Procon

ENERGY MONITORING

APPLICATION GUIDE

Version 2.01 (Public Release)

MITSUBISHI ELECTRIC

Contents

1. Introduction

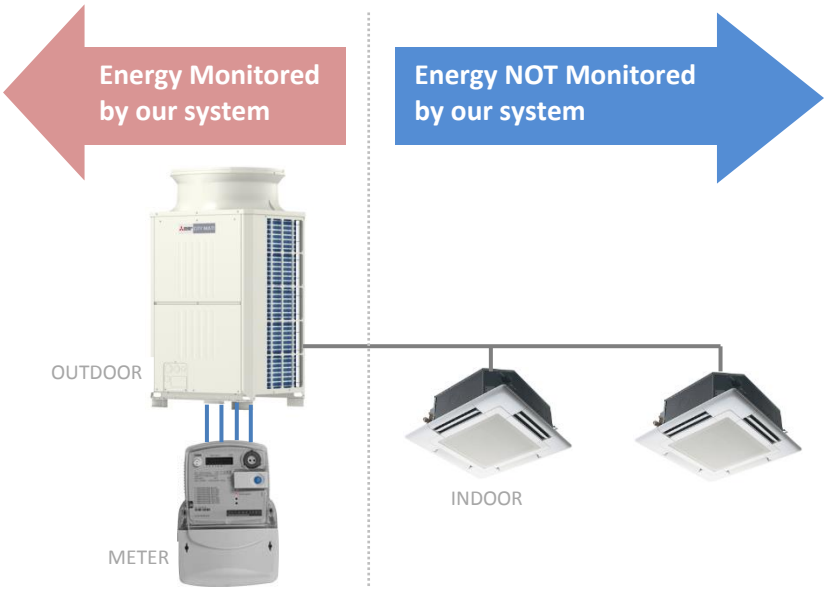
Energy monitoring is becoming more important as you cannot manage if you don't measure.

This document explains the different options available with our centralised controllers and our software package.

2. Important terms

It is important to understand the different terms in energy monitoring.

In all the options described in this guide, the indoor unit energy monitoring data is not taken into account as the indoor unit power supply is always connected locally. (Indoor unit energy consumption Fan & PCB Power)

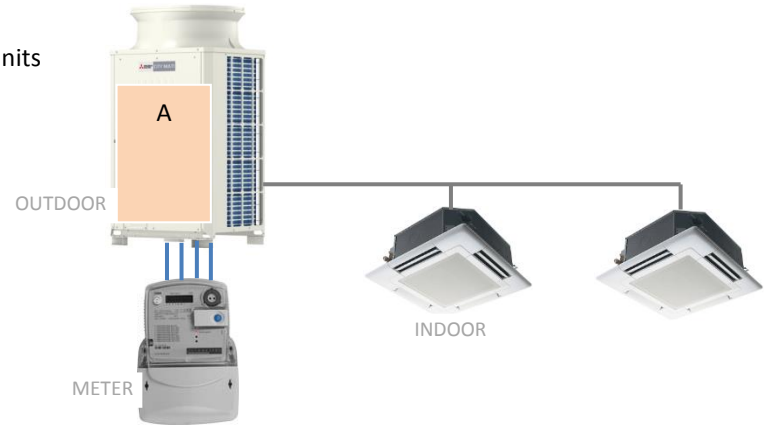


2.1. kW per system

kW per system means that the energy output will be the energy consumption of the outdoor unit.

A = Outdoor energy consumption for all indoor units

⇨ Output = A kW



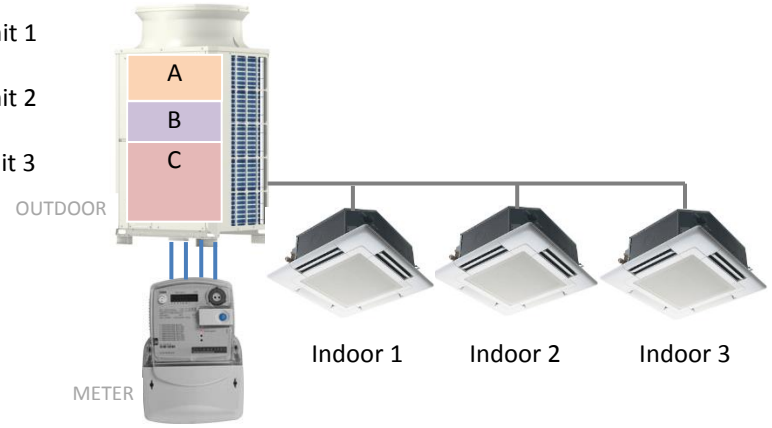
2.2. kW per indoor

kW per indoor means that the outdoor unit energy consumption will be apportioned using the indoor unit information.

A = Outdoor energy consumption for indoor unit 1

B = Outdoor energy consumption for indoor unit 2

C = Outdoor energy consumption for indoor unit 3



⇨ Output A, B and C

For instance:

Unit 1 has been using 25% of the outdoor.
Unit 2 has been using 25% of the outdoor.
Unit 3 has been using 50% of the outdoor.

If the energy meter has registered 10kW then:

- Unit 1 will have used 2.5kW of the outdoor unit energy consumption
- Unit 2 will have used 2.5kW of the outdoor unit energy consumption
- Unit 3 will have used 5.0kW of the outdoor unit energy consumption

3. Quick features overview

Below is a table describing the features for each product.

Products	Meter connection	kW per system	kW per areas	kW per indoor	kW for 3rd party	Cost using tariffs	Visibility
AE-200E Measurement	Pulse via AE-200E	✓	×	×	✓	×*3	Read only Screen display
AE-200E Measurement	Pulse via PAC-YG60MCA	✓	×	×	✓	×*3	Read only Screen display
AE-200E & EW-50E Energy Apportionment	Pulse via EW-50E	✓	✓	✓	✓	×*3	Screen display, Table & CSV
AE-200E & EW-50E Energy Apportionment	Pulse via PAC-YG60MCA	✓	✓	✓	✓	×*3	Screen display, Table & CSV
AE-200E & EW-50E Energy Apportionment	Pulse via EW-50E	✓	✓	✓	✓	×*3	Screen display, Table CSV & BACnet *1/*2 Modbus *2
AE-200E & EW-50E Energy Apportionment	Pulse via PAC-YG60MCA	✓	✓	✓	✓	×*3	Screen display, Table CSV & BACnet *1/*2 Modbus *2

*1 via BACnet PIN Code on EW-50E LAN2
*2 via MelcoBEMS on EW-50E LAN1 BACnet or Modbus
*3 Costs using tariffs not available under MID 2013 regulations

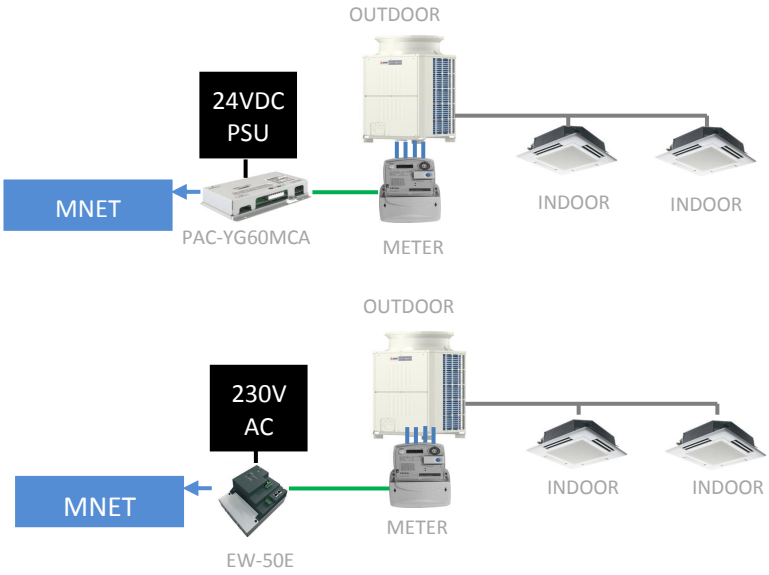
4. Connecting the energy meter and setting up

To accurately monitor and calculate the energy consumption, energy meters are required. We do not supply energy meters directly to our customers but most of the pulse energy meters are compatible with our EW-50E on-board pulse input channels or MNET pulse meter interface: the PAC-YG60MCA.

The EW-50E & PAC-YG60MCA each have 4 channels and can therefore monitor up to 4 pulse energy meters.

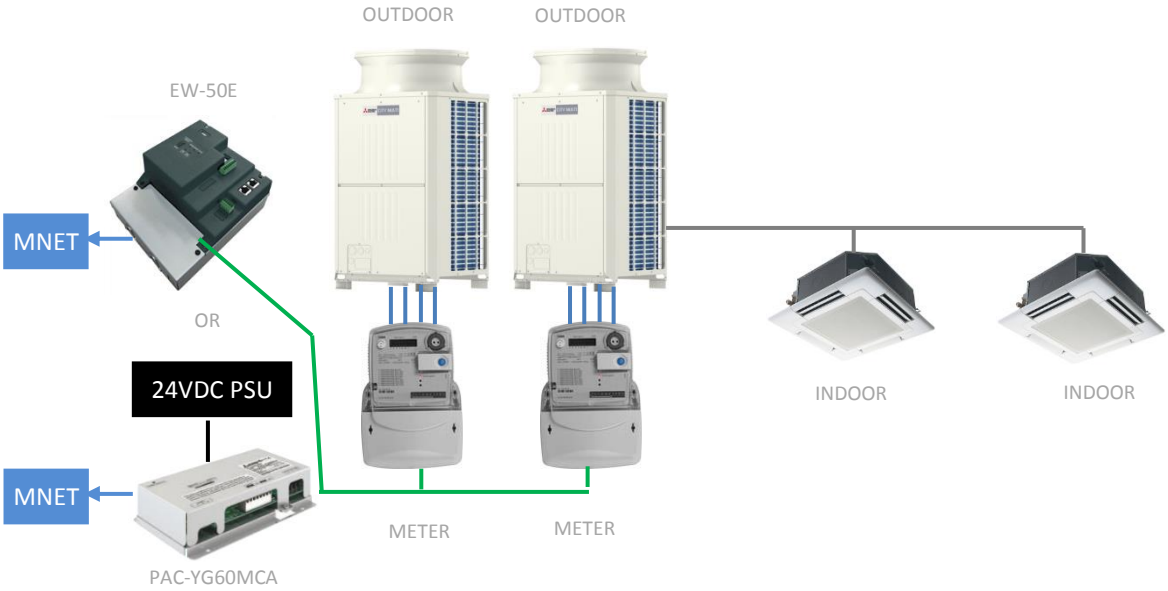
4.1. Using single module

When using a single module, one energy meter is connected to each outdoor unit.



4.2. Using multiple modules

When using multiple modules, one energy meter is connected to each module but all the energy meters will be connected together to one channel only.



4.3. Using City Multi and Splits systems

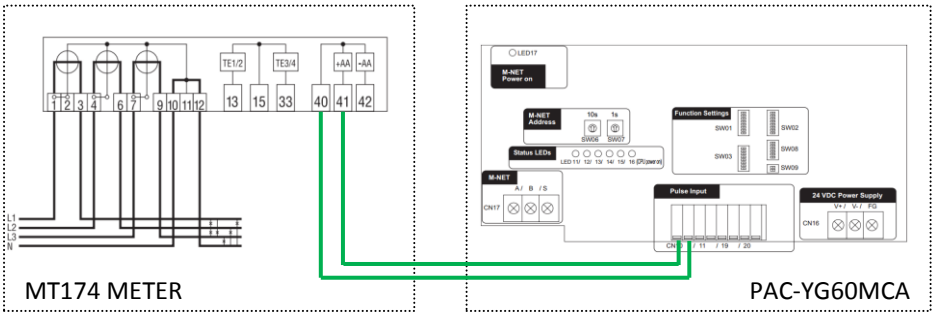
We must strongly advise the requirement of separating the power supply between splits and City Multi systems.

At least two pulse energy meters will then be required, one for City Multi and one for split systems which means two EW-50E or PAC-YG60MCA channels will be in use.

4.4. Connecting the MT174 energy meter to the PAC-YG60MCA

Meter:

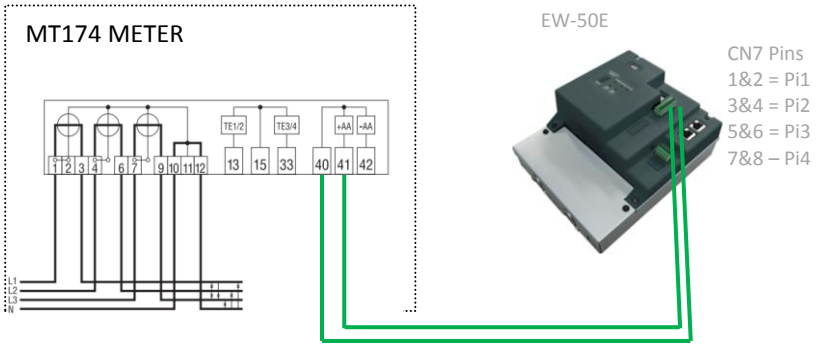
Wiring diagram:



4.5. Connecting the MT174 energy meter to the EW-50E

Meter:

Wiring diagram:



4.6. Setting up the meters and the EW-50E / PAC-YG60MCA

There are different ways to setup the PAC-YG60MCA and the energy meters.

Option 1, using the AE200 screen:

http://library.mitsubishielectric.co.uk/pdf/book/AE200_Instruction_Book__WT07190X01#

Option 2, using the AE-200E/EW-50E Webpages:

http://library.mitsubishielectric.co.uk/pdf/book/AE-200E_Browser_For_Initial_Settings__WT07138X01

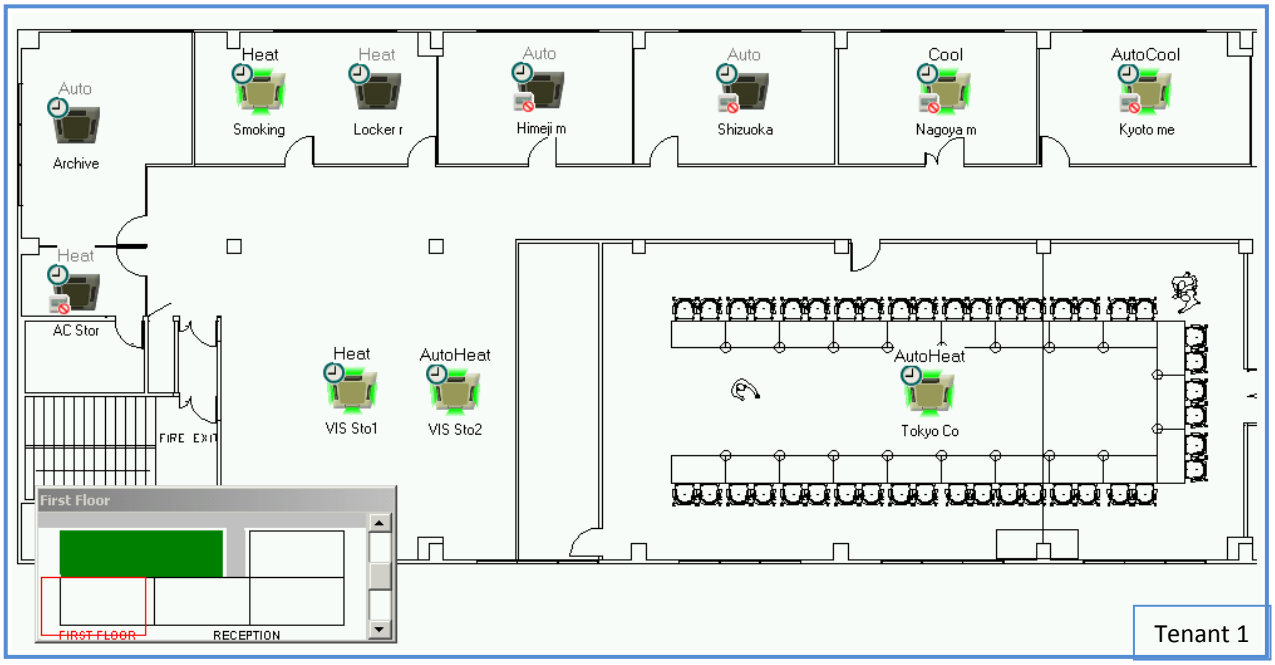
http://library.mitsubishielectric.co.uk/pdf/book/EW-50E_Browser_For_Initial_Settings_Manual#

5. Energy monitoring per system and with or without 3rd party equipment

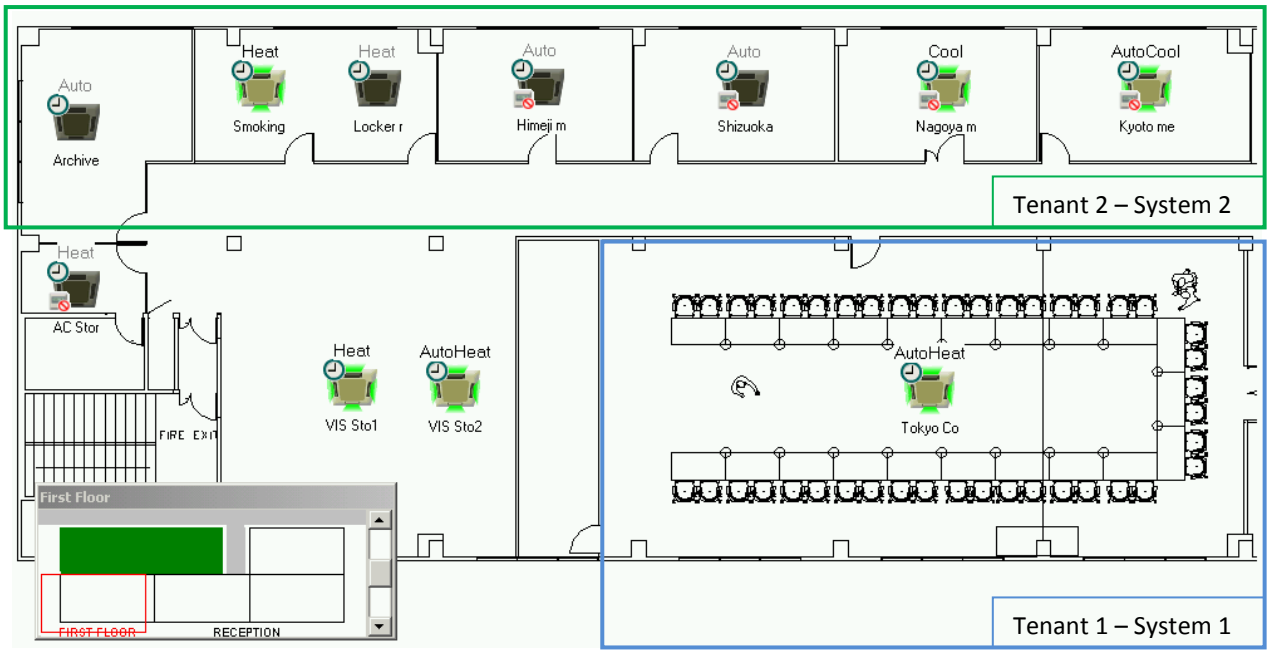
5.1. Overview and application

This solution allows the energy meter values to be shown on the AE-200E display but also and the AE-200E or EW-50E Webpages.

This option is ideal when there is only one tenant in the building.

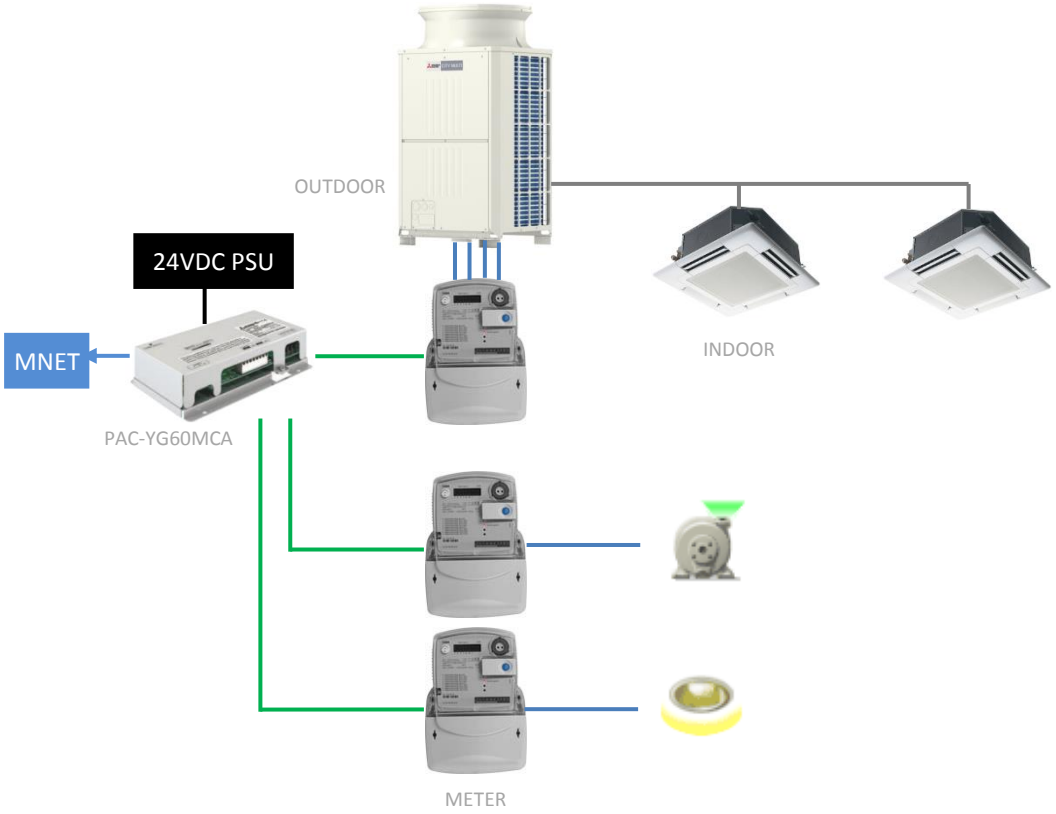


This option can also be used when you have multiple tenants but each tenant will need to have its own systems. The tenant energy consumption will then be the system energy consumption.



5.2. Setup

Up to 4 pulse energy meters can be monitored by the EW-50E on-board or PAC-YG60MCA pulse inputs so up to 4no items of 3rd party equipment may be monitored. It is also possible to monitor outdoor energy consumption by connecting a meter to the outdoor unit as shown below. The AE-200E if Not energy apportioning can use its 4no on-board pulse inputs to display MEASUREMENT of meters.



5.3. Output details

5.3.1. AE-200E Display

The pulse energy meters values will be displayed on the AE-200E MEASUREMENT TAB on the screen.

The values displayed on the AE-200E screen are READ ONLY and these cannot be exported or downloaded by USB.

5.3.1. AE-200E and EW-50E Webpages

The pulse energy meters values will be displayed on the AE-200E or / and EW-50E Webpages, under Monitor Operation > MEASUREMENT STATUS Tab

The values displayed on the AE-200E & EW-50E HTML5 web pages are READ ONLY and cannot be exported or downloaded, no Download button function exists on the HTML5 web page.

The values are accumulators which simply count the meter pulses and continuously add to the values, screen grabs (Print Screen) or Snipping tools can be used to copy data.

5.4. Compatibility

The table below shows compatibility with different product ranges.

Product range	Compatible
M Series	✓
P Series Mr Slim	✓
City Multi	✓
Lossnay	✓

5.5. Options required

Products	Details	Supplied by MEUK
Centralised controller	AE-200E or EW-50E	✓
Interface	PAC-YG60MCA (option if not using AE-200E or EW-50E on-board pulse inputs)	✓
Power supply	24VDC power supply only for PAC-YG60MCA	✗ (Refer to section 8)
PIN Code	None required	N/A
kWh meter	MT174 pulse output meter	✗ (Refer to section 8)

This is for Energy Measurement not Individual Apportionment

6. Energy monitoring per indoor unit or area

6.1. Overview and application

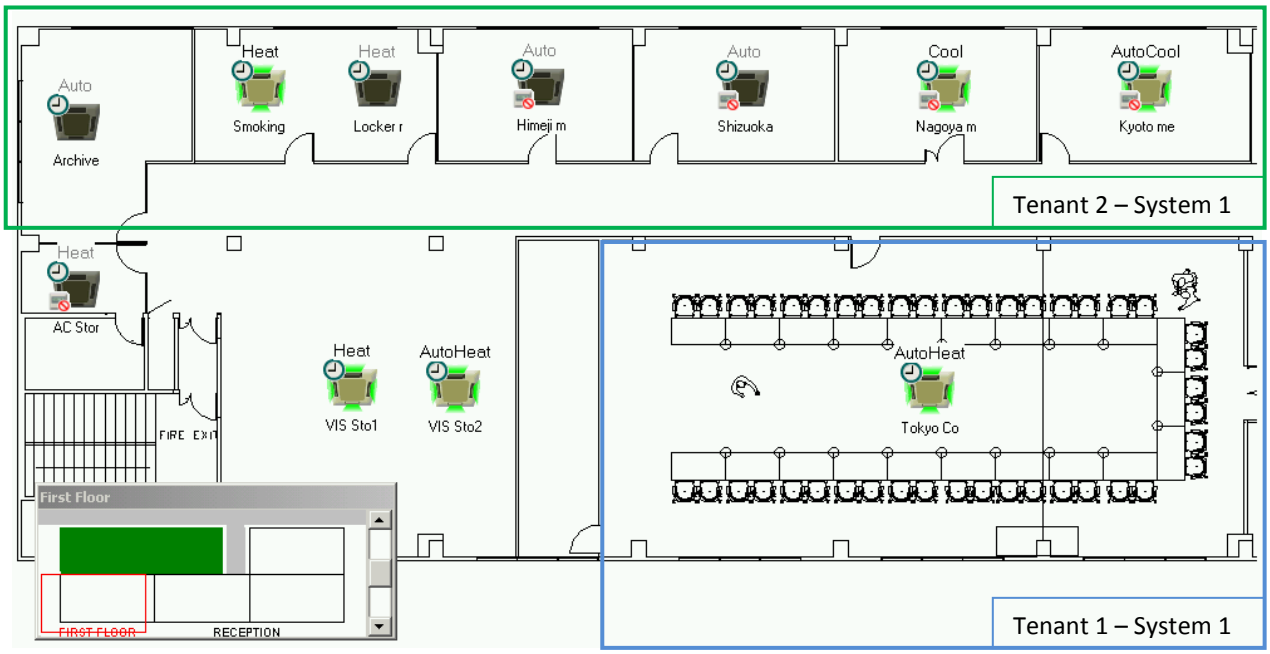
This solution allows the outdoor energy consumption in kW to be distributed across all indoor units. This information is shown on the AE-200E screen or / and / or EW50E Webpages.

The EW-50E reads the outdoor energy consumption from the pulse power meters and with the calculations performed by AE-200E without M-NET connected, and distributes it across the indoor units using indoor unit factors. Indoor unit factors are dependent of the running time of the unit, the size of the unit and the load of the unit.

The formula is per below:

$$IndoorUnitA = TotalEnergy \times \frac{IndoorUnitAFactor}{\sum IndoorUnitFactor}$$

This option is used when you have multiple tenants sharing the same system.



6.2. Data storage

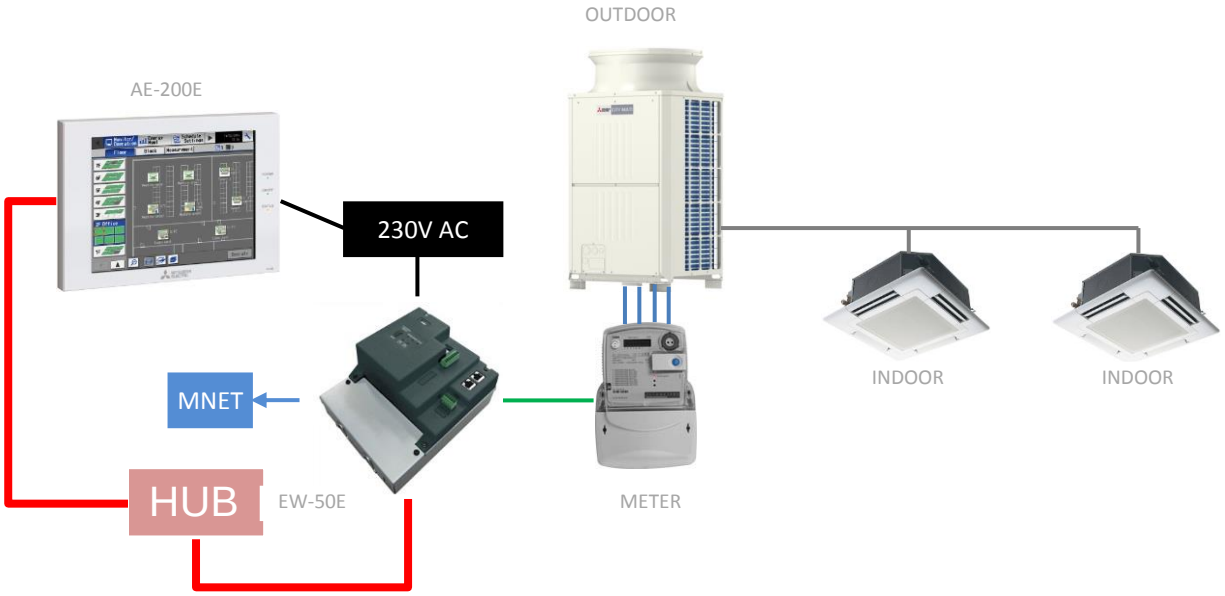
When using the AE-200E & EW-50E, the data is stored on the memory of the EW-50E and buffer backed up on the memory of the AE-200E which means the energy monitoring can be stored for many years.

The EW-50E & AE-200E is storing the data into an internal memory and has therefore a limitation:

Logging interval		**Maximum storage**
30 min	->	24 months
1 day	->	24 months
1 month	->	24 months
1 year	->	24 months

6.3. Setup

The setup is quite simple. All you need 1no AE-200E and 1 – 4no EW-50E and one energy meter per outdoor unit to monitor the outdoor energy consumption. Maximum 200 Indoor units connected to EW-50E only, AE-200E required.

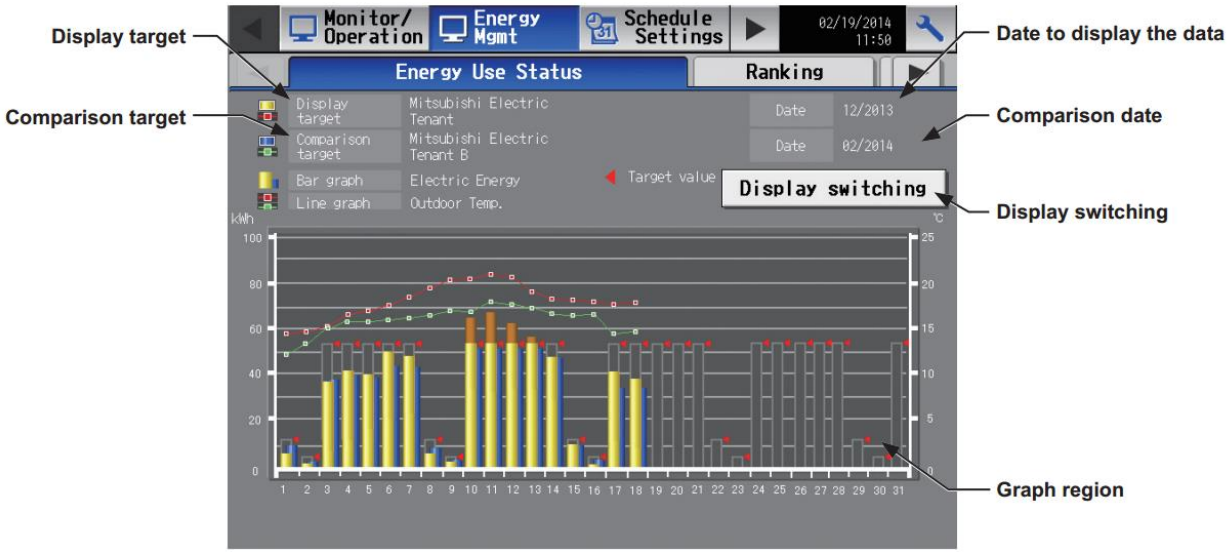


6.4. Output details

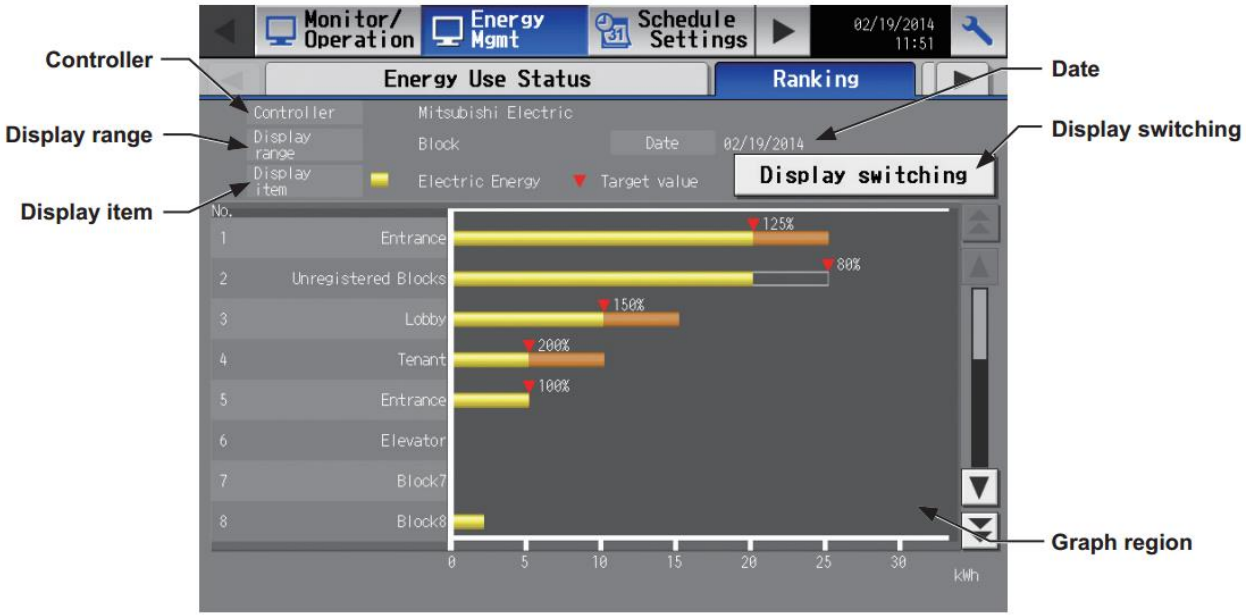
6.4.1. AE-200E Screen

The energy data is available in the energy management tab.

Energy per meter:



Energy per indoor unit/area including ranking and energy target:



6.4.2. EW-50E HTML5 Webpages

The energy data is available in the energy management tab > Energy Use Status.

(1) Click [Edit] to set the display items.

Click on the Ranking tab to show the kW per indoor units. Each area or indoor unit is then displayed with its power consumption. The information is available for daily, monthly and yearly consumption.

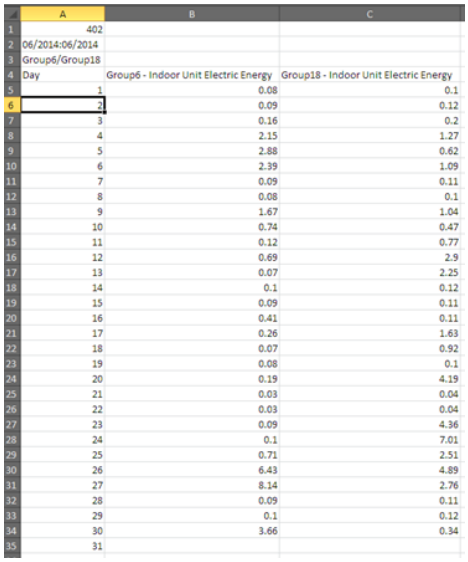
(1) Click [Display target] to set the display items.

Click on the Target Value tab and the data can be displayed measured vs target on a daily, weekly or monthly range of display.

6.5. Exporting data

6.5.1. Using the AE-200E screen and / or the EW-50E HTML5 web pages

The energy monitoring information can be exported to a CSV file (Excel format) using the Download button on the Measurement List Trend Logging option.



	A	B	C
1	402		
2	06/2014:06/2014		
3	Group6/Group18		
4	Day	Group6 - Indoor Unit Electric Energy	Group18 - Indoor Unit Electric Energy
5	1	0.08	0.1
6	2	0.09	0.12
7	3	0.16	0.2
8	4	2.15	1.27
9	5	2.88	0.62
10	6	2.39	1.09
11	7	0.09	0.11
12	8	0.08	0.1
13	9	1.67	1.04
14	10	0.74	0.47
15	11	0.12	0.77
16	12	0.69	2.9
17	13	0.07	2.25
18	14	0.1	0.12
19	15	0.09	0.11
20	16	0.41	0.11
21	17	0.26	1.63
22	18	0.07	0.92
23	19	0.08	0.1
24	20	0.19	4.19
25	21	0.03	0.04
26	22	0.03	0.04
27	23	0.09	4.36
28	24	0.1	7.01
29	25	0.71	2.51
30	26	6.43	4.89
31	27	8.14	2.76
32	28	0.09	0.11
33	29	0.1	0.12
34	30	3.66	0.34
35	31		

6.6. Compatibility

The table below shows compatibility with different product ranges.

Product range	Compatible
M Series	✘
P Series Mr Slim	✘
City Multi	✓
Lossnay	✘

6.7. Options required

Products	Details	Supplied by MEUK
Centralised controller	1no AE-200E and 1-4no EW-50E	✓
Interface	PAC-YG60MCA (option if not using EW-50E on-board pulse inputs)	✓
Power supply	24VDC power supply only for PAC-YG60MCA	✗ (Refer to section 8)
PIN Codes AE-200E Energy	Only quote and customer order 1no AE200E Energy	✓
kWh meter	MT174 pulse output meter	✗ (Refer to section 8)
Switch/Cables	Ethernet unmanaged network switch & cables	✗ (No part recommended as generic parts from IT supplier)
Site Commissioning	3 days MEU-UK field service attendance cannot be done by installer *1	✓

*1 MEU-UK field service commissioning 3 separate 1 day visits, on day of initial commissioning, 10 days and 30 days after initial commission to verify apportioned energy result accuracy.

7. Energy monitoring with BEMS

7.1. Two options

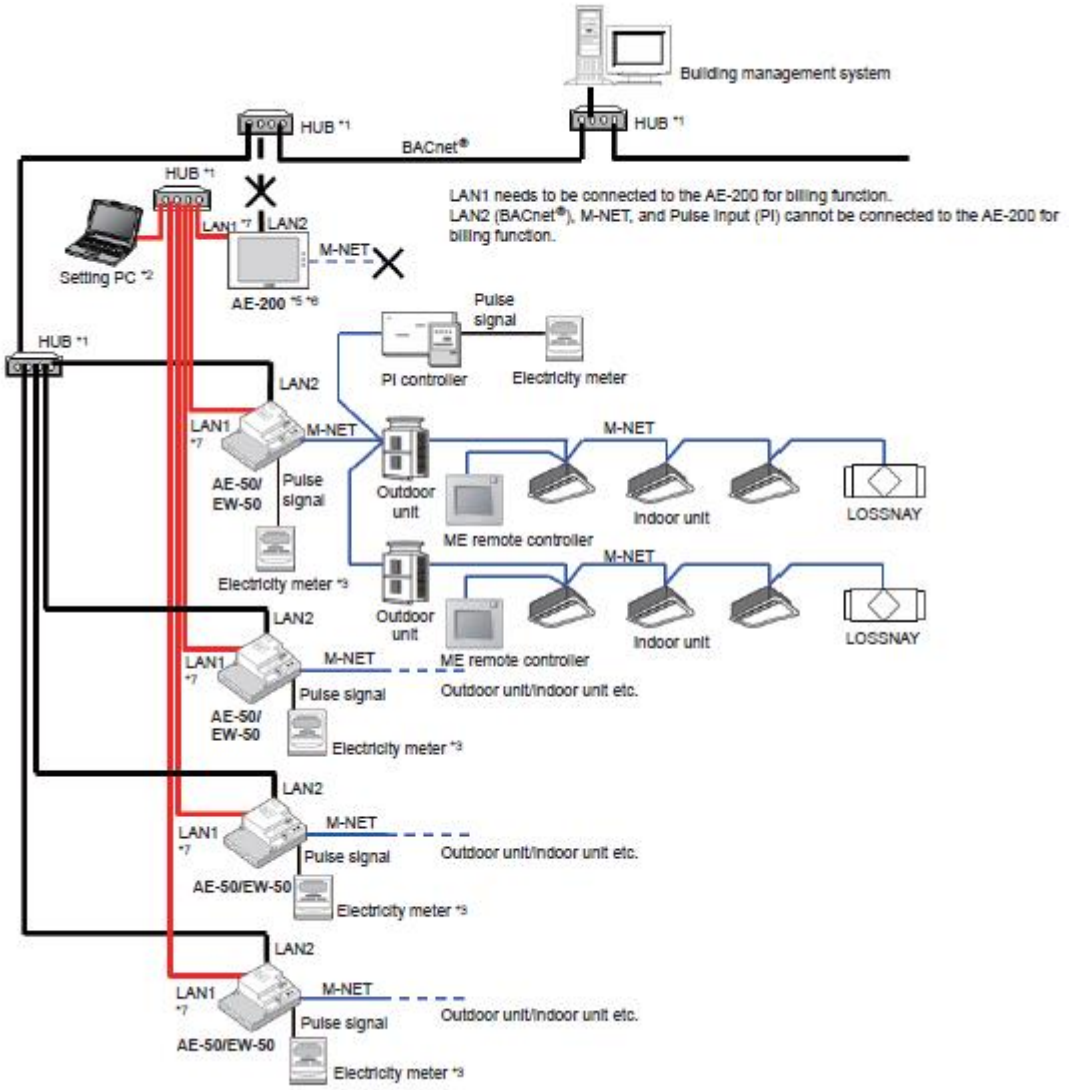
Two options are available to export energy monitoring data to a BEMS system:

- Option 1: using our on-board LAN2 BACnet IP on each EW-50E. This will require a BACnet PIN code.
- Option 2: using our MelcoBEMS interface. The BEMS will then be able to view energy monitoring data through Modbus or BACnet protocol

7.2. Energy monitoring with EW-50E LAN 2 with BACnet PIN code

7.2.1. Overview

With EW-50E LAN2 and BACnet PIN code the EW-50E can export to a BEMS data over BACnet IP



This setup requires AE-200E not connected by M-NET, or BACnet all connections to EW-50E only.

7.2.2. Compatibility

The table below shows compatibility with different product ranges.

Product range	Compatible
M Series	✓
P Series Mr Slim	✓
City Multi	✓
Lossnay	✓

WARNING on BMS/BEMS reading of Apportioned Energy over BACnet

The output by BACnet is energy apportionment by Accumulator BACnet object, this requires the BEMS to carry out a calculation of New Reading Less Old Reading as this is a value which will always grow and can be read to resolution of 0.1kWh, Example Reading at 09:00am on 1st day of Month (01 Nov 2017 @ 09:00 = 2100.1kWh, 2nd Reading 01 Dec 2017 @ 09:00am = 3100.6 kWh) = 1000.5 kWh, this calculation required to be carried out per Energy Management Block. If BMS is TREND then TREND XNC cannot carry out this calculation, TREND TONN with this calculation is required.
If any other BEMS ensure this calculation method is required to be confirmed as being performed.

7.2.3. Options required

Products	Details	Supplied by MEUK
Centralised controller	AE-200E and 1-4 no EW-50E	✓
Interface	PAC-YG60MCA (option if not using EW-50E on-board pulse inputs)	✓
PIN Codes AE-200E Energy AE-200E BACnet	Only quote and customer order 1no AE200E Energy 1no AE-200E BACnet	✓
kWh meter	MT174 pulse output meter	✗ (Refer to section 8)
Power supply	24VDC power supply only for PAC-YG60MCA	✗ (Refer to section 8)
Switch/Cables	Ethernet unmanaged network switch & cables	✗ (No part recommended as generic parts from IT supplier)
Site Commissioning	4 days MEU-UK field service attendance cannot be done by installer *1	✓

*1 MEU-UK field service commissioning 4 separate 1 day visits, on day of initial commissioning for Energy apportioning and another for BACnet commissioning as BMS/ BEMS contractor may not be present, 10 days and 30 days after initial commission to verify apportioned energy result accuracy.

7.3. Energy monitoring with BEMS using the MelcoBEMS interface

7.3.1. Overview

When the MelcoBEMS is connected to the EW-50E LAN1, the energy monitoring data can be seen on the Modbus or BACnet BEMS network.

It is important to activate the AE200 Energy PIN code on the AE-200E and EW-50E to allow energy monitoring. The on-board EW-50E pulse inputs must be in use or at least one PAC-YG60MCA must be connected to the EW-50E to allow the EW-50E to monitor pulses from the field supplied energy meter.

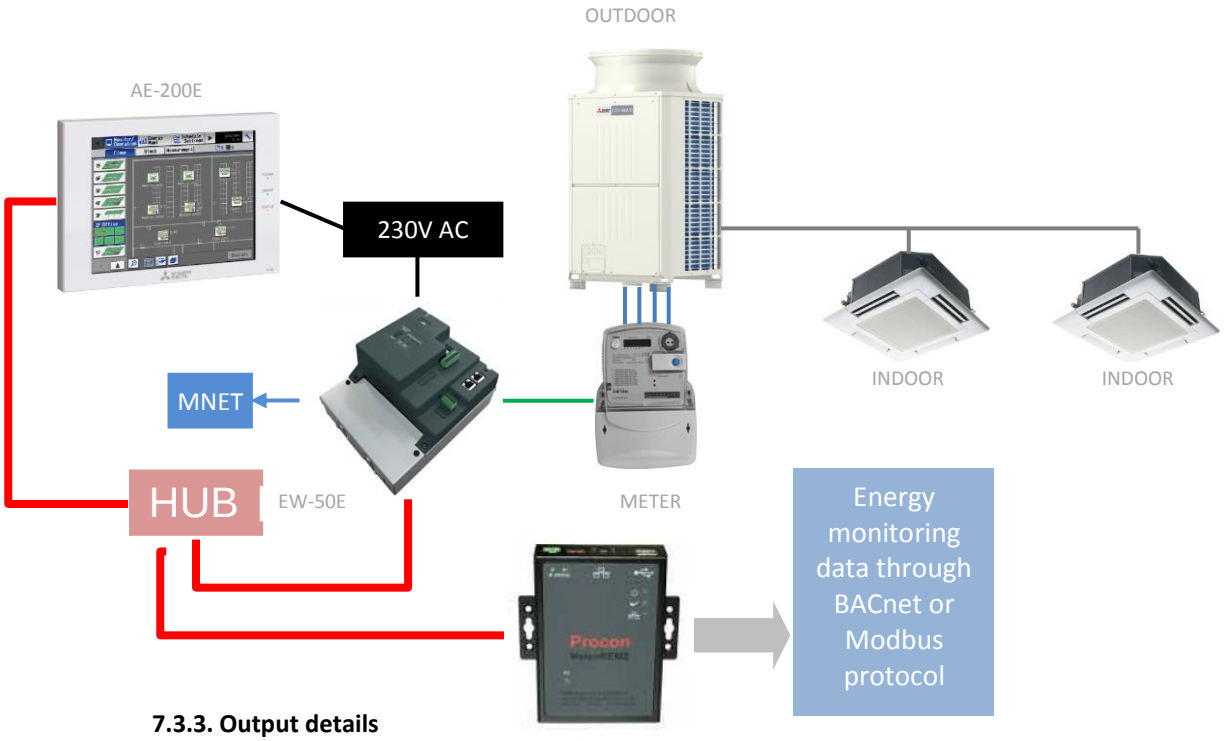
The BEMS will be able to monitor two different points:

- Previous Day Energy (kWh)
- Previous Month Energy (kWh)

<u>The MelcoBEMS does not log the energy data. It is down to BEMS to monitor and log the data every day or every month.</u>

7.3.2. Setup

It is important to connect the pulse energy meter to the EW-50E on-board Pulse inputs or PAC-YG60MCA and not the BEMS. The MelcoBEMS will then read the information from the EW-50E.
The MelcoBEMS is connected to LAN1 of EW-50E and NOT to AE-200E. AE-200E has no M-NET in use.



7.3.3. Output details

The energy monitoring data is calculated by the AE-200E and EW-50E and is available on BACnet or Modbus.

The MelcoBEMS requests daily data every day at 00:05 and monthly data at 00:15 on the last day of the month.
Monthly and daily data are also requested on power up.
For more information about air conditioning energy monitoring, refer to the AE-200E and EW-50E manuals.

7.3.4. Compatibility

The table below shows compatibility with different product ranges.

Product range	Compatible
M Series	✗
P Series Mr Slim	✗
City Multi	✓
Lossnay	✗

7.3.5. Options required

Products	Details	Supplied by MEUK
Centralised controller	1no AE-200E and 1-4no EW-50E	✓
PIN Code AE-200E Energy	Only quote and customer order 1no AE200E Energy	✓
Interface	MelcoBEMS (1no required per EW-50E)	✓
Interface	PAC-YG60MCA (option if not using EW-50E on-board pulse inputs)	✓
kWh meter	MT174 pulse output meter	✗ (Refer to section 8)
Power supply	24VDC power supply only for PAC-YG60MCA	✗ (Refer to section 8)
Switch/Cables	Ethernet unmanaged network switch & cables	✗ (No part recommended as generic parts from IT supplier)
Site Commissioning	3 days MEU-UK field service attendance cannot be done by installer *1	✓

*1 MEU-UK field service commissioning 3 separate 1 day visits, on day of initial commissioning, 10 days and 30 days after initial commission to verify apportioned energy result accuracy. No Commissioning of MelcoBEMS required this is the responsibility of BMS/BEMS contractor.

8. Third Party Equipment Suggestions

8.1. Energy meters

Suggestion:

Detail: MT174
Supplier: Autometers Systems Limited, 4b Albany Road, Chorlton-cum-Hardy, Manchester M21 0AW
autometers.co.uk Tel. 0161 861 9056
Note: **It is very important to specify to the supplier the pulse weight for the meter i.e. 1 pulse / kW.**

8.2. 24VDC power supplies

Suggestion 1:

Detail: XP POWER - DNR05US24 - DIN RAIL PSU, 5W, 24V SINGLE O/P (DNR05US24)
Supplier: uk.farnell.com (Farnell order code: 1858048)

Suggestion 2:

Detail: IMO PRECISION CONTROLS - DPS-1-018-24 - PSU, 18W, 24DC, 0.75A, DIN MOUNT (DPS-1-018-24)
Supplier: uk.farnell.com (Farnell order code: 1714519)

9. Information about Ofgem and MID

9.1. Introduction

Ofgem regulates the electricity and gas markets in the UK.

MID, the Measuring Instruments Directive (2004/22/EC) is a directive by the European Union, which intends to create a common market for measuring instruments across the 27 countries of the EU.

Meters which receive a certain class of MID certification may be used or sold in all countries across the EU for billing purposes.

9.2. Meter certification

MID started on the 31st of August 2006. It runs alongside Ofgem until 31 Oct 2016. After which Ofgem meters less than 100kW cannot be installed or replaced when used for billing.

MID is split into a number of classes:

- MID b – this is a “conforms to” mark and cannot be used for billing
- MID b + d – this means the unit is self-certified and can be used for billing
- MID f – this is an independently verified mark and can be used for billing

The MID f mark is rare, due to the costs per product – “MID certified” with MID b + d is most common.

The accuracy of the accruing of data at the meter is what is certified the output method is completely independent.

In a dispute over billing accuracy the Fair Trade office would refer straight to the certified meter counter itself and not the centralised control system. Therefore both pulse and Modbus outputs are found on meters allowing the user to choose their method of centralised monitoring.

Their advice is to have the ability to see any faults with centralised monitoring and to periodically verify with actual meter readings.

10.Frequently asked questions

1. How many meters can we connect to a singleEW-50E on-board pulse input or PAC-YG60MCA?
   ➔ 4.

2. Is there a limit on the number of PAC-YG60MCA per AE-200E and EW-50E?
   ➔ Yes, the limit is 15.

3. How many MNET addresses does the PAC-YG60MCA use?
   ➔ The PAC-YG60MCA uses only one MNET address even when 4 meters are connected.

4. Is it possible to setup tariffs on AE-200E?
   ➔ No, you cannot set up tariffs on AE-200E outlawed under MID2013.

5. Is it possible to set up a standard charge on AE-200E?
   ➔ No.

6. Is it possible to automatically export energy monitoring data and if so how often?
   ➔ No this has to be extracted using USB on AE-200E or by EW-50E HTML5 web pages.

7. Is it possible to include indoor energy consumption to the energy bills?
   ➔ Yes, it is possible using AE-200E & EW-50E. Indoor energy consumption can be estimated or measured using dedicated pulse energy meters.

8. How long does the EW-50E and AE-200E store the energy data for?
   ➔ AE-200E: 2 years, EW-50E: 2 years.

9. Does the MelcoBEMS stores the energy monitoring data?
   ➔ No, the BEMS company must read the data daily or monthly and store it.

10. How many M-NET addresses does the EW-50E on-board pulse input channels use?
    ➔ None as on-board EW-50E as M-NET address 000.