The Australian National University
Electrical Meter Specification

Contents

Version	Date	Authors	Summary of Changes
1.0	15 January 2015	Rajeel Naicker	

ELECTRICAL METERING STANDARDS AND REQUIREMENTS

ANU Energy Management System (EMS) will gather and store energy consumption data from each of the buildings throughout the campus. Information will be collected from electricity, gas and water meters. Data will be used for in house billing, optimize energy /water consumption of the buildings, provide feedback to building users through a dashboard display and to building mangers through the BMS.

Approved Make of Electricity Meters

The electrical meters must be of proven design and manufacture. Manufactured and supplied by:

- SATEC
- Schneider Power
- NHP

Meter Communication Protocol

Electrical meters must have the ability to connect to ANU EMS TCP/IP LAN. Meters should have the ability to be set up with a fixed IP address. Operators of the current Energy Management System must be able to extract all necessary data from the electric meters with ease. The University must also be able to extract data from other devices attached to the meter e.g. pulsed gas or water meters.

Please note Main Incoming meters and Mechanical switch boards meters must be IP meters. These meters must not be connected to the data point via any third party gateways. Gateways must be native to the meters.

Meter Features /Requirements

Type -EM-1 (Refer to electrical drawings for EM-1 locations). See figure 1 for example

- NMI Approved or NMI Grandfathered
- Volts, Amps, Power Factor (total and per phase)
- Power kW, kVA, kVAr (total and per phase)
- Demands and Max Demands kW, kVA, kVAr
- Energy kWh, kVA, kVAr Import and Export
- Voltage/current unbalance
- Energy accuracy class 0.5s
- Time of Use (TOU)
- Voltage and Current Harmonics
- Voltage and Current THD (Total Harmonic Distortion)
- Max/Min values
- Real Time Clock
- Sufficient internal storage to capture seven days of data (Capturing time can be varied)
- System Events and Data Logging
- Alarm and Control function
- Ethernet Port (protocol Modbus/TCP)
- Should have at least 2 low level pulse input.(These will be used for Gas and Water meters)
- LED or LCD Display
- Rechargeable lithium ion battery for backup power.- Optional
- Should be flush or DIN rail mount

Type-EM-2 (Refer to electrical drawings for EM-2 locations). See figure 1 for example

- NMI Approved or NMI grandfathered if board is directly fed from the substation.
- Volts, Amps, Power Factor (total and per phase)
- Power kW, kVA, kVAr (total and per phase)
- Demands and Max Demands kW, kVA, kVAr
- Energy kWh, kVA, kVAr Import and Export
- Voltage/current unbalance
- Energy accuracy class 0.5s
- Time of Use (TOU)
- Voltage and Current Harmonics
- Voltage and Current THD (Total Harmonic Distortion)
- Max/Min values
- Real Time Clock
- Sufficient internal storage to capture seven days of data (Capturing time can be varied)
- System Events and Data Logging

- Serial Port RS-485 (protocol Modbus RTU)
- Ethernet Port (protocol Modbus/TCP)- not required if daisy chained with EM-1 Type meter
- Should have at least 2 low level pulse input.(These will be used for Gas and Water meters or for connecting to slave meters EM-3)
- LED or LCD Display
- Rechargeable lithium ion battery for backup power.- Optional
- Should be flush or DIN rail mount

Type - EM-3 (Refer to electrical drawings for EM-3 locations). See figure 1 for example

- Volts, Amps, Power Factor (total and per phase)
- Power kW, kVA, kVAr (total and per phase)
- Demands and Max Demands kW, kVA, kVAr
- Energy kWh, kVA, kVAr Import and Export
- Energy accuracy class 0.5
- Real Time Clock
- Serial Port RS-485 (protocol Modbus RTU)
- LED or LCD Display.-Optional
- Should be flush or DIN rail mount.

One Meter Per Circuit

Use one meter per electrical circuit, do not use one meter for multiple circuits.

Meter Locations in Board

Meter, test block, external power supply, and communication block must be separated from the bus-bar chassis cubical.

Current Transformers

- Correct rated CTs should be provided which each meter.
- CTs must be of proven design and manufacture.
- Split core CTs are preferred for maintenance purposes.
- Cable length for CTs should not be greater than 100m.
- Preferred output from CTs 0-10A ac

Current Transformers Installation

- Current transformers specifications labels/ name plate must not be obstructed.

- To ensure that voltage can be measured while the board is live, current Transformers terminal must be facing the front of the switchboard unobstructed.
- Current Transformers must be placed towards the front of the board and not mid-way or towards the back of the board.

Communication LAN Modbus-RS 485

- Communication cables must be terminated with boot lace crimps.
- Tails of comms cables must have labelled (+), (-) and Shield.
- Tails should be labelled as per Modbus network number. Modbus network naming format “Modbus Network xx”. These labels must match with the metering LAN schematic.

Pulse Inputs (Gas and Water Meters)

The EM1 and EM2 Type meters require pulse inputs to facilitate the connection of 'Dumb' Gas and Water meters. 'Dumb' meters refer to meters that only offer pulse outputs.

The following specifications and guidelines should be adhered to:

1. Pulse input must be self-powered.
2. If the meter is unable to provide DC power to the inputs, an external power supply should be utilised.
3. The power supply should be physically separated from the bus-bar chassis cubicle.
4. The power supply must be clearly labeled as "DC Power Supply for Meter Inputs."

During the handover process, it is essential to document the type of meter (Gas or Water) connected to each input in the EM1 or EM2 meters. This documentation should clearly outline the specific connections between the meters and inputs for future reference and troubleshooting purposes.

Current Transformer Test Blocks and Direct Connect Meters

- Each meter shall have an individual Current Transformers (CT) test blocks, potential fuses or circuit breaker and correctly rated CT’s. A CT Test block is a device or equipment that has terminals for CTs, testing voltage and most importantly test sockets. Test Sockets (banana sockets) will be used to connect University’s specialized test equipment during meter verification.
- Direct connect meters must not be used on campus.

Commissioning of meters

Meter installer must commission the meters and provide the following information in to ANU and meter verification contractor.

- Meter location
- Board Name and Location

- Meter IP Address , Subnet and Gateway
- Meter Modbus Address, Baud Rate and Parity
- LAN schematic ,showing how meters are daisy chained with highlighted End of Lines
- Electrical Single Line Diagram. This must be provided by the principal contractor via the electrical contractor.

Meter connection to Energy Management System.

- IP Meter: IP meters need to connect to the nearest data port.
- Modbus Meter: Modbus network needs to be connected to a Modbus gateway that must be accessed and configured via a web page. BMS Controllers cannot be used as a Modbus gateway.

Meter Verification, Certification and Integration

- The University will engage a University approved meter verification contractor. Using the commissioning sheet provided by the meter installer the verification contractor will verify the meter installation and submit a certificate directly to ANU. Once this is completed then the meter installer or principal contractor must engage an ANU approved contractor to integrate meters to the Energy Management System.

Meter Current Transformer Wiring

Refer to the wiring diagram provided in the Appendix below.

General Guidelines

As a general guide to the utilization of energy meters, the following is the proposed strategy:

- Meter EM-1 to be used as the main meter for the building. The main gas and water meters shall be connected to this meter or connected to an ANU approved gateway.
- Meter EM-2, to be used in distribution board or mechanical boards.
- MeterEM-3 to be used as sub meters to EM-2 meters for metering light ,power and mechanical system power in order to comply with NCC requirements. Where EM-3 meter is not suitable, EM-2 meters shall be used.

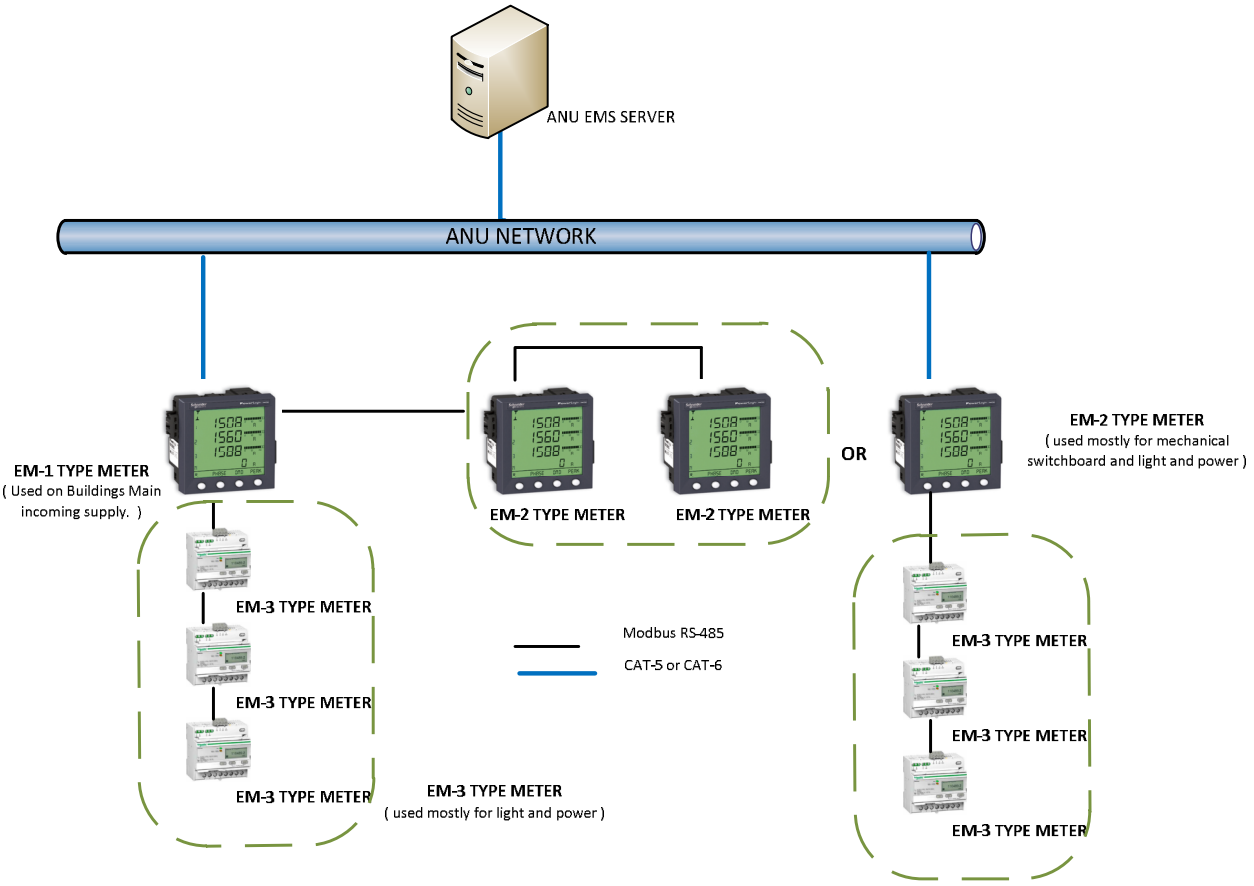
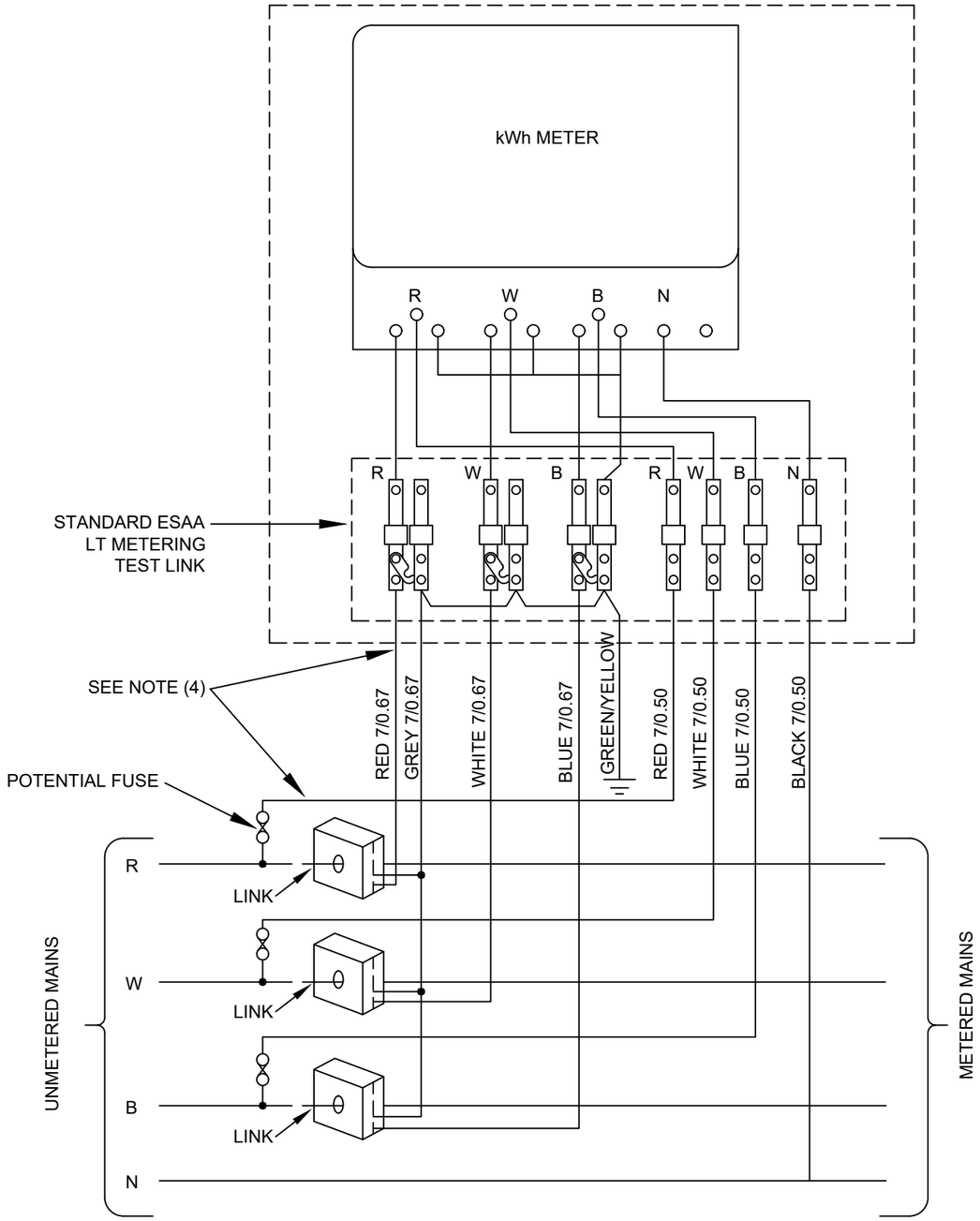

ANU EMS SERVER
ANU NETWORK
EM-1 TYPE METER
(Used on Buildings Main incoming supply.)
EM-2 TYPE METER
EM-2 TYPE METER
OR
EM-2 TYPE METER
(used mostly for mechanical switchboard and light and power)
EM-3 TYPE METER
EM-3 TYPE METER
EM-3 TYPE METER
EM-3 TYPE METER
(used mostly for light and power)
Modbus RS-485
CAT-5 or CAT-6
EM-3 TYPE METER
EM-3 TYPE METER
EM-3 TYPE METER

Figure 1



Maximum CT Wiring / Cable Route Lengths			
Conductor Size	Maximum CT Wiring / Cable Route Lengths (m)		
(mm^2)	5VA CT	10VA CT	15VA CT
2.5	10	20	30
4	16	32	50
6	25	50	75
10	40	80	120

NOTES:

1. THE MINIMUM PREFERED SIZE OF CT CABLE IS 7/0.67 ($2.5mm^2$)
2. ALL POTENTIAL CABLES TO BE 7/0.50 ($1.5mm^2$)
3. POTENTIAL FUSES 10AMP EE HRC TYPE RS20PH
4. CT CABLES SHOULD NOT EXCEED THE LENGTHS SHOWN IN THE ADJACENT TABLE
5. ROUTE LENGTH OF 10m ASSUMES A CONDUCTOR LENGTH OF 20m (TO INCLUDE THE IMPEDANCE OF THE RETURN PATH)
6. METER BURDENS CAN BE ASSUMED TO BE NEGLIGIBLE AND HAVE NOT BEEN INCLUDED IN THESE CALCUATIONS

No.	DATE.	AMENDMENT.	DWN.	CKD.	APP.

Australian National University
FACILITIES AND SERVICES

PROJECT TITLE:
Diagram of Connections
To Current Transformers

DRAWING TITLE:
Kilowatthour Polyphase Meter
Test Links and Potential Fuses

Date: February 2020 | Scale: N.T.S.
Drawn: G.G. | Checked:
Approved: | Sheet Size:
DWG No: | Issue 1

LOCATION: \\HOMEDRIVE.ANU.EDU.AU\U1070857\MY DOCUMENTS\DIAGRAM OF CONNECTIONS.DWG