANSI/NFPA 70, NEC, with CSA C22.1, CEC, Part I or with both as appropriate.

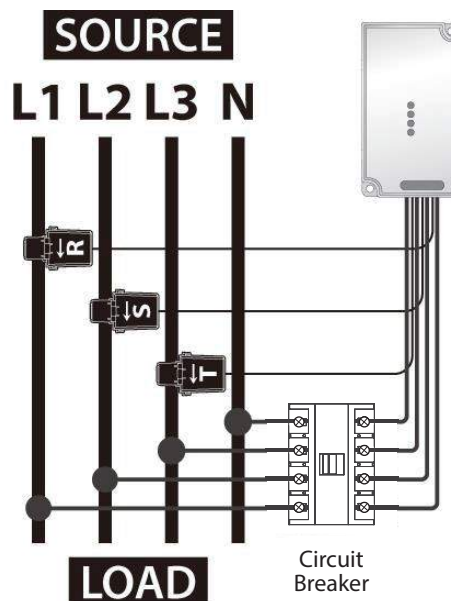


CAUTION

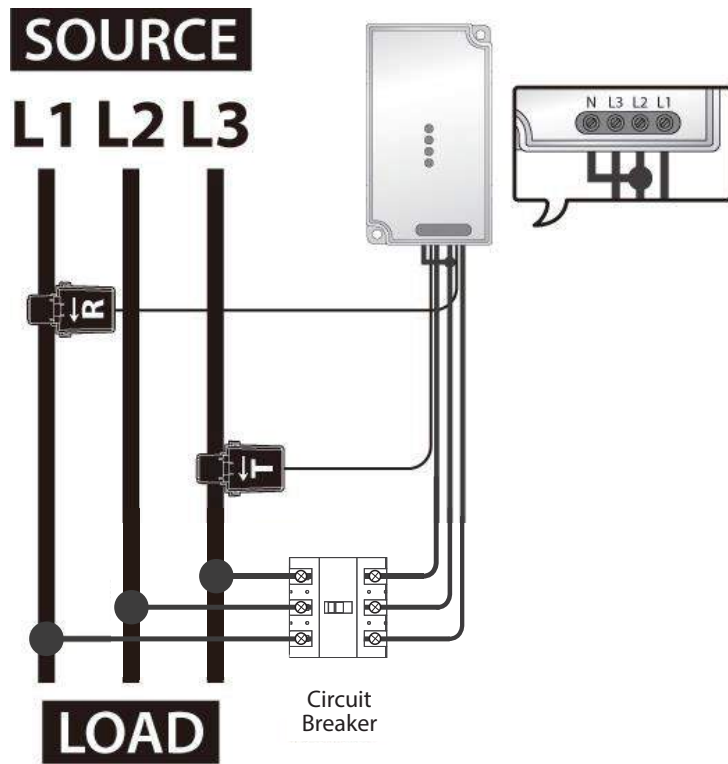
For protection, the circuit breaker must be installed between the voltage wire and power. The maximum rating of circuit breaker is 20A, then minimum size of branch circuit wiring will be used with 12 AWG.

The following explains how to connect the wires for each case.

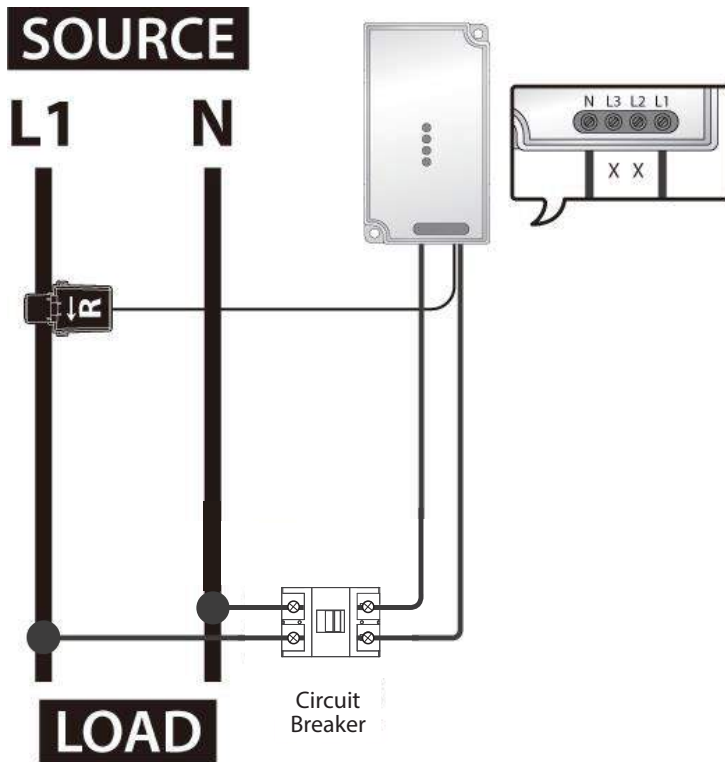
Wiring for 3phase 4wires



Wiring for 3phase 3wires (2CT)



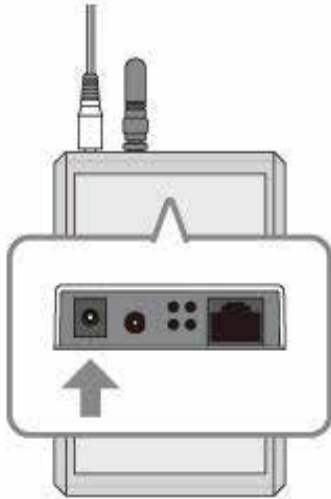
Wiring for Single phase 2wires



3. Installing EMRs and EMC

According to the prepared topology plan, install EMRs near the installed EMUs. Then install EMC near the monitoring computer.

Power connection to EMR



USB connection to EMC

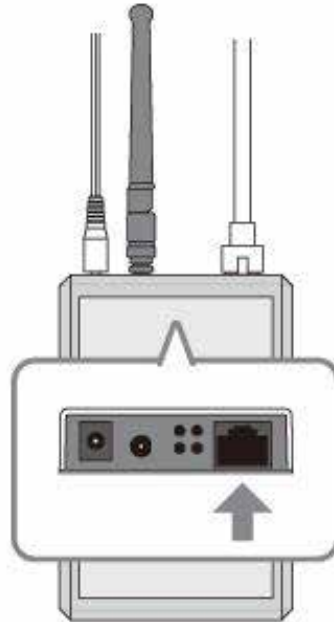


Figure 1.11 Installation of EMR and EMC

4. Connecting EMC to PC

EMC is configured for the MODBUS protocol. when the EMC is turned on, the network starts building the structure. It may take a while.

For connection between EMC and PC, use the USB to RS232 Converter. EMC has a RS232 port on it.



The pin numbers for RS232 port cabling are below

RS232 Port(RJ45)

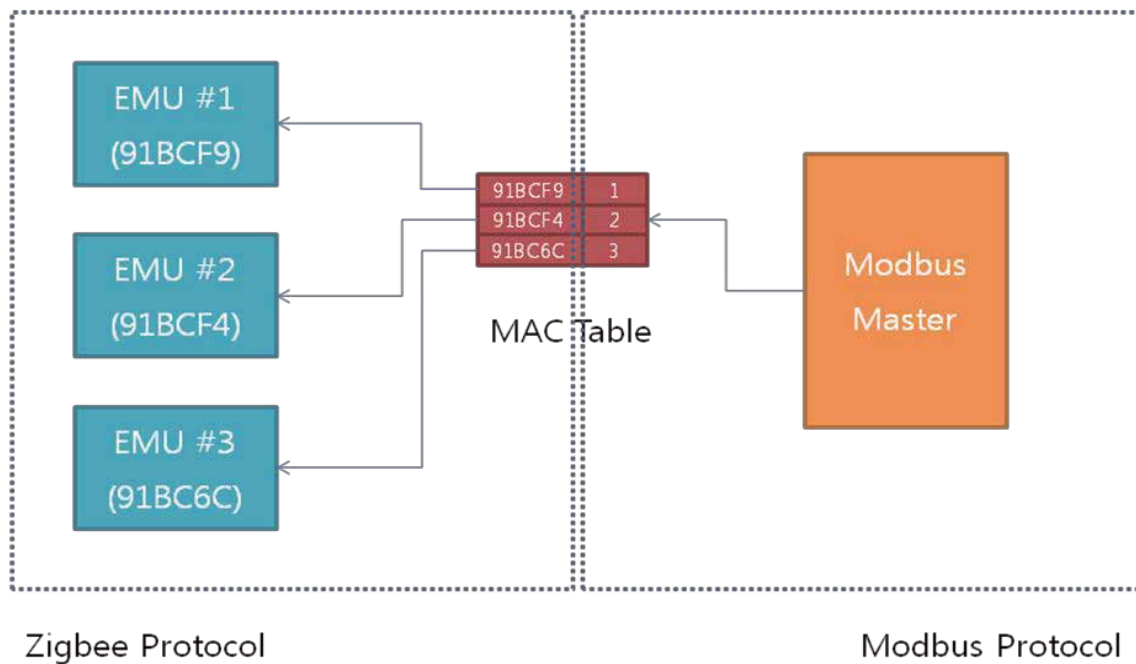
Signal Name	Pin Number
TX	4
RX	5
GND	3, 6

The serial port settings of modbus master are below for Modbus RTU protocol communication.

Signal Name	Pin Number
TX	4
RX	5
GND	3, 6

5. Installing the MMI software and Settings

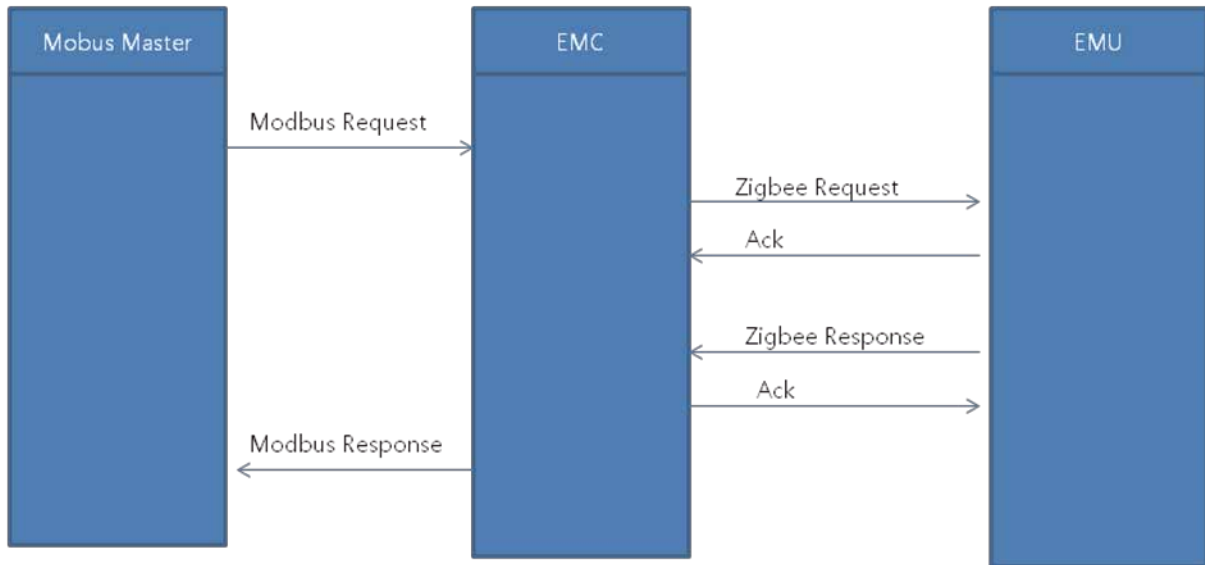
The diagram below shows the protocol transformation concept between Zigbee and Modbus protocol.



5.1 Setting of the address table

1) Editing Mac address.

EMC is a device acts as a modbus gateway. it relays the protocol between Modbus protocol and Zigbee protocol. All EMUs are allocated with its own MAC addresses. It is written on the label of EMU. To read the data of EMU with Modbus protocol, it needs to transform the Modbus address into MAC address. EMC performs it's process using the internal address transformation table.



The transformation table includes MAC address area, Modbus address area and the name area to be able to distinguish the EMU each. Input the MAC address first and then input the Modbus address and the name responding to it one by one.

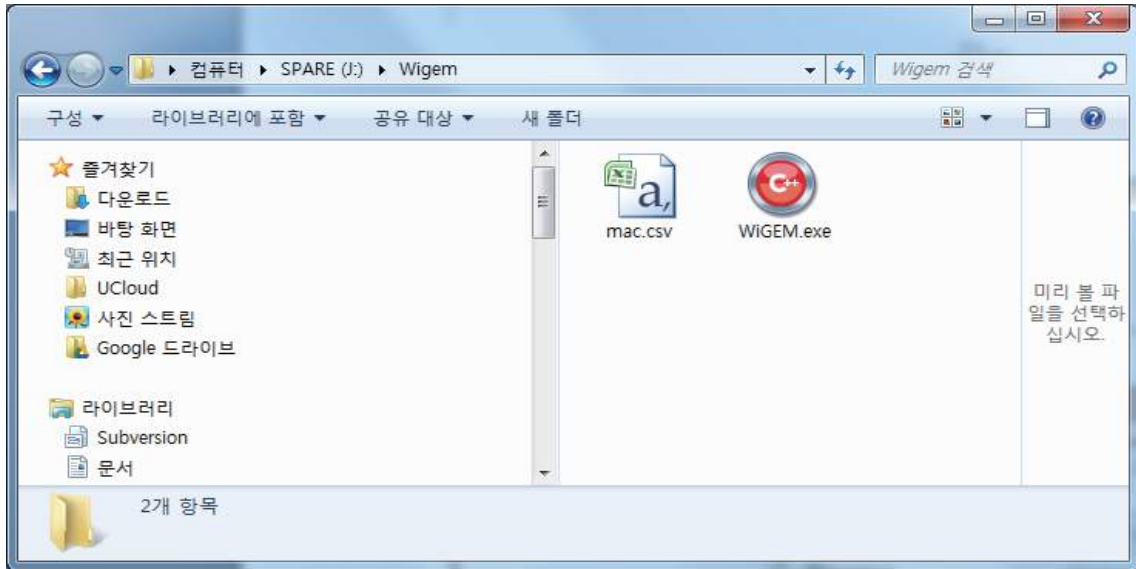
For example, if the MAC address is "91BCF9", the Modbus address is "1", and the name is "EMU#1", the table forms as 91, BC, F9, 1, EMU#1.

91	BC	F9	1	EMU#1
91	BC	F4	2	EMU#2
91	BC	6C	3	EMU#3

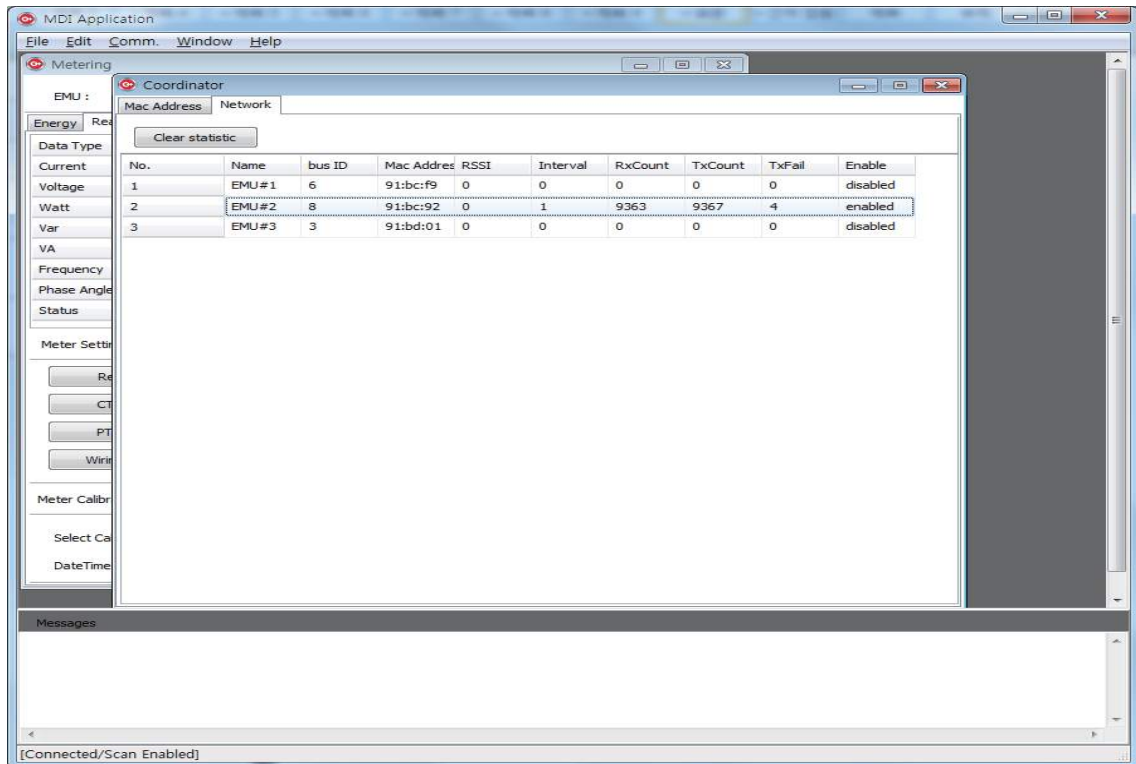
After input the addresses and store it with ".csv" file name extension.

2) Import

After making a "mac.csv" file in the folder which the MMI software is installed, run the MMI software "Wigem manager" by clicking the program icon WiGEM. When it is loaded, it reads the "mac.csv" file and displays the contents on the window automatically. The "coordinator window" displays MAC address, Modbus address, EMU name on the "MAC Address" table.

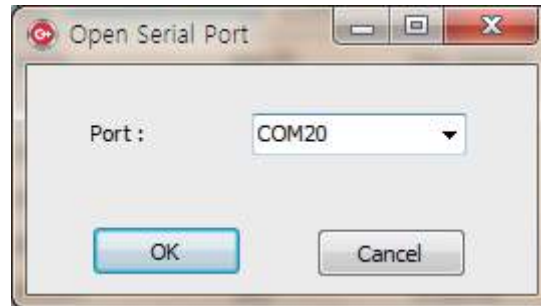


In case of reading a "mac.csv" file again during the MMI software running. Run the [File-Reload Mac File] menu.

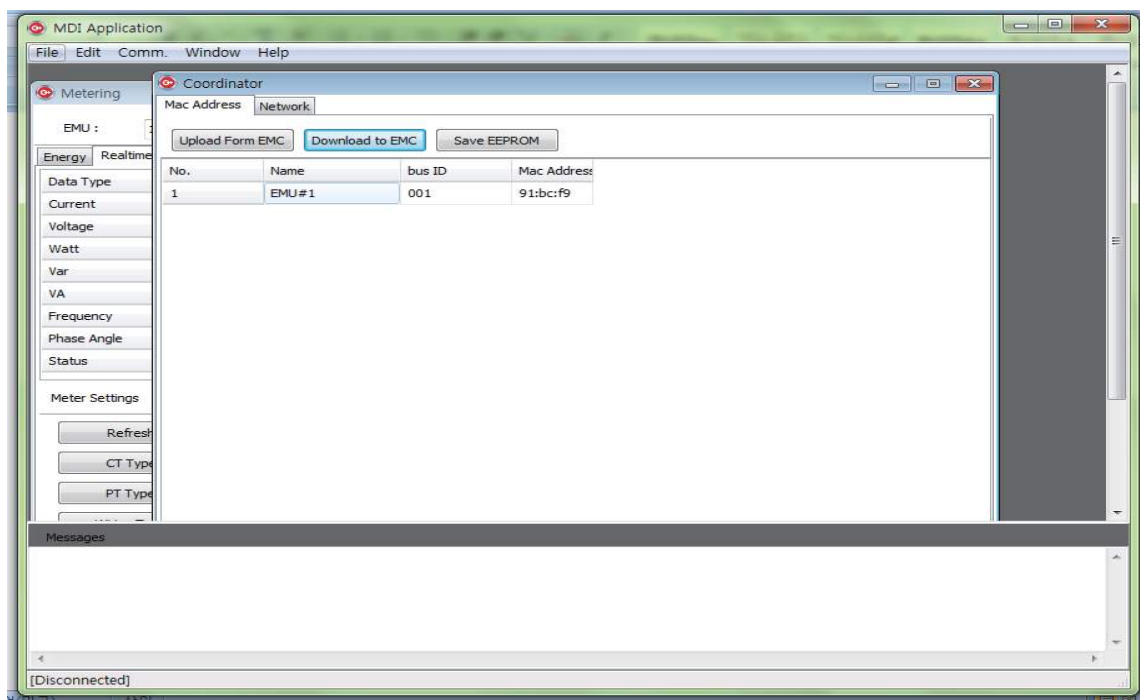


3) Download

To transfer the MAC address imported to the EMC, click the [Comm.-connect] menu. Then the "Open Serial Port" window pops up. Select a com. port and click O.K button and the communication port is opened.



After select the "MAC address" tap at the "Coordinator window" and push the "Download to EMC" menu button. When the download is completed, the "Download Success" message displays on the "Message"



4) Upload

It uses the MAC address stored in the EMC. When click the "Upload From EMC" menu button, It displays the MAC address read on the table. EMC does not store the device name and reserves it as blank.

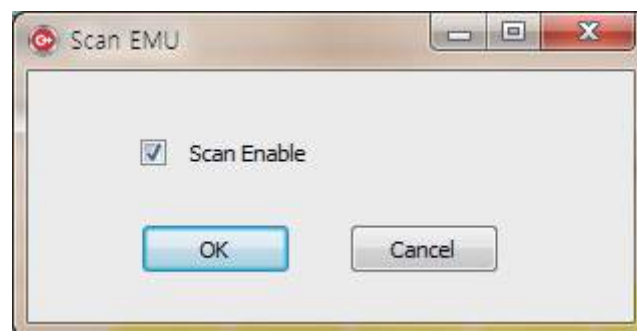
5.2 Communication Monitoring

1) When click the [Comm.-Enable Scan] menu at the Main menu, it requests the data in the table on by one in order
 When click the [Comm.-Disable Scan] menu at the Main menu, it stops all communication with EMU.

2) When click "Network" menu tab at the "Coordinator window", it shows sending and receiving count, fail count on the table.

No.	Name	bus ID	Mac Address	RSSI	Interval	RxCount	TxCount	TxFail	Enable
1	EMU#1	6	91:bc:f9	0	0	0	0	0	disabled
2	EMU#2	8	91:bc:92	0	1	10263	10267	4	enabled
3	EMU#3	3	91:bd:01	0	0	0	0	0	disabled

- Tx Count : Whenever it sends the request from, it counts up one by one.
- Rx Count : Whenever it receives the response from, it counts up one by one.
- Tx Fail : It is sum of subtract Rx Count from Tx Count. Whenever the communication fails, it increases the number one by one.
- Enabled : It displays the status of EMU each. If it is at no scan status, it displays it by "Disabled" and displays it by "Enabled" at scan status. When it stops and activates the Comm. for a designated specific EMU, double click the row of EMU in the table and pops up the "Dialog window" as like below. If it needs to stop the Coom., check off it in the small check bos. and click O.K button, and then the background color of the EMU changes into "yellow" and stops scanning.



RSSI : Displays the receiving radio signal intensity of EMU.

Interval : Displays the Recording Interval of EMU.

5.3 EMU

1. LED

Run	The LED is flickering in normal status
Comm.	When it joins Zigbee network, the LED turns on. When it activates Comm. the LED is flickering.
Wh	Active Energy Pulse
Varh	Reactive Energy Pulse

2. Measurement

1) Select the “Metering Window” and EMU to be monitored in the Combo box.

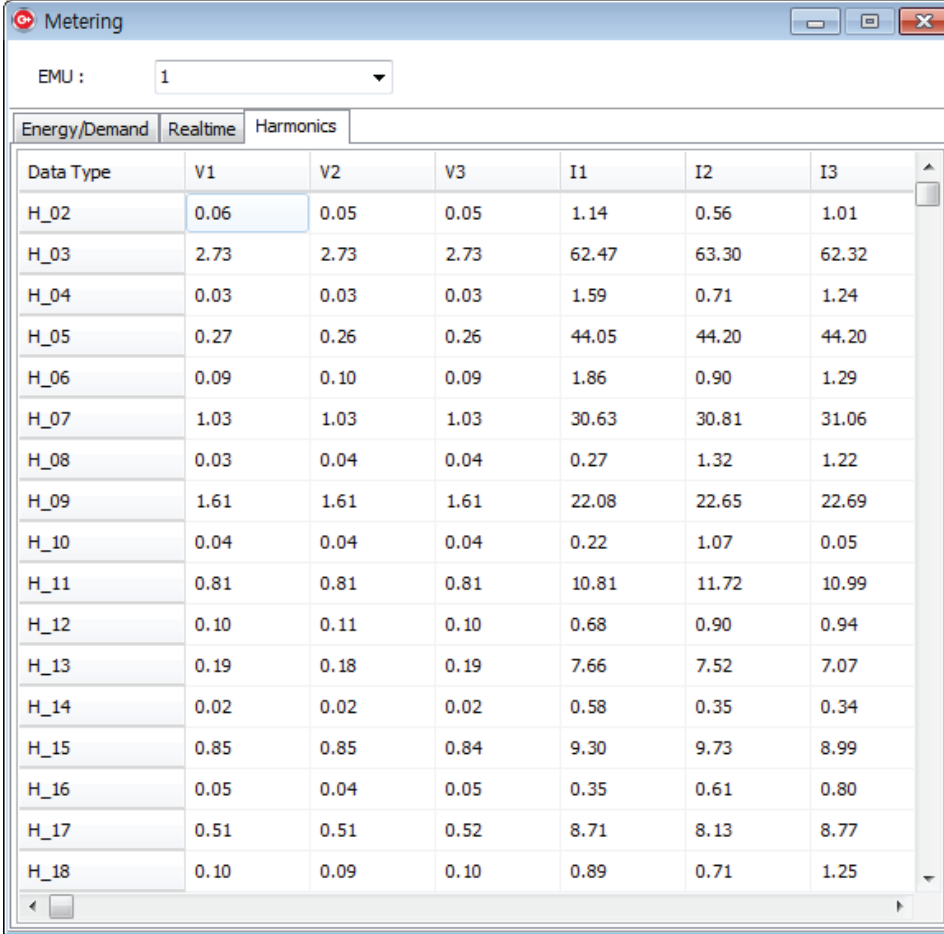
The screenshot shows the 'Metering' application window. At the top, 'EMU : 1' is selected in a dropdown menu. Below this, there are tabs for 'Energy/Demand', 'Realtime', and 'Harmonics'. The 'Energy Register' section contains a table with the following data:

Data Type	Phase Total	Phase A	Phase B	Phase C
kWatt/h	12.794	4.460	3.684	4.422
kVar/h	2.907	0.964	0.977	0.966
kVA/h	15.171	5.332	4.302	5.284

Below the Energy Register is the 'Demand Register' section, which includes a 'Time Stamp' field set to '2015-01-07, 11:35:01'. The Demand Register table contains the following data:

Data Type	Phase A	Phase B	Phase C
Volt Demand(Min)	209.31	209.31	209.28
Current Demand(Max)	1.98	1.96	2.00
kWatt Demand	0.136		
kVA Demand	0.000		
kVA Demand	0.180		
Cumulative kWatt Demand	1.173		
Cumulative kVA Demand	0.000		
Cumulative kVA Demand	1.58		
Min. Volt Demand	0.00	0.00	0.00
Max. Current Demand	1.98	1.96	2.00
Max. kWatt Demand	0.348		
Max. kVA Demand	0.000		

2) Select the "Metering Window" and Harmonics to be monitored in the Combo box.



The screenshot shows a window titled "Metering" with a dropdown menu for "EMU" set to "1". Below the dropdown are three tabs: "Energy/Demand", "Realtime", and "Harmonics". The "Harmonics" tab is active, displaying a table with the following data:

Data Type	V1	V2	V3	I1	I2	I3
H_02	0.06	0.05	0.05	1.14	0.56	1.01
H_03	2.73	2.73	2.73	62.47	63.30	62.32
H_04	0.03	0.03	0.03	1.59	0.71	1.24
H_05	0.27	0.26	0.26	44.05	44.20	44.20
H_06	0.09	0.10	0.09	1.86	0.90	1.29
H_07	1.03	1.03	1.03	30.63	30.81	31.06
H_08	0.03	0.04	0.04	0.27	1.32	1.22
H_09	1.61	1.61	1.61	22.08	22.65	22.69
H_10	0.04	0.04	0.04	0.22	1.07	0.05
H_11	0.81	0.81	0.81	10.81	11.72	10.99
H_12	0.10	0.11	0.10	0.68	0.90	0.94
H_13	0.19	0.18	0.19	7.66	7.52	7.07
H_14	0.02	0.02	0.02	0.58	0.35	0.34
H_15	0.85	0.85	0.84	9.30	9.73	8.99
H_16	0.05	0.04	0.05	0.35	0.61	0.80
H_17	0.51	0.51	0.52	8.71	8.13	8.77
H_18	0.10	0.09	0.10	0.89	0.71	1.25

2) The Measurement information of EMU is displayed in the "Energy/Demand" tab, "Realtime" tab and "Harmonics" tab divided.

The screenshot shows the 'Metering' application window. At the top, there is a dropdown menu for 'EMU' set to '1'. Below it are three tabs: 'Energy/Demand' (selected), 'Realtime', and 'Harmonics'. The main area contains a table with the following data:

Data Type	Total/Average	Phase A	Phase B	Phase C
Current	3.377	1.126	1.126	1.126
Voltage	211.251	211.259	211.255	211.238
Watt	538.800	180.000	178.800	180.000
VAr	0.000	0.000	0.000	0.000
VA	712.800	237.600	237.600	237.600
Phase Angle	354.46	355.36	354.52	353.50
Power Factor	75.59	75.76	75.25	75.76
Line Frequency	60.00			
Status Word	SE,FS			
V THD	3.73	3.71	3.72	3.78
I THD	83.72	82.76	84.44	83.96

Below the table is the 'Meter Settings' section, which includes a 'Refresh' button and several input fields and buttons: 'CT Type' (100), 'PT Type' (1), 'Wiring Type' (3P4W), 'Send Time' (2015-01-07 13:29:33), 'Zero Power Level' (0.001), 'Recording Interval' (1), 'Clear Meter', and 'Clear Demand'.

3) Energy/Demand

MMU software "Wi-GEM Manager" shows the data below.

- Energy Register
 - Active Energy : Displays Active Energy of each phase and total. The unit is Watt/h
 - Reactive Energy : Displays Reactive Energy of each phase and total. The unit is Var/h
 - Apparent Energy : Displays Apparent Energy of each phase and total. The unit is VA/h.
 - Time Stamp : Displays the updated time of the Energy Register newly.
- Unit range is 0 ~ 999,999,999.

4) Demand Data

It measures the Energy in a certain period of time. The time units to be set are 1, 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 minutes. Its criteria of time is based on the internal timer of EMU. When its time is up, EMU stores the gathered data in the "Demand Register" and initializes it.

- Time Stamp : Displays the updated time of the Recording Interval Register newly.

- Demand Register
 - Voltage Demand
 - Current Demand
 - Watt Demand
 - Var Demand
 - VA Demand
 - Min. Voltage
 - Max. Current
 - Max. Watt Demand
 - Max. Var Demand
 - Max. VA Demand

It records the maximum current, minimum voltage and maximum power after comparing the present on and the prior one, whenever the "Demand Data" is generated. And it records the time simultaneously.

5) Real Time Data

- RMS Value : Voltage, Current
- Power : Active, Reactive, Apparent
- Frequency
- Phase Angle
- Status : The value becomes "1", when the frequency o voltage engaged to EMU is in the range of 45~65Hz.
- Recording Interval : It defines the time for the each section. It set the value by divisor of 60minute.
For example, it becomes 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60.
- CT Ratio : Input the primary CT rating ratio. For example, if the CT rating current is 100A, Input the value of 100. CT should be used with the designated one made by manufacturer.
- PT Ratio : When the EMU is connected to the PT for high voltage application, enter the rated voltage of the PT. in case of direct connection, enter the value of the 110.
- Zero Power Level : The threshold value to define the unload status of power.

■ Software Interfaces

To program a customer specific application, the following software development data is required.

1. EMU related

1.1 Parameters and functions

The related parameters and functions are :

MODEL		Wi-GEM	
Power system		1P2W, 3P3W(2CT), 3P4W	
Inputs Rating	Voltage		100 ~ 250 VAC (Line to Neutral) 100 ~ 250V (Line to Line for 3P3W (2CT)) 173 ~ 457VAC (Line to Line for 3P4W)
	Current	Primary	with Split core CT : 50 ~ 2,400A with Rogowski coil CT : 250 ~ 5,000A
		Secondary	100mA/333mV (CT secondary side)
	Frequency		45 ~ 65 Hz
	Accuracy		1.0 Class
	Power Consumption		Less than 2W
	Communication		ZigBee (250 kbps)
Operation Temp.		-10 C° ~ 55 C	
Storage Temp.		-25 C° ~ 70 C	
Standards		IEC 62053-21, IEC 62053-22	

Measurement

Item		Unit	Digit	Remark
Real time	Voltage	V	Floating point	Phase/Average 1P2W, 3P3W (2CT), 3P4W
	Line current	A	Floating point	Phase/Total
	Active power	W	Floating point	Phase/Total
	Reactive power	Var	Floating point	Phase/Total
	Apparent power	VA	Floating point	Phase/Total
	Frequency	Hz	Floating point	

	Phase angle	degree	Floating point	Between Voltage and Current
	Power factor	%	Floating point	Phase/Total
	Voltage THD	%	WORD(0~399.00)	Phase/Total
	Current THD	%	WORD(0~399.00)	Phase/Total
Energy	Active Energy	W/h	DWORD 99,999,999/999,999,999	Phase/ Total
	Reactive Energy	Var/h	DWORD 99,999,999/999,999,999	Phase/ Total
	Apparent Energy	VA/h	DWORD 99,999,999/999,999,999	Phase/ Total
Demand	Voltage Demand	V	Floating point	Phase
	Current Demand	V	Floating point	Phase
	Watt Demand	W	Floating point	Total
	Var Demand	Var	Floating point	Total
	VA Demand	VA	Floating point	Total
	Accumulative Watt Demand	W	Floating point	Total
	Accumulative Var Demand	Var	Floating point	Total
	Accumulative VA Demand	VA	Floating point	Total
	Max. Current	A	Floating point	Phase
	Min. Voltage	V	Floating point	Phase
	Max. Watt Demand	W	Floating point	Total
	Max. Var Demand	Var	Floating point	Total
	Max. VA Demand	VA	Floating point	Total
Harmonics	Voltage Harmonics 2 nd ~63 rd	%	WORD, 0~399.00%	Phase
	Current Harmonics 2 nd ~63 rd	%	WORD, 0~399.00%	Phase

1.2 Modbus commands

The commands used in the Modbus register map are :

- Read holding register (0x03)
- Read Input register (0x04)
- Write single register (0x06)
- Write multiple register (0x16)

1.3 Modbus register map

* MSW : Most Significant Word, LSW : Least Significant Word

* NV : Non-volatile, V : Volatile, S : Signed, U : Unsigned, R : Read, W : Write

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
Meter Data						
0	Current, Phase 1	4	A	2	FLOAT	
2	Current, Phase 2	4		2	FLOAT	
4	Current, Phase 3	4		2	FLOAT	
6	Current, Phase Total	4		2	FLOAT	
8	Reserved	4		2	FLOAT	
10	Reserved	4		2	FLOAT	
12	Voltage, Phase 1	4	V	2	FLOAT	
14	Voltage, Phase 2	4		2	FLOAT	
16	Voltage, Phase 3	4		2	FLOAT	
18	Voltage, Phase Total Average	4		2	FLOAT	
20	Watt, Phase 1	4	WATT	2	FLOAT	
22	Watt, Phase 2	4		2	FLOAT	
24	Watt, Phase 3	4		2	FLOAT	
26	Watt, Phase Total	4		2	FLOAT	
28	Var, Phase 1	4	VAR	2	FLOAT	
30	Var, Phase 2	4		2	FLOAT	
32	Var, Phase 3	4		2	FLOAT	
34	Var, Phase Total	4		2	FLOAT	
36	VA, Phase 1	4	VAR	2	FLOAT	
38	VA, Phase 2	4		2	FLOAT	
40	VA, Phase 3	4		2	FLOAT	
42	VA, Phase Total	4		2	FLOAT	
44	Angle, V1-I1	4	Degree	2	FLOAT	
46	Angle, V2-I2	4		2	FLOAT	
48	Angle, V3-I3	4		2	FLOAT	
50	Power factor, Phase 1	4	%	2	FLOAT	
52	Power factor, Phase 2	4		2	FLOAT	
54	Power factor, Phase 3	4		2	FLOAT	
56	Power factor, Phase Average	4		2	FLOAT	
58	Lline frequency	4	Hz	2	FLOAT	
60	Status Word	4		2	WORD	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
61	Reserved	4		1	U16	
62	Reserved	4		2	U16	
63	Reserved	4		2	U16	
64	Reserved	4		2	U16	
65	Reserved	4		2	U16	
66	Reserved	4		2	U16	
67	Reserved	4		2	U16	
68	Reserved	4		2	U16	
69	Reserved	4		2	U16	
70	Reserved	4		2	U16	
71	Reserved	4		2	U16	
72	Reserved	4		2	U16	
73	Reserved	4		2	U16	
74	Reserved	4		2	U16	
75	Reserved	4		2	U16	
76	Watt/Hr, Phase 1	4	W/HR	2	U32	0 ~ 99,999,999
78	Watt/Hr, Phase 2	4		2	U32	
80	Watt/Hr, Phase 3	4		2	U32	
82	Watt/Hr, Total	4		2	U32	0 ~ 999,999,999
84	Fundamental Watt/Hr, Phase 1	4	W/HR	2	U32	0 ~ 99,999,999
86	Fundamental Watt/Hr, Phase 2	4		2	U32	
88	Fundamental Watt/Hr, Phase 3	4		2	U32	
90	Fundamental Watt/Hr, Total	4		2	U32	0 ~ 999,999,999
92	Fundamental VAR/Hr, Phase 1	4	VAR/HR	2	U32	0 ~ 99,999,999
94	Fundamental VAR/Hr, Phase 2	4		2	U32	
96	Fundamental VAR/Hr, Phase 3	4		2	U32	
98	Fundamental VAR/Hr, Total	4		2	U32	0 ~ 999,999,999
100	VA/Hr, Phase 1	4	VA/HR	2	U32	0 ~ 99,999,999
102	VA/Hr, Phase 2	4		2	U32	
104	VA/Hr, Phase 3	4		2	U32	
106	VA/Hr, Phase Total	4		2	U32	0 ~ 999,999,999

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
108	VTHD, Phase 1	4		1	U16	0 ~ 39900 (0.00 ~ 399.00 %)
109	VTHD, Phase 2	4		1	U16	
110	VTHD, Phase 3	4		1	U16	
111	VTHD, Phase Average	4		1	U16	
112	ITHD, Phase 1	4		1	U16	0 ~ 39900 (0.00 ~ 399.00 %)
113	ITHD, Phase 2	4		1	U16	
114	ITHD, Phase 3	4		1	U16	
115	ITHD, Average	4		1	U16	
116	Reserved	4		1	U16	
117	Reserved	4		1	U16	
118	Reserved	4		1	U16	
119	Reserved	4		1	U16	
Configuration						
120	Time Stamp	4.16		3	TS	
123	Reserved	4.6		1	U16	
124	Reserved	4.6		1	U16	
125	Connection Type	4.6		1	U16	0:3P4W, 1:3P3W(2CT), 2:1P3W, 3:1P2W
126	# of CT Turn	4.6		1	U16	1 ~ 10(default:1)
127	CT Ratio	4.6		1	U16	1 ~ 65535(default:100)
128	PT Ratio	4.6		1	U16	1 ~65535(default 110)
129	Demand Period	4.6		1	U16	1/5/10/15/30/60(default:15)
130	ZERO Power	4.6		1	U16	1 ~ 20 (0.0001%~0.002%, default:10)
131	Reserved	4.6		1	U16	
132	Reserved	4.6		2	U32	
134	Reserved	4.6		1	U16	
135	Reserved	4.6		1	U16	
136	Reserved	4.6		1	U16	
137	Reserved	4.6		1	U16	
138	Reserved	4.6		1	U16	
139	Reserved	4.6		1	U16	
140	Reset meter	4.6		1	U16	
141	Reserved	4.6		1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
142	Reserved	4,6		1	U16	
143	Reserved	4,6		1	U16	
144	Reserved	4,6		1	U16	
145	Reserved	4,6		1	U16	
146	Reserved	4,6		1	U16	
147	Reserved	4,6		1	U16	
148	Reserved	4,6		1	U16	
149	Reserved	4,6		1	U16	
Demand						
150	Time Stamp	4		3	TS	
153	Reserved	4		1	U16	
154	Volt Demand, Phase 1	4		2	FLOAT	
156	Volt Demand, Phase 2	4		2	FLOAT	
158	Volt Demand, Phase 3	4		2	FLOAT	
160	Current Demand, Phase 1	4		2	FLOAT	
162	Current Demand, Phase 2	4		2	FLOAT	
164	Current Demand, Phase 3	4		2	FLOAT	
166	Watt Demand	4		2	FLOAT	
168	Var Demand	4		2	FLOAT	
170	VA Demand	4		2	FLOAT	
172	Reserved	4		2	FLOAT	
174	Reserved	4		2	FLOAT	
176	Reserved	4		2	FLOAT	
178	Reserved	4		2	FLOAT	
180	Min. Volt, Phase 1	4		2	FLOAT	
182	Min. Volt, Phase 2	4		2	FLOAT	
184	Min. Volt, Phase 3	4		2	FLOAT	
186	Max. Current, Phase 1	4		2	FLOAT	
188	Max. Current, Phase 2	4		2	FLOAT	
190	Max. Current, Phase 3	4		2	FLOAT	
192	Max. Demand Watt	4		2	FLOAT	
194	Max. Demand Var	4		2	FLOAT	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
196	Max Demand VA	4		2	FLOAT	
198	Reserved	4		1	U16	
200	Reserved	4		1	U16	
202	Reserved	4		1	U16	
204	Reserved	4		1	U16	
206	Reserved	4		1	U16	
207	Reserved	4		1	U16	
208	Reserved	4		1	U16	
209	Reserved	4		1	U16	
Harmonic						
210	2nd VHD, Phase 1	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
211	2nd VHD, Phase 2	4	%	1	U16	
212	2nd VHD, Phase 3	4	%	1	U16	
213	2nd IHD, Phase 1	4	%	1	U16	
214	2nd IHD, Phase 2	4	%	1	U16	
215	2nd IHD, Phase 3	4	%	1	U16	
216	3rd VHD, Phase 1	4	%	1	U16	
217	3rd VHD, Phase 2	4	%	1	U16	
218	3rd VHD, Phase 3	4	%	1	U16	
219	3rd IHD, Phase 1	4	%	1	U16	
220	3rd IHD, Phase 2	4	%	1	U16	
221	3rd IHD, Phase 3	4	%	1	U16	
222	4th VHD, Phase 1	4	%	1	U16	
223	4th VHD, Phase 2	4	%	1	U16	
224	4th VHD, Phase 3	4	%	1	U16	
225	4th IHD, Phase 1	4	%	1	U16	
226	4th IHD, Phase 2	4	%	1	U16	
227	4th IHD, Phase 3	4	%	1	U16	
228	5th VHD, Phase 1	4	%	1	U16	
229	5th VHD, Phase 2	4	%	1	U16	
230	5th VHD, Phase 3	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
231	5th IHD, Phase 1	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
232	5th IHD, Phase 2	4	%	1	U16	
233	5th IHD, Phase 3	4	%	1	U16	
234	6th VHD, Phase 1	4	%	1	U16	
235	6th VHD, Phase 2	4	%	1	U16	
236	6th VHD, Phase 3	4	%	1	U16	
237	6th IHD, Phase 1	4	%	1	U16	
238	6th IHD, Phase 2	4	%	1	U16	
239	6th IHD, Phase 3	4	%	1	U16	
240	7th VHD, Phase 1	4	%	1	U16	
241	7th VHD, Phase 2	4	%	1	U16	
242	7th VHD, Phase 3	4	%	1	U16	
243	7th IHD, Phase 1	4	%	1	U16	
244	7th IHD, Phase 2	4	%	1	U16	
245	7th IHD, Phase 3	4	%	1	U16	
246	8th VHD, Phase 1	4	%	1	U16	
247	8th VHD, Phase 2	4	%	1	U16	
248	8th VHD, Phase 3	4	%	1	U16	
249	8th IHD, Phase 1	4	%	1	U16	
250	8th IHD, Phase 2	4	%	1	U16	
251	8th IHD, Phase 3	4	%	1	U16	
252	9th VHD, Phase 1	4	%	1	U16	
253	9th VHD, Phase 2	4	%	1	U16	
254	9th VHD, Phase 3	4	%	1	U16	
255	9th IHD, Phase 1	4	%	1	U16	
256	9th IHD, Phase 2	4	%	1	U16	
257	9th IHD, Phase 3	4	%	1	U16	
258	10th VHD, Phase 1	4	%	1	U16	
259	10th VHD, Phase 2	4	%	1	U16	
260	10th VHD, Phase 3	4	%	1	U16	
261	10th IHD, Phase 1	4	%	1	U16	
262	10th IHD, Phase 2	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
263	10th IHD, Phase 3	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
264	11th VHD, Phase 1	4	%	1	U16	
265	11th VHD, Phase 2	4	%	1	U16	
266	11th VHD, Phase 3	4	%	1	U16	
267	11th IHD, Phase 1	4	%	1	U16	
268	11th IHD, Phase 2	4	%	1	U16	
269	11th IHD, Phase 3	4	%	1	U16	
270	12th VHD, Phase 1	4	%	1	U16	
271	12th VHD, Phase 2	4	%	1	U16	
272	12th VHD, Phase 3	4	%	1	U16	
273	12th IHD, Phase 1	4	%	1	U16	
274	12th IHD, Phase 2	4	%	1	U16	
275	12th IHD, Phase 3	4	%	1	U16	
276	13th VHD, Phase 1	4	%	1	U16	
277	13th VHD, Phase 2	4	%	1	U16	
278	13th VHD, Phase 3	4	%	1	U16	
279	13th IHD, Phase 1	4	%	1	U16	
280	13th IHD, Phase 2	4	%	1	U16	
281	13th IHD, Phase 3	4	%	1	U16	
282	14th VHD, Phase 1	4	%	1	U16	
283	14th VHD, Phase 2	4	%	1	U16	
284	14th VHD, Phase 3	4	%	1	U16	
285	14th IHD, Phase 1	4	%	1	U16	
286	14th IHD, Phase 2	4	%	1	U16	
287	14th IHD, Phase 3	4	%	1	U16	
288	15th VHD, Phase 1	4	%	1	U16	
289	15th VHD, Phase 2	4	%	1	U16	
290	15th VHD, Phase 3	4	%	1	U16	
291	15th IHD, Phase 1	4	%	1	U16	
292	15th IHD, Phase 2	4	%	1	U16	
293	15th IHD, Phase 3	4	%	1	U16	
294	16th VHD, Phase 1	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
295	16th VHD, Phase 2	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
296	16th VHD, Phase 3	4	%	1	U16	
297	16th IHD, Phase 1	4	%	1	U16	
298	16th IHD, Phase 2	4	%	1	U16	
299	16th IHD, Phase 3	4	%	1	U16	
300	17th VHD, Phase 1	4	%	1	U16	
301	17th VHD, Phase 2	4	%	1	U16	
302	17th VHD, Phase 3	4	%	1	U16	
303	17th IHD, Phase 1	4	%	1	U16	
304	17th IHD, Phase 2	4	%	1	U16	
305	17th IHD, Phase 3	4	%	1	U16	
306	18th VHD, Phase 1	4	%	1	U16	
307	18th VHD, Phase 2	4	%	1	U16	
308	18th VHD, Phase 3	4	%	1	U16	
309	18th IHD, Phase 1	4	%	1	U16	
310	18th IHD, Phase 2	4	%	1	U16	
311	18th IHD, Phase 3	4	%	1	U16	
312	19th VHD, Phase 1	4	%	1	U16	
313	19th VHD, Phase 2	4	%	1	U16	
314	19th VHD, Phase 3	4	%	1	U16	
315	19th IHD, Phase 1	4	%	1	U16	
316	19th IHD, Phase 2	4	%	1	U16	
317	19th IHD, Phase 3	4	%	1	U16	
318	20th VHD, Phase 1	4	%	1	U16	
319	20th VHD, Phase 2	4	%	1	U16	
320	20th VHD, Phase 3	4	%	1	U16	
321	20th IHD, Phase 1	4	%	1	U16	
322	20th IHD, Phase 2	4	%	1	U16	
323	20th IHD, Phase 3	4	%	1	U16	
324	21st VHD, Phase 1	4	%	1	U16	
325	21st VHD, Phase 2	4	%	1	U16	
326	21st VHD, Phase 3	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
327	21st IHD, Phase 1	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
328	21st IHD, Phase 2	4	%	1	U16	
329	21st IHD, Phase 3	4	%	1	U16	
330	22nd VHD, Phase 1	4	%	1	U16	
331	22nd VHD, Phase 2	4	%	1	U16	
332	22nd VHD, Phase 3	4	%	1	U16	
333	22nd IHD, Phase 1	4	%	1	U16	
334	22nd IHD, Phase 2	4	%	1	U16	
335	22nd IHD, Phase 3	4	%	1	U16	
336	23rd VHD, Phase 1	4	%	1	U16	
337	23rd VHD, Phase 2	4	%	1	U16	
338	23rd VHD, Phase 3	4	%	1	U16	
339	23rd IHD, Phase 1	4	%	1	U16	
340	23rd IHD, Phase 2	4	%	1	U16	
341	23rd IHD, Phase 3	4	%	1	U16	
342	24th VHD, Phase 1	4	%	1	U16	
343	24th VHD, Phase 2	4	%	1	U16	
344	24th VHD, Phase 3	4	%	1	U16	
345	24th IHD, Phase 1	4	%	1	U16	
346	24th IHD, Phase 2	4	%	1	U16	
347	24th IHD, Phase 3	4	%	1	U16	
348	25th VHD, Phase 1	4	%	1	U16	
349	25th VHD, Phase 2	4	%	1	U16	
350	25th VHD, Phase 3	4	%	1	U16	
351	25th IHD, Phase 1	4	%	1	U16	
352	25th IHD, Phase 2	4	%	1	U16	
353	25th IHD, Phase 3	4	%	1	U16	
354	26th VHD, Phase 1	4	%	1	U16	
355	26th VHD, Phase 2	4	%	1	U16	
356	26th VHD, Phase 3	4	%	1	U16	
357	26th IHD, Phase 1	4	%	1	U16	
358	26th IHD, Phase 2	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
359	26th IHD, Phase 3	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
360	27th VHD, Phase 1	4	%	1	U16	
361	27th VHD, Phase 2	4	%	1	U16	
362	27th VHD, Phase 3	4	%	1	U16	
363	27th IHD, Phase 1	4	%	1	U16	
364	27th IHD, Phase 2	4	%	1	U16	
365	27th IHD, Phase 3	4	%	1	U16	
366	28th VHD, Phase 1	4	%	1	U16	
367	28th VHD, Phase 2	4	%	1	U16	
368	28th VHD, Phase 3	4	%	1	U16	
369	28th IHD, Phase 1	4	%	1	U16	
370	28th IHD, Phase 2	4	%	1	U16	
371	28th IHD, Phase 3	4	%	1	U16	
372	29th VHD, Phase 1	4	%	1	U16	
373	29th VHD, Phase 2	4	%	1	U16	
374	29th VHD, Phase 3	4	%	1	U16	
375	29th IHD, Phase 1	4	%	1	U16	
376	29th IHD, Phase 2	4	%	1	U16	
377	29th IHD, Phase 3	4	%	1	U16	
378	30th VHD, Phase 1	4	%	1	U16	
379	30th VHD, Phase 2	4	%	1	U16	
380	30th VHD, Phase 3	4	%	1	U16	
381	30th IHD, Phase 1	4	%	1	U16	
382	30th IHD, Phase 2	4	%	1	U16	
383	30th IHD, Phase 3	4	%	1	U16	
384	31st VHD, Phase 1	4	%	1	U16	
385	31st VHD, Phase 2	4	%	1	U16	
386	31st VHD, Phase 3	4	%	1	U16	
387	31st IHD, Phase 1	4	%	1	U16	
388	31st IHD, Phase 2	4	%	1	U16	
389	31st IHD, Phase 3	4	%	1	U16	
390	32nd VHD, Phase 1	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
391	32nd VHD, Phase 2	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
392	32nd VHD, Phase 3	4	%	1	U16	
393	32nd IHD, Phase 1	4	%	1	U16	
394	32nd IHD, Phase 2	4	%	1	U16	
395	32nd IHD, Phase 3	4	%	1	U16	
396	33rd VHD, Phase 1	4	%	1	U16	
397	33rd VHD, Phase 2	4	%	1	U16	
398	33rd VHD, Phase 3	4	%	1	U16	
399	33rd IHD, Phase 1	4	%	1	U16	
400	33rd IHD, Phase 2	4	%	1	U16	
401	33rd IHD, Phase 3	4	%	1	U16	
402	34th VHD, Phase 1	4	%	1	U16	
403	34th VHD, Phase 2	4	%	1	U16	
404	34th VHD, Phase 3	4	%	1	U16	
405	34th IHD, Phase 1	4	%	1	U16	
406	34th IHD, Phase 2	4	%	1	U16	
407	34th IHD, Phase 3	4	%	1	U16	
408	35th VHD, Phase 1	4	%	1	U16	
409	35th VHD, Phase 2	4	%	1	U16	
410	35th VHD, Phase 3	4	%	1	U16	
411	35th IHD, Phase 1	4	%	1	U16	
412	35th IHD, Phase 2	4	%	1	U16	
413	35th IHD, Phase 3	4	%	1	U16	
414	36th VHD, Phase 1	4	%	1	U16	
415	36th VHD, Phase 2	4	%	1	U16	
416	36th VHD, Phase 3	4	%	1	U16	
417	36th IHD, Phase 1	4	%	1	U16	
418	36th IHD, Phase 2	4	%	1	U16	
419	36th IHD, Phase 3	4	%	1	U16	
420	37th VHD, Phase 1	4	%	1	U16	
421	37th VHD, Phase 2	4	%	1	U16	
422	37th VHD, Phase 3	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
423	37th IHD, Phase 1	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
424	37th IHD, Phase 2	4	%	1	U16	
425	37th IHD, Phase 3	4	%	1	U16	
426	38th VHD, Phase 1	4	%	1	U16	
427	38th VHD, Phase 2	4	%	1	U16	
428	38th VHD, Phase 3	4	%	1	U16	
429	38th IHD, Phase 1	4	%	1	U16	
430	38th IHD, Phase 2	4	%	1	U16	
431	38th IHD, Phase 3	4	%	1	U16	
432	39th VHD, Phase 1	4	%	1	U16	
433	39th VHD, Phase 2	4	%	1	U16	
434	39th VHD, Phase 3	4	%	1	U16	
435	39th IHD, Phase 1	4	%	1	U16	
436	39th IHD, Phase 2	4	%	1	U16	
437	39th IHD, Phase 3	4	%	1	U16	
438	40th VHD, Phase 1	4	%	1	U16	
439	40th VHD, Phase 2	4	%	1	U16	
440	40th VHD, Phase 3	4	%	1	U16	
441	40th IHD, Phase 1	4	%	1	U16	
442	40th IHD, Phase 2	4	%	1	U16	
443	40th IHD, Phase 3	4	%	1	U16	
444	41st VHD, Phase 1	4	%	1	U16	
445	41st VHD, Phase 2	4	%	1	U16	
446	41st VHD, Phase 3	4	%	1	U16	
447	41st IHD, Phase 1	4	%	1	U16	
448	41st IHD, Phase 2	4	%	1	U16	
449	41st IHD, Phase 3	4	%	1	U16	
450	42nd VHD, Phase 1	4	%	1	U16	
451	42nd VHD, Phase 2	4	%	1	U16	
452	42nd VHD, Phase 3	4	%	1	U16	
453	42nd IHD, Phase 1	4	%	1	U16	
454	42nd IHD, Phase 2	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
455	42nd IHD, Phase 3	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
456	43rd VHD, Phase 1	4	%	1	U16	
457	43rd VHD, Phase 2	4	%	1	U16	
458	43rd VHD, Phase 3	4	%	1	U16	
459	43rd IHD, Phase 1	4	%	1	U16	
460	43rd IHD, Phase 2	4	%	1	U16	
461	43rd IHD, Phase 3	4	%	1	U16	
462	44th VHD, Phase 1	4	%	1	U16	
463	44th VHD, Phase 2	4	%	1	U16	
464	44th VHD, Phase 3	4	%	1	U16	
465	44th IHD, Phase 1	4	%	1	U16	
466	44th IHD, Phase 2	4	%	1	U16	
467	44th IHD, Phase 3	4	%	1	U16	
468	45th VHD, Phase 1	4	%	1	U16	
469	45th VHD, Phase 2	4	%	1	U16	
470	45th VHD, Phase 3	4	%	1	U16	
471	45th IHD, Phase 1	4	%	1	U16	
472	45th IHD, Phase 2	4	%	1	U16	
473	45th IHD, Phase 3	4	%	1	U16	
474	46th VHD, Phase 1	4	%	1	U16	
475	46th VHD, Phase 2	4	%	1	U16	
476	46th VHD, Phase 3	4	%	1	U16	
477	46th IHD, Phase 1	4	%	1	U16	
478	46th IHD, Phase 2	4	%	1	U16	
479	46th IHD, Phase 3	4	%	1	U16	
480	47th VHD, Phase 1	4	%	1	U16	
481	47th VHD, Phase 2	4	%	1	U16	
482	47th VHD, Phase 3	4	%	1	U16	
483	47th IHD, Phase 1	4	%	1	U16	
484	47th IHD, Phase 2	4	%	1	U16	
485	47th IHD, Phase 3	4	%	1	U16	
486	48th VHD, Phase 1	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
487	48th VHD, Phase 2	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
488	48th VHD, Phase 3	4	%	1	U16	
489	48th IHD, Phase 1	4	%	1	U16	
490	48th IHD, Phase 2	4	%	1	U16	
491	48th IHD, Phase 3	4	%	1	U16	
492	49th VHD, Phase 1	4	%	1	U16	
493	49th VHD, Phase 2	4	%	1	U16	
494	49th VHD, Phase 3	4	%	1	U16	
495	49th IHD, Phase 1	4	%	1	U16	
496	49th IHD, Phase 2	4	%	1	U16	
497	49th IHD, Phase 3	4	%	1	U16	
498	50th VHD, Phase 1	4	%	1	U16	
499	50th VHD, Phase 2	4	%	1	U16	
500	50th VHD, Phase 3	4	%	1	U16	
501	50th IHD, Phase 1	4	%	1	U16	
502	50th IHD, Phase 2	4	%	1	U16	
503	50th IHD, Phase 3	4	%	1	U16	
504	51st VHD, Phase 1	4	%	1	U16	
505	51st VHD, Phase 2	4	%	1	U16	
506	51st VHD, Phase 3	4	%	1	U16	
507	51st IHD, Phase 1	4	%	1	U16	
508	51st IHD, Phase 2	4	%	1	U16	
509	51st IHD, Phase 3	4	%	1	U16	
510	52nd VHD, Phase 1	4	%	1	U16	
511	52nd VHD, Phase 2	4	%	1	U16	
512	52nd VHD, Phase 3	4	%	1	U16	
513	52nd IHD, Phase 1	4	%	1	U16	
514	52nd IHD, Phase 2	4	%	1	U16	
515	52nd IHD, Phase 2	4	%	1	U16	
516	53rd VHD, Phase 1	4	%	1	U16	
517	53rd VHD, Phase 2	4	%	1	U16	
518	53rd VHD, Phase 3	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
519	53th IHD, Phase 1	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
520	53th IHD, Phase 2	4	%	1	U16	
521	53th IHD, Phase 3	4	%	1	U16	
522	54th VHD, Phase 1	4	%	1	U16	
523	54th VHD, Phase 2	4	%	1	U16	
524	54th VHD, Phase 3	4	%	1	U16	
525	54th IHD, Phase 1	4	%	1	U16	
526	54th IHD, Phase 2	4	%	1	U16	
527	54th IHD, Phase 3	4	%	1	U16	
528	55th VHD, Phase 1	4	%	1	U16	
529	55th VHD, Phase 2	4	%	1	U16	
530	55th VHD, Phase 3	4	%	1	U16	
531	55th IHD, Phase 1	4	%	1	U16	
532	55th IHD, Phase 2	4	%	1	U16	
533	55th IHD, Phase 3	4	%	1	U16	
534	56th VHD, Phase 1	4	%	1	U16	
535	56th VHD, Phase 2	4	%	1	U16	
536	56th VHD, Phase 3	4	%	1	U16	
537	56th IHD, Phase 1	4	%	1	U16	
538	56th IHD, Phase 2	4	%	1	U16	
539	56th IHD, Phase 3	4	%	1	U16	
540	57th VHD, Phase 1	4	%	1	U16	
541	57th VHD, Phase 2	4	%	1	U16	
542	57th VHD, Phase 3	4	%	1	U16	
543	57th IHD, Phase 1	4	%	1	U16	
544	57th IHD, Phase 2	4	%	1	U16	
545	57th IHD, Phase 3	4	%	1	U16	
546	58th VHD, Phase 1	4	%	1	U16	
547	58th VHD, Phase 2	4	%	1	U16	
548	58th VHD, Phase 3	4	%	1	U16	
549	58th IHD, Phase 1	4	%	1	U16	
550	58th IHD, Phase 2	4	%	1	U16	

Word Address	Name	FC	Unit	Word Size	Data Type	Comment
551	58th IHD, Phase 3	4	%	1	U16	0 ~ 39900(0.00 ~ 399.00%)
552	59th VHD, Phase 1	4	%	1	U16	
553	59th VHD, Phase 2	4	%	1	U16	
554	59th VHD, Phase 3	4	%	1	U16	
555	59th IHD, Phase 1	4	%	1	U16	
556	59th IHD, Phase 2	4	%	1	U16	
557	59th IHD, Phase 3	4	%	1	U16	
558	60th VHD, Phase 1	4	%	1	U16	
559	60th VHD, Phase 2	4	%	1	U16	
560	60th VHD, Phase 3	4	%	1	U16	
561	60th IHD, Phase 1	4	%	1	U16	
562	60th IHD, Phase 2	4	%	1	U16	
563	60th IHD, Phase 3	4	%	1	U16	
564	61st VHD, Phase 1	4	%	1	U16	
565	61st VHD, Phase 2	4	%	1	U16	
566	61st VHD, Phase 3	4	%	1	U16	
567	61st IHD, Phase 1	4	%	1	U16	
568	61st IHD, Phase 2	4	%	1	U16	
569	61st IHD, Phase 3	4	%	1	U16	
570	62nd VHD, Phase 1	4	%	1	U16	
571	62nd VHD, Phase 2	4	%	1	U16	
572	62nd VHD, Phase 3	4	%	1	U16	
573	62nd IHD, Phase 1	4	%	1	U16	
574	62nd IHD, Phase 2	4	%	1	U16	
575	62nd IHD, Phase 3	4	%	1	U16	
576	63rd VHD, Phase 1	4	%	1	U16	
577	63rd VHD, Phase 2	4	%	1	U16	
578	63rd VHD, Phase 3	4	%	1	U16	
579	63rd IHD, Phase 1	4	%	1	U16	
580	63rd IHD, Phase 2	4	%	1	U16	
581	63rd IHD, Phase 3	4	%	1	U16	

1.4 Real Time Registers

- 1) Voltage, Current RMS
- 2) Active, Reactive, Apparent Power
- 3) Power Factor
- 4) Frequency
- 5) Phase Angle

The real time data format follows the IEEE 754 Floating Point.

IEEE 754 Floating Point refers to 32-bit single value using two data addresses.

Following Table is an example of reading the voltage data($V=100.1V$ (0x42c83333))

Word Address	Value	Remark
1 st	3333	LSW
2 nd	42c8c	MSW

1.5 Energy Registers

Accumulative energy registers have the total consumed energy calculated by EMU.

Active, reactive, and apparent energy consumption values are stored as 32-bit unsigned values(DWORD), thus using 2 word registers.

The lower register address contains the low word value(LSW) and the high register contains the high word value(MSW).

Following Table is an example of reading the active energy data($W/H=1,000,000$ (0xF4240))

Word Address	Value	Remark
1 st	4240	LSW
2 nd	000F	MSW

1.6 System parameter Settings

- 1) Time Stamp Register

Time Stamp : 2015-1-1, 12:30:00

Word Address	Value	Remark
1 st	1E00	Minute/Second
2 nd	010C	Day/Hour
3 rd	0F01	Year/Month

2) Connection

Value	Description
0	3P4W
1	3P3W(2CT)
2	1P3W
3	1P2W

3) CT ratio

Input the primary value of CT. For example the primary value of CT is 100A, enter the value 100.

4) PT ratio

Input the primary value of PT. For example the primary value of PT is 3300, enter the value 3300.

In case of direct connection, enter the value of 100.

5) Reset Meter

The EMU can execute the reset commands to the accumulated energy and demand value which is mapped to a R/W register. Setting a bit in the command word executes the command.

6) Demand Period

Supported demand period are 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 minute.

The start of an demand is at the hour + each interval.

Value	Description
0	Clear the demand registers.
1	Clear the accumulative energies registers.
2	Clear the accumulative energies registers and the demand registers.

1.7 Power Quality Register

1) THD

Voltage and Current Total Harmonics Distortion are stored here.

2) Harmonics

Voltage and Current Harmonics are stored here. The harmonics is 2nd to 63rd.

1.8 Demand Register

1) Voltage Demand

The minimum voltage value is recorded during Recording Interval.

2) Current Demand

The maximum current value is recorded during Recording Interval.

3) Power Demand

The average power value is recorded during Recording Interval.

4) Min. Voltage Demand

It updates the value of min. voltage when the recording interval data is created every time.

5) Max. Current Demand

It updates the value of max. current when the recording interval data is created every time.

6) Max. Active Power Demand

It updates the value of max. power when the recording interval data is created every time.

1.9 Frequency

The Line Frequency is measured based on the phase of the power supply only (phase L1). The latest value is stored in this register.

The data format follows the IEEE 754 Floating Point.

1.10 Angle

It is a phase angle between phase voltage and phase current.

The data format follows the IEEE 754 Floating Point.

1.11 Status word

The status of the EMU can be read from a read-only register.

Bit	Status Description
0	phase L1 voltage is missing.
1	phase L2 voltage is missing.
2	phase L3 voltage is missing.
3	total kWh is reverse.
4	Wiring is wrong.
5	Time Synchronization is required
6	Set when synchronized it 50/60Hz

1.12 Connection

Value	Description
0	3P4W
1	3P3W(2CT)
2	1P3W
3	1P2W

The value number is the power system for Wi-GEM to be connected.

1.13 Rated Current

Input the Current rating to be used. For example the primary CT ratio is 100A input the value 100, 300A input the value 300.

1.14 Rated Voltage

Input the Voltage rating to be used, For example, if the rated voltage is 220V, then inputs value of 220

1.15 Recording Interval time

Supported interval times are 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 minute.

The start of an interval is at the hour + each interval.

1.16 Reset Meter

The EMU can execute the reset commands to the accumulated energy and demand value which is mapped to a R/W register. Setting a bit in the command word executes the command.

Value	Description
0	Clear the demand registers.
1	Clear the accumulative energies registers.
2	Clear the accumulative energies registers and the demand registers.

1.17 Recording Interval Time Stamp

It means the time when the recording interval based energy is generated.

1.18 Voltage, Current Demand

The maximum current and voltage value is recorded.

1.19 Maximum Current in Interval

The maximum current value is recorded.

1.20 Maximum Voltage in Interval

The minimum voltage value is recorded during Recording Interval.

1.21 Demand Register

Average power is calculated based on the recording time interval.

1.22 Accumulative Demand

Harmonics Reactive Power = (Total-Fundamental)/Fundamental

1.23 Max Demand

It updates the value of max power when the recording interval data is created every time.

1.24 Max Power Time Stamp

It records the time when the Demand Register updates.

2. EMR related

The related parameters and functions are :

Function/Setting	Description
Number of connectable EMUs	200 EMUs
Selectable Baud Rate	250 kbps

3. EMC related

The related parameters and functions are :

Function/Setting	Description
Number of connectable EMUs or EMRs	200 EMUs or EMRs
Selectable Baud Rate	250 kbps

3.1 Serial Port

Signal Name	Pin Number
3, 6	GND
4	TX
5	RX

3.2 Modbus Protocol

Modbus ID	255
Baud Rate	115200
Parity	None
Stop bit	1
Data Size	8

3.3 Modbus Register Table

Modbus Register	Description	Type	Storage	Unit	Access
Energy Register					
0	Reserved				
1	Reserved				
2	Reserved				
3	Reserved				
4	Reserved				
5	Operating Channel	U16	V		R
6	Reserved				
7	Reserved				
8	Save Mac Table				W
9	Reserved				
10	Reserved				
11	Reserved				
12	Reserved				
13	Reserved				
14	Reserved				
15	Reserved				
16	Reserved				
17	Reserved				
18	Reserved				
19	Reserved				
20	EMU #0 Mac Address	MAC	NV		R
21					
...
218	EMU #199 Mac Address	MAC	NV		R
219					

3.4 Mac Address Format

Value	High Byte	Low Byte	Description
0	MAC1	MAC0	
1	Modbus ID	MAC2	

4. Communication protocol

For the communication protocol, the Modbus RTU method has been adopted. The following lists the basic functions:

Code	Description
03	Multiple registers (read)
06	Single register (write)
16	Multiple register (write)

4.1 Frame structure of multiple registers for read

When requested to Wi-GEM, the frame structure is as follows :

Station Address	Function (03)	Starting Address		Word Count		Error Check	
		High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte

When replied by Wi-GEM, the frame structure is as follows :

Station Address	Function (03)	Byte Count	Data Word 1		...	Data Word 52		Error Check	
			High Byte	Low Byte		High Byte	Low Byte	High Byte	Low Byte
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	...	1 Byte	1 Byte	1 Byte	1 Byte

4.2 Frame structure of single register for write

When requested to Wi-GEM, the frame structure of the force coil register is as follows :

Station Address	Function (06)	DO Address		Force Data Value		Error Check	
		High Byte	Low Byte	High Byte	Low Byte	High Byte	Low Byte
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte

When replied by Wi-GEM, it returns the frame that is requested to Wi-GEM in case of write success.

■ Troubleshooting

Symptom		Corrective Action
There is no measured data displayed in the monitoring program.		<ol style="list-style-type: none"> 1. Check the cable connection status. 2. Check the communication port status. 3. Check the communication speed.
Wrong Measurement	Voltage Error	<ol style="list-style-type: none"> 1. Check the cable wiring status. 2. Check the input voltage
	Current Error or Watt/Var Error	<ol style="list-style-type: none"> 1. Check the sensor wiring status. 2. Check the current flow of the sensor. 3. Check whether the sensor is open.
Power Operation Error		Check the input voltage.



DANGER

When the above-mentioned actions cannot solve the problem, contact with the manufacturer or purchasing agent. In case of product disassembly or modification, it may cause personal damage due to product failure. In this case, you cannot receive warranty services.

■ Specifications

1. EMU specifications

Item	Specification
Frequency	50/60 Hz
Operating temperature	-10 to 55°C
Storage temperature	-25 to 85°C
Weight	160g except clamp(s)
Size	66(W) x 117 (D) x 40 (H) mm

2. EMR & EMC specifications

Item	Specification
Operating temperature	-10 to 55°C
Storage temperature	-25 to 85°C
Weight	125g
Size	80(W) x 120 (D) x 23 (H) mm

3. Measurement information

Item	Instantaneous Values				Interval-based Values				Accumulated Values			
	L1	L2	L3	Sum or Av	L1/L2/L3			Sum	L1	L2	L3	Sum
					Av	Min	Max					
Current (A) Irms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>			<input type="radio"/>					
Voltage (V) Vrms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>						
Active Energy (W/h)									<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reactive Energy (Var/h)									<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Apparent Energy (VA/h)									<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Power Factor(%)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>								
Phase Angle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>								
Frequency(Hz)	<input type="radio"/>											
Active Power (W)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>					
Reactive Power (Var)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>					
Apparent Power (VA)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>					
Voltage Total Harmonics Distortion(%)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>								
Current Total Harmonics Distortion(%)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>								
Voltage Harmonics(%)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>									
Current Harmonics(%)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>									

■ Manufacturer Information

1. Manufacturer

J&D Electronics Co., Ltd.

B-401 Dosim Knowledge Industry center, 234 Deokso-ro, Wabu-eup, Namyangju-si, Gyeonggi-do, 472-908 South Korea

TEL : +82-31-577-2280

FAX : +82-31-601-8098

www.hqsensing.com

2. Documents and others

- User Guide revision 1.00
- Monitoring Program version 1.00
- Modbus Register Map revision 2.30
- Last modification date : 2015. 03. 20



J&D SMART
SENSING

**Head office
& Factory**

B-401 Dosim Knowledge Industry center,
234 Deokso-ro, Wabu-eup, Namyangju-si,
Gyeonggi-do, 472-908 South Korea

Tel
Fax
Link

+82-31-577-2280(Ext.2)
+82-31-601-8098
<http://www.hqsensing.com>