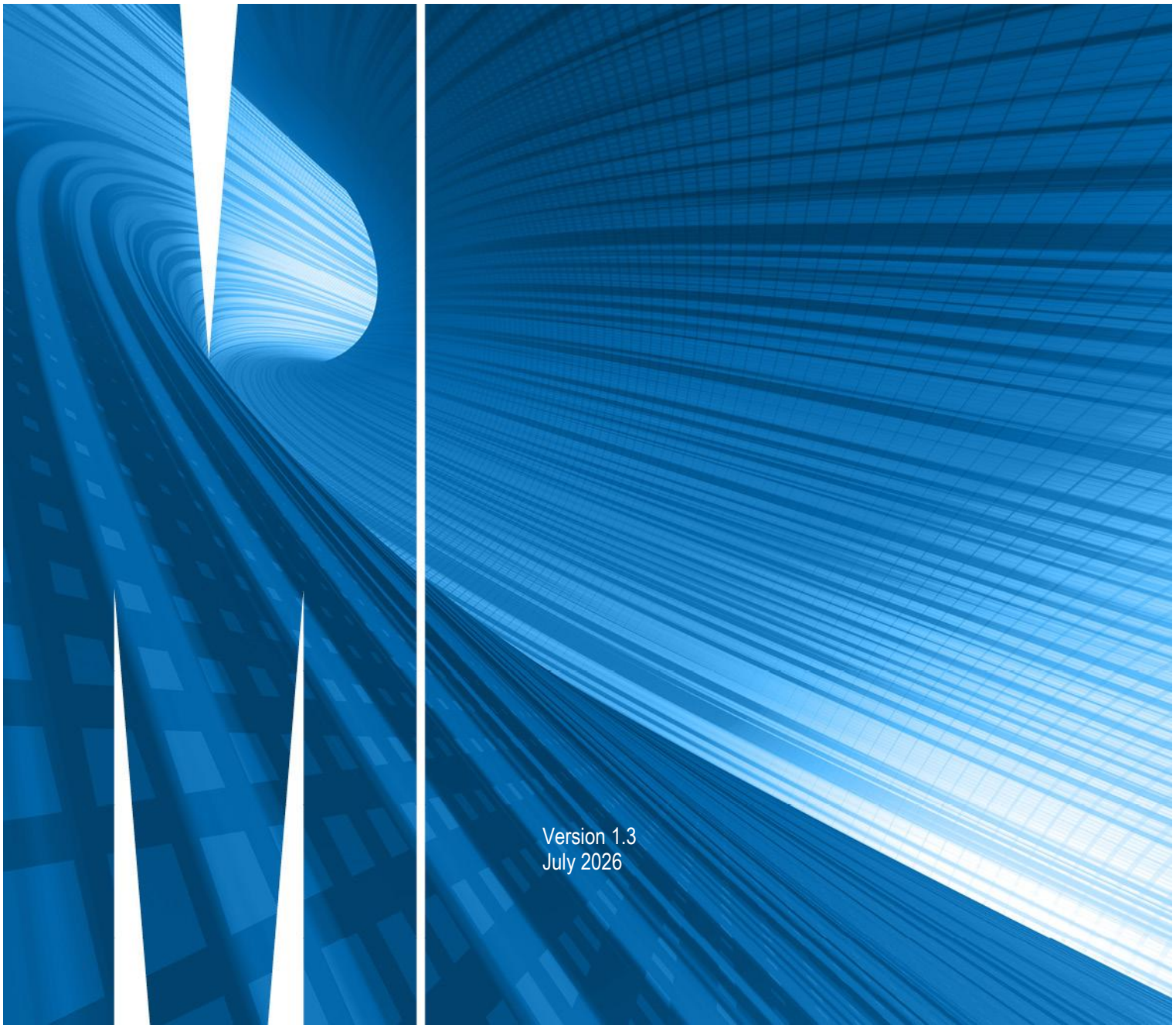
MONASH University

Buildings and Property Division

METERING STANDARD



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1.0	12/05/2026	Draft issue
1.1	29/05/2026	Original issue
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1.3	28/07/2026	Addition of approved topologies content

MONASH University

CONTENTS

ABBREVIATIONS AND DEFINITIONS

Abbreviations	Definitions
BAS	Building Automation System
CHW	Chilled Water
CT	Current Transformer
EV	Electric Vehicle
HHW	Heated Hot Water
HV	High Voltage
MDCS	Monash Design and Construction Standards
MU	Monash University
NCC	National Construction Code
SPME	Schneider Power Monitoring Expert
TEMS	Tridium Energy Monitoring System
UTP	Unshielded Twisted Pair
VLAN	Virtual Local Area Network

1 INTRODUCTION

1.1 PURPOSE

This Metering Standard aims to define best practice for the design, installation and commissioning of the Monash University (MU) metering systems. It aims to meet the key functional requirements to enable a consistent, objective-led metering strategy across the MU portfolio.

This standard is intended for use by relevant personnel, including but not limited to designers, installers, and approval professionals during the feasibility stage of a project through to project completion. Compliance with this standard is mandatory, except in cases where a deviation has been approved.

This standard shall be read in conjunction with the Monash Design and Construction Standards (MDCS). Compliance with the MDCS is also mandatory.

1.2 SCOPE

This Standard applies to all future capital works, retrofits, refurbishments, and upgrades at MU (encompassing services, operations, planning, and projects). This includes, but is not limited to new builds, mechanical plant upgrades, energy generation systems and change of use of buildings. To ensure compliance with this standard, criteria must be addressed from the project feasibility stage.

1.3 KEY FUNCTIONS

The metering systems at MU are required to achieve the following key functions.

- **Demand Response:** Utilise metering data to drive demand response across the campus to dynamically balance and distribute energy resources.
- **Tenant Billing:** Adequate billing grade meters shall be utilised to accurately bill MU tenants.
- **Cost Recovery:** Extensive metering and submetering network support in allocating energy costs internally to various faculties and departments.
- **Operations and Maintenance:** Provide a tool to monitor and maintain meters across the campuses.
- **Energy Monitoring:** Customisable energy graphical user interfaces to showcase building energy performance.
- **Building Analytics:** Provide access to live and historic metering data for the purpose of building optimisation across the campuses.
- **Measurement and Verification:** Extensive metering network to support measurement and verification processes to track and assess the energy performance outcomes of initiatives.
- **Research and Development:** Provide energy and resource consumption reporting, and data access, to support MU research and development.

1.4 CONTRACTOR OBLIGATIONS

Contractor shall be responsible for meter design, supply, installation, and commissioning, including the following.

- **Installation:** Install meters in accordance with this Standard, manufacturer recommendations and all applicable statutory requirements.
- **Protocol:** Provide Modbus communications from each meter to the EMS via the nominated interface (typically Modbus TCP/IP for Ethernet devices, or Modbus RTU via an approved RS-485 to IP gateway).
- **Network Addressing:** Obtain and apply MU-assigned IP addressing and VLAN/subnet details, connect the meter to the structured cabling system provided by MU via the Ethernet port and document the final addressing schedule.
- **Meter Commissioning:** Test and commission the new meters to operate as part of the energy system providing all system functionality and accessibility. Ensure all meters are cabled correctly, fully operational and meter readings on the EMS align with an independent measurement device.

1.5 DOCUMENTATION

This Standard shall be read in conjunction with the following documentation:

- Monash Design and Construction Standards (MDCS)
- MU BAS Commissioning Plan Template
- MU BAS Tagging Standard
- MU BAS Graphics Standard
- MU New Metering Device Request Form Template
- MU Metering Commissioning Template

1.6 NATIONAL CONSTRUCTION CODE (NCC)

The metering installations at MU shall comply with the latest applicable version of the National Construction Code (NCC). Specifically, except in cases where a deviation has been approved, compliance shall be with section 'J9D3 Facilities for Energy Monitoring' of NCC 2025 Volume 1, including the following clauses.

- A building with a floor area of more than 500 m^2 shall have meters configured to record the time-of-use consumption of gas and electricity.
- A building with a floor area of more than 2,500 m^2 shall have meters configured to enable individual time-of-use energy data recording, of mechanical services (including heating plant, cooling plant and air handling fans); artificial lighting; power; central hot water; lifts; escalators; moving walkways; solar photovoltaic systems; electric vehicle chargers; battery systems; and other ancillary plant.
- The meters shall be interlinked by a communication system that collates the time-of-use energy data to a monitoring system where it can be stored, analysed, and reviewed.

The definition of 'time-of-use' in NCC is time-stamped interval consumption data log. It is not the multi-tariff (peak, off-Peak, shoulder) time-of-use schedule from the energy retailers.

2 EXTENT OF SCOPE

New meters shall be connected to MU's **Energy Monitoring System (EMS)**, which includes the following.

- **Schneider Power Monitoring Expert (SPME):** All new high voltage electrical (11,000V and higher) meters (i.e. Tiers 1A and 1B) shall be connected to this system.
- **Tridium Energy Monitoring System (TEMS):** All new high voltage electrical (11,000V and higher) meters, low voltage electrical (415V and lower), thermal energy, water, and gas meters (i.e. all Tiers) shall be connected to this system.
- **Tridium Building Automation System (BAS):** Where meters are required for the control or monitoring of mechanical assets, they shall additionally be connected to the BAS.

2.1 SCOPE OF METERING

MU's metering system covers electrical, thermal energy, water, and gas metering services across its building portfolio. Table 1 details key metering points required for each service across MU's facilities.

Meter Tier	Electrical Meters	Thermal Energy Meters	Water Meters	Gas Meters
1A	• Incoming HV supply			
1B	• Electrical ring main		• Main site or campus potable water supply or ring main	• Main site or campus gas supply
2	• Main building supply • Incoming supply to main switchboard		• Main building potable water supply	• Main building gas supply
3	• Submains cables from main switchboard • Generators • Uninterruptible power supplies • Distributed energy resources • EV charging • Mechanical services switchboard • Hydraulic services switchboard • Major mechanical plant • Lifts • Tenancy supply	• Base building supply (HHW, CHW) • Tenancy supply (HHW, CHW)	• Major sources (rainwater harvesting, water treatment) • Central plant (hot water, mechanical) • Kitchen • Bathrooms • Irrigation • Laboratory • Tenancy supply (retail, commercial)	• Central plant • Kitchen • Laboratory • Tenancy supply (retail, commercial)
4	• Distribution board (light and power supplies)			

Table 1: Scope of Metering

2.1.1 OUT OF SCOPE

The following items are beyond the scope of this Standard and to be managed separately by MU:

- Existing installed meters and metering systems across MU's building portfolio unless explicitly identified for replacement, upgrade, or integration.
- Configuration and management of the EMS, including server hardware/software, licensing, database configuration, user management, and enterprise integrations.
- This Metering Standard does not supersede the requirements of project-specific tender documentation, specifications, or contract requirements; applicable Australian Standards and statutory regulations; the NCC; or relevant authority requirements.

3 ELECTRICAL METERS

3.1 GENERAL

Electrical meters shall be provided throughout each electrical installation to provide real time and historical monitoring of energy associated with the campuses. The new electrical meters specified in this section are private meters and not authority meters (i.e. not retail meters). Provide electrical supply authority meters (i.e. retail meters) as required by the relevant supply authority, as per the relevant electrical authority guidelines.

All electrical meters shall be:

- Installed as per AS 3000. Electrical Safety Certificates to be provided for each installation.
- Provided with current transformers (CTs). For each electrical meter, install CTs with correct orientation and ratio. Ensure correct phase association and polarity.
- Provided with CT shorting links and circuit breakers to allow for replacement and maintenance of meters whilst avoiding the need for full electrical board shutdowns.
- Installed in accessible locations and in accordance with the manufacturer's recommendations.
- Installed as per local electrical authority guidelines (if applicable).
- Physically labelled for identification (matching with the As-Installed electrical services documentation).

3.2 COMMUNICATIONS

All new electrical meters with an Ethernet port shall communicate via Modbus TCP/IP and be connected to the EMS, through the structured cabling system using Category 6A cables.

- Contractors are to provide cabling from these meters to the MU-provided Ethernet port and terminate the cables at both ends. Cable type shall be Category 6A.

Unless connected through an approved topology shown in Section 9, each Ethernet meter shall be connected directly to an MU-provided Ethernet port. Where manufacturer-supported Ethernet daisy chaining is used, multiple Tier 2 and/or Tier 3 meters may share a network connection. Where meters of different tiers are included, the highest-tier meter shall be connected closest to the MU network connection.

All new electrical meters without an Ethernet port shall communicate via Modbus RTU and be connected to the EMS via Modbus RS-485 to Ethernet gateways.

- Contractors are to provide cabling from these meters to the Ethernet gateway(s) and terminate the cables at both ends. Cable type shall be Modbus RS-485 serial comms cable. The limit of any Modbus RS-485 channel shall be 20 meters.
- Modbus RS-485 serial comms cable shall have 2 twisted pairs, polyethylene individual element insulation, outer shield, PVC outer jacket, and minimum 24AWG (7x32) size and stranding.
- The Ethernet gateways shall:
    - Be connected directly to the EMS, through the structured cabling system using Category 6A cables.
    - Provide Modbus RS-485 serial-to-Ethernet connectivity.
    - Support the specified electrical meters.
    - Be **Schneider Electric PAS600L, Moxa MGate** or approved equal.

Where supported by the manufacturer:

- Auxiliary serial communications ports on Ethernet-connected electrical meters may be used to provide Modbus RS-485-to-Ethernet gateway connectivity for downstream serial devices.
- Auxiliary digital inputs with suitable pulse-counting functionality may be used for integration of downstream digital pulse-output devices.

Refer to Section 9 for further detail regarding approved topologies.

3.3 PERFORMANCE SPECIFICATIONS

3.3.1 TIER 1A

Tier 1A electrical meters shall:

- Be provided for the incoming high voltage (11,000V and higher) electrical supplies.
- Be able to connect to the EMS. Where required, meters shall support simultaneous communication with multiple systems (i.e. SPME and TEMS).
- Be **Schneider Electric PowerLogic ION9000** or approved equal.
- Have the following minimum features as per Table 2 (for all phases).

Functionality	Specification
Type of Network	3 Phases + Neutral + Earth
Accuracy	Class 0.1 Active Energy
Instantaneous Reading	Voltage between phases (100-600 Vac) Voltage between neutral and phase (100-400 Vac) Current (A) Frequency (50-69 Hz) Apparent power (kVA) Active power (kW) Reactive power (kVAr) Power Factor Harmonic Distortion
Maximum Demand Reading	Current (A) Apparent power (kVA) Active power (kW) Reactive power (kVAr)
Memory Capacity	2GB
Operating Temperature	-25…+70 degrees Celsius
Rated Current	1A or 5A (via Current Transformer)
Import/Export	Bi-directional Electrical Energy Metering
Communications Protocol	Ethernet (Modbus TCP/IP, ION protocol)
Display	Integrated LCD Display
Mounting	DIN mount capability

Table 2: Minimum Technical Specifications for Tier 1A Electrical Meters

3.3.2 TIER 1B

Tier 1B electrical meters shall:

- Be provided for the incoming high voltage (11,000V and higher) ring main.
- Be able to connect to the EMS. Where required, meters shall support simultaneous communication with multiple systems (i.e. SPME and TEMS).
- Be **Schneider Electric PowerLogic ION7400** or approved equal.
- Have the following minimum features as per Table 3 (for all phases).

Functionality	Specification
Type of Network	3 Phases + Neutral + Earth
Accuracy	Class 0.2 Active Energy
Instantaneous Reading	Voltage between phases (100-600 Vac) Voltage between neutral and phase (100-400 Vac) Current (A) Frequency (50-69 Hz) Apparent power (kVA) Active power (kW) Reactive power (kVAr) Power Factor Harmonic Distortion
Maximum Demand Reading	Current (A) Apparent power (kVA) Active power (kW) Reactive power (kVAr)
Memory Capacity	512MB
Operating Temperature	-25…+70 degrees Celsius
Rated Current	1A or 5A (via Current Transformer)
Import/Export	Bi-directional Electrical Energy Metering
Communications Protocol	Ethernet (Modbus TCP/IP, ION protocol)
Display	Integrated LCD Display
Mounting	DIN mount capability

Table 3: Minimum Technical Specifications for Tier 1B Electrical Meters

3.3.3 TIER 2

Tier 2 electrical meters shall:

- Be provided for the incoming low voltage (415V and lower) electrical supplies to the buildings and/or the main switchboards.
- Be installed at the incomer of each main switchboard, downstream of the main switchboard main switch, but upstream of any generators or electrical loads.
- Be able to connect to the EMS.
- Be **Schneider Electric PowerLogic PM8000** or approved equal.
- Have the following minimum features as per Table 4 (for all phases).

Functionality	Specification
Type of Network	3 Phases + Neutral + Earth
Accuracy	Class 0.2 Active Energy
Instantaneous Reading	Voltage between phases (100-600 Vac) Voltage between neutral and phase (100-400 Vac) Current (A) Frequency (50-69 Hz) Apparent power (kVA) Active power (kW) Reactive power (kVAr) Power Factor Harmonic Distortion
Maximum Demand Reading	Current (A) Apparent power (kVA) Active power (kW) Reactive power (kVAr)
Calculated Energy	Active (kWh) Reactive (kVArh)
Memory Capacity	512MB
Operating Temperature	-25…+70 degrees Celsius
Rated Current	1A or 5A (via Current Transformer)
Import/Export	Bi-directional Electrical Energy Metering
Communications Protocol	Ethernet (Modbus TCP/IP, ION protocol)
Display	Integrated LCD Display
Mounting	DIN mount capability

Table 4: Minimum Technical Specifications for Tier 2 Electrical Meters

3.3.4 TIER 3

Tier 3 electrical meters shall:

- Be provided for all submains cables from the main switchboards, as required for NCC compliance, apart from the electrical distribution boards.
- Be provided for the incoming low voltage (415 Volts and lower) electrical supplies to generators, uninterruptible power supplies, solar photovoltaic systems, electric vehicle charging switchboards, chillers, mechanical services switchboards and major plant, hydraulic services switchboards and major plant, central hot water systems, lifts, pumps, tenancies, meter panels, etc. that are directly supplied from the main switchboards (i.e. not from the electrical distribution boards).
- Be installed in the main switchboards, on the relevant submains cables, after the submains cable circuit breakers.
- Be able to connect to the EMS.
- Be **Schneider Electric PowerLogic PM5560** or approved equal.
- Have the following minimum features as per Table 5 (for all phases).

Functionality	Specification
Type of Network	3 Phases + Neutral + Earth
Accuracy	Class 0.2 Active Energy
Instantaneous Reading	Voltage between phases (100-600 Vac) Voltage between neutral and phase (100-400 Vac) Current (A) Frequency (50-69 Hz) Apparent power (kVA) Active power (kW) Reactive power (kVAr) Power Factor Harmonic Distortion
Maximum Demand Reading	Current (A) Apparent power (kVA) Active power (kW) Reactive power (kVAr)
Calculated Energy	Active (kWh) Reactive (kVArh)
Memory Capacity	1.1MB
Operating Temperature	-25…+70 degrees Celsius
Rated Current	1A or 5A (via Current Transformer)
Import/Export	Bi-directional Electrical Energy Metering
Communications Protocol	Ethernet (Modbus TCP/IP)
Display	Integrated LCD Display
Mounting	DIN mount capability

Table 5: Minimum Technical Specifications for Tier 3 Electrical Meters

3.3.5 TIER 4

Tier 4 electrical meters shall:

- Be provided in all electrical distribution boards (DBs): at least 1 meter for the lighting chassis and at least 1 meter for the power chassis.
- Be provided as required for NCC compliance, in the electrical distribution boards for any additional DB chassis (e.g. for essential lighting, non-essential lighting, essential power, non-essential power, mechanical services, lifts, etc).
- Be able to connect to the EMS.
- Be **Schneider Electric iEM3250** or approved equal.
- Have the following minimum features as per Table 6 (for all phases).

Functionality	Specification
Type of Network	3 Phases + Neutral + Earth
Accuracy	Class 0.5S Active Energy
Instantaneous Reading	Voltage (Vac) Current (A)
Calculated Energy	Active (kWh)
Operating Temperature	-5…+55 degrees Celsius
Rated Current	1A or 5A (via Current Transformer)
Communications Protocol	Modbus RS-485 (channel shall be limited to 20 meters)
Display	Integrated LCD Display
Mounting	DIN mount capability

Table 6: Minimum Technical Specifications for Tier 4 Electrical Meters

4 THERMAL ENERGY METERS

4.1 GENERAL

Thermal energy meters shall be provided throughout each Heating Hot Water (HHW) and Chilled Water (CHW) system to provide real time and historical monitoring of thermal energy usage associated with the campuses.

All thermal energy meters shall be:

- Installed as per the relevant Australian Standards. Electrical and Plumbing Safety Certificates to be provided for each installation.
- Provided with isolation valves upstream and downstream of the meter to facilitate safe maintenance.
- Installed in accessible locations and in accordance with the manufacturer's recommendations.
- Physically labelled for identification (matching with the As-Installed mechanical services documentation).

4.2 COMMUNICATIONS

All new thermal meters with an Ethernet port shall communicate via Modbus TCP/IP and be connected to the EMS, through the structured cabling system using Category 6A cables.

- Contractors are to provide cabling from these meters to the MU-provided Ethernet port and terminate the cables at both ends. Cable type shall be Category 6A.

All new thermal meters without an Ethernet port shall communicate via Modbus RTU and be connected to the EMS via Modbus RS-485 to Ethernet gateways.

- Contractors are to provide cabling from these meters to the Ethernet gateway(s) and terminate the cables at both ends. Cable type shall be Modbus RS-485 serial comms cable. The limit of any Modbus RS-485 channel shall be 20 meters.
- Modbus RS-485 serial comms cable shall have 2 twisted pairs, polyethylene individual element insulation, outer shield, PVC outer jacket, and minimum 24AWG (7x32) size and stranding.
- The Ethernet gateways shall:
    - Be connected directly to the EMS, through the structured cabling system using Category 6A cables.
    - Provide Modbus RS-485 serial-to-Ethernet connectivity.
    - Support the specified electrical meters.
    - Be **Schneider Electric PAS600L, Moxa MGate** or approved equal.

Refer to Section 9 for further detail regarding approved topologies.

4.3 PERFORMANCE SPECIFICATIONS

All thermal energy meters shall:

- Be provided for all base building and tenancy HHW and CHW supplies.
- Be able to connect to the EMS. Where required, meters shall support simultaneous communication with multiple systems (i.e. TEMS and BAS).
- Be **Proline Promag W 300**, **Flexim FLUXUS 5 Series**, or approved equal, with factory matched temperature sensors and thermal energy calculator. Where the provided selections are impractical due to pipe configuration or spatial constraints, contractor may submit alternative selections for approval.
- Be weatherproofed for external meter installations to preserve measurement integrity.
- Have the following minimum features as per Table 7 (for all tiers).

Functionality	Specification
Flow Sensor Type	Electromagnetic (Inline) Ultrasonic (Inline or Clamp-on)
Temperature Sensor Type	Immersion Clamp-on
Accuracy	Flow: ±1% Temperature: ±0.5% Calculator: Class 1 EN1434
Measurements	Flow velocity (m/s) Volumetric flow rate (cubic meters/hr) Flow and return temperatures (degrees Celsius) Instantaneous energy (kW) Cumulative flow (cubic meters) Cumulative energy (kWh)
Fluid Temperature	-20…+120 degrees Celsius
Direction	Bi-directional
Communications Protocol / Outputs	Ethernet (Modbus TCP/IP) Modbus RS-485 (channel shall be limited to 20 meters)
Display	Integrated LCD Display

Table 7: Minimum Technical Specifications for Thermal Energy Meters

5 WATER METERS

5.1 GENERAL

Water meters shall be provided throughout each water system to provide real time and historical monitoring of water usage associated with the campuses. The new water meters specified in this section are private meters and not authority meters (i.e. not retail meters). Provide water supply authority meters (i.e. retail meters) as required by the relevant supply authority, as per the relevant water authority guidelines.

All water meters shall be:

- Installed as per AS 3500. Electrical and Plumbing Safety Certificates to be provided for each installation.
- Provided with isolation valves upstream and downstream of the meter to facilitate safe maintenance.
- Installed in accessible locations and in accordance with the manufacturer's recommendations.
- Installed as per local water authority guidelines (if applicable).
- Physically labelled for identification (matching with the As-Installed hydraulic services documentation).

5.2 COMMUNICATIONS

Unless otherwise specified, all new water meters shall communicate with the EMS via pulse outputs connected to dedicated data loggers. Provide cabling from all meters to data loggers and terminate the cables at both ends.

- Cable shall be:
    - Two pair twisted communication type with a drain wire and overall shielding (7/020). Do not use Category 3/5/6 UTP cable.
    - Blue, blue/white, orange and orange/white (**Electra EAS7202P** or approved equal).
    - Installed into the bottom of the data logger with approximately 2 meters overlap and minimum 150mm clearance below the data logger (to enable connection).
    - Identified with the number and meter type and tagged with a manufactured cable marker at both ends.
- Each meter shall be connected to the data logger with its own two pair cable. Do not cable the meters in a daisy-chain arrangement.
- The data loggers shall:
    - Communicate via Modbus TCP/IP and be connected directly to the EMS, through the structured cabling system using Category 6A cables.
    - Provide pulse-to-Ethernet connectivity.
    - Support the specified water meters.
    - Be **Moxa ioLogik E1200 Series** or an approved equal.

Refer to Section 9 for further detail regarding approved topologies.

5.3 PERFORMANCE SPECIFICATIONS

All water meters shall:

- Be provided for all main site, main building, key asset (kitchen, irrigation), and tenancy supplies.
- Be NMI pattern approved and regularly validated if installed for tenant billing purposes.
- Be able to connect to the EMS.
- Have the following minimum features as per Table 8 (for all tiers).

Functionality	Specification
Installation Type	Inline
Accuracy	±1%
Outputs	Pulse (proportional to consumption, e.g. cubic meters)
Display	Integrated LCD Display

Table 8: Minimum Technical Specifications for Water Meters

6 GAS METERS

6.1 GENERAL

Gas meters shall be provided throughout each gas system to provide real time and historical monitoring of gas usage associated with the campuses. The new gas meters specified in this section are private meters and not authority meters (i.e. not retail meters). Provide gas supply authority meters (i.e. retail meters) as required by the relevant supply authority, as per the relevant gas authority guidelines.

All gas meters shall be:

- Installed as per AS 5601. Electrical and Plumbing Safety Certificates to be provided for each installation.
- Provided with isolation valves upstream and downstream of the meter to facilitate safe maintenance.
- Capable of pulse output and connection to the EMS.
- Installed in accessible locations and in accordance with the manufacturer's recommendations.
- Installed as per local gas authority guidelines (if applicable).
- Physically labelled for identification (matching with the As-Installed hydraulic services documentation).

6.2 COMMUNICATIONS

Unless otherwise specified, all new gas meters shall communicate with the EMS via pulse outputs connected to dedicated data loggers. Provide cabling from all meters to data loggers and terminate the cables at both ends.

- Cable shall be:
    - Two pair twisted communication type with a drain wire and overall shielding (7/020). Do not use Category 3/5/6 UTP cable.
    - Blue, blue/white, orange and orange/white (**Electra EAS7202P** or approved equal).
    - Installed into the bottom of the data logger with approximately 2 meters overlap and minimum 150mm clearance below the data logger (to enable connection).
    - Identified with the number and meter type and tagged with a manufactured cable marker at both ends.
- Each meter shall be connected to the data logger with its own two pair cable. Do not cable the meters in a daisy-chain arrangement.
- The data loggers shall:
    - Communicate via Modbus TCP/IP and be connected directly to the EMS, through the structured cabling system using Category 6A cables.
    - Provide pulse-to-Ethernet connectivity.
    - Support the specified water meters.
    - Be **Moxa ioLogik E1200 Series** or an approved equal.

Refer to Section 9 for further detail regarding approved topologies.

6.3 PERFORMANCE SPECIFICATIONS

All gas meters shall:

- Be provided for main site, main building, key asset (central plant, kitchen, laboratory), and tenancy supplies.
- Be NMI pattern approved and regularly validated if installed for tenant billing purposes.
- Be able to connect to the EMS.
- Have the following minimum features as per Table 9 (for all tiers).

Functionality	Specification
Installation Type	Inline
Accuracy	±1%
Outputs	Pulse (proportional to consumption, e.g. cubic meters)
Display	Integrated LCD Display

Table 9: Minimum Technical Specifications for Gas Meters

7 COMMISSIONING AND INTEGRATION PROCESS

Meter commissioning shall comply with the ***MU BAS Commissioning Plan Template***, including submission of Planning Documentation, Cutover Plan, and all specified Alarming and Commissioning Templates. Meter integration shall follow the process outlined below in Table 10.

Stage	Title	Responsible Party	Scope Summary
1	Meter Design and Pre-Commissioning	Contractor	• Design and supply meters, gateways, and loggers • Provide MU Project Manager or BAS Team with the completed New Metering Device Request Form
2	Network Access Configuration	MU BAS Team or Nominated BAS Provider	• Allocate IP address and VLAN/subnet for meter • Provide Contractor with approved network details
3	Network Infrastructure Provisioning	MU eSolutions or Nominated Builder	• Provision of structured cabling system
4	Meter Installation and Configuration	Contractor	• Install meters, gateways, and loggers • Connect meter to the MU-provided Ethernet port • Configure meter communications parameters
5	System Integration	MU BAS Team or Nominated BAS Provider	• Configure meter device within the EMS, including trending and alarming
6	Witnessed Commissioning	Contractor	• Demonstrate meter data is successfully received within the EMS

Table 10: Meter Commissioning and Integration Process

7.1 METER DESIGN AND PRE-COMMISSIONING

Contractors shall design and supply meters as well as any requisite gateways and data loggers in accordance with this Metering Standard, Australian Standards, MDCS and manufacturer recommendations.

Identify any switchboards, gas lines, hydraulic systems or building services that require shutdown for meter installation. Advise MU of any planned shutdowns via the Cutover Plan. Contractors shall not undertake any shutdowns, isolations or cutovers prior to receiving approval from MU.

Prior to requesting network access or commissioning, Contractors shall submit a New Metering Device Request Form to the nominated MU Project Manager or BAS Team. Submission shall comply with or exceed the requirements detailed in the ***MU New Metering Device Request Form Template*** and include at a minimum:

- Meter service type (electrical / gas / water / thermal energy).
- Meter manufacturer details (make, model, serial number, firmware version, communication protocol).
- Meter name as per Section 10.
- Proposed Ethernet port location.
- Documentation demonstrating point of connection (single line diagram / pipework configuration).

No meter shall be connected to the MU network without submission and approval of the New Metering Device Request Form. Delays arising from incomplete or inaccurate New Metering Device Request Form submissions shall not constitute a MU delay.

7.2 NETWORK ACCESS CONFIGURATION

The MU BAS Team or a nominated BAS provider shall review submitted New Metering Device Request Forms and allocate an IP address and VLAN/subnet for each meter, including configuration of all firewalls, routing and security. IP address details and network configuration requirements will be provided to the Contractor. Contractors shall not self-assign IP addresses or VLAN/subnets.

7.3 NETWORK INFRASTRUCTURE PROVISIONING

MU eSolutions or a nominated Builder shall be responsible for any provision, upgrade, and modification of MU structured cabling system, including servers, fibre, network switches, patching, and all network infrastructure. A suitably located Ethernet port shall be provided to Contractors as required for meter connections. Contractors shall not connect any meters to unauthorised Ethernet switchports, or unauthorised devices to the MU network.

7.4 METER INSTALLATION AND CONFIGURATION

Contractors shall install and wire the meters in accordance with the Metering Standard, Australian Standards, MDCS and manufacturer recommendations. Connect each directly networked meter, gateway, data logger or approved topology head-end device to the MU-provided Ethernet port and configure its communications parameters in accordance with the approved network details. Verify physical installation, wiring integrity and basic network connectivity.

Contractors shall provide all required gateways and Ethernet / Modbus RS-485 cabling. Ensure all meters are cabled correctly and are fully operational. Clearly label daisy chain cables so that at each end of the cable, the origin and destination devices are stated. Where multiple buses and mixed topologies are used, the bus identity should also be included. Labelling shall match the services As-Installed documentation.

Any metering or converter devices with BACnet capabilities are required to have all BACnet configurations disabled to prevent potential BACnet broadcast issues resulting from improperly configured meters.

7.5 SYSTEM INTEGRATION

The MU BAS Team or a nominated BAS provider shall configure each new meter device within the EMS, including:

- Map required data points.
- Configure communications polling and addressing.
- Configure trending for all specified readings in Sections 3 to 4 per Section 7.5.1.
- Configure all semantic tagging (in accordance with ***MU BAS Tagging Standard***).
- Configure all required alarming per Section 7.5.2 (in accordance with ***MU BAS Alarm Standard***).
- Create or update an interactive graphical user interface per the Contractor-submitted As-Installed documentation (in accordance with ***MU BAS Graphics Standard***).
- Provision of any required EMS software licensing.

7.5.1 TRENDING

For every meter, trend all required points as per the specifications in this Metering Standard. Trend data and storage configuration shall be in accordance with Table 11. Do not enable automatic deletion of data.

Meter Tiers	Trend Data Increment	Storage
1A, 1B	1-minute	5 years
2, 3, 4	15-minute	5 years

Table 11: Trend Data and Storage Configuration

7.5.2 TAGGING

Semantic tagging shall be implemented for each meter, in accordance with ***MU BAS Tagging Standard***. Where applicable, tags applied to a typical meter shall identify the asset ID, installation location, space reference (using MU's unique space identifier), metered services, and submetering relationships. Data points for each meter, such as demand and energy data, shall have appropriate tags applied as applicable.

7.5.3 ALARMING

At a minimum, the alarms detailed in Table 12 below shall be configured for each meter, in accordance with the ***MU BAS Alarm Standard***. Alarming is to be programmed and configured at the integration layer, except for Tier 1A and 1B electrical meters which shall have intrinsic alarm capability. Alarm delays, deadbands, and priorities shall be configured to minimise nuisance alarms.

Meter Type	Meter Tiers	Minimum Alarm Requirements
All	All	Loss of Communication: No data is received from the meter for a defined period (e.g. 15 days). No Increment: Cumulative consumption does not increment over a defined period (e.g. 7 days). Data Quality: Meter values are outside valid ranges (e.g. negative flow). Storage Limitation: Storage exceeds 80% capacity.
Electric	1A, 1B	Meter Fault: Meter reports an internal fault, diagnostic error, or malfunction. Excessive Harmonic Distortion: Total harmonic distortion exceeds the defined upper threshold over a defined period (e.g. 5 minutes).
	All	Over- and Under-Voltage: Measured voltage exceeds or falls below bound over a defined period (e.g. 5 minutes). Over- and Under Frequency: System frequency exceeds or falls below bound over a defined period (e.g. 5 minutes). Over- and Under Power Factor: Power factor exceeds or falls below bound over a defined period (e.g. 15 minutes). Current Threshold: Measured current exceeds threshold over defined period (e.g. 15 minutes).
Gas	All	Leak Detection: Continuous flow detected over defined period (e.g. 7 days). Flow Threshold: Flow exceeds expected maximum.
Water	All	Leak Detection: Continuous flow detected over defined period (e.g. 7 days). Flow Threshold: Flow exceeds expected maximum.
Thermal Energy	All	Reading Mismatch: Cumulative energy incrementing without flow present, or vice-versa. Flow Threshold: Flow exceeds expected maximum. Temperature Threshold: Temperature differential outside expected range.

Table 12: Minimum Alarm Requirements

7.6 WITNESSED COMMISSIONING

For each new meter, contractors shall create an asset record in the MU Fulcrum system with the following details:

- Manufacturer.
- Meter model.
- Firmware revision.
- Installation location.
- Installation date.
- Metered service.
- Meter name.
- Asset ID.
- Validation certificate.
- Maintenance record.
- High-resolution photo of meter face.
- High-resolution photo of meter current transformer (if applicable) and wiring.
- High-resolution photo of overall location showing meter position.

Contractors shall energise, test and commission each new meter and submit metering commissioning results to the nominated MU Project Manager or BAS Team. Commissioning shall comply with or exceed the requirements detailed in the ***MU Metering Commissioning Template*** and verify the following at a minimum:

- Installation complies with the Australian Standards, manufacturer instructions and the MDCS.
- Independent measurement device reading, meter readings, and EMS inputs are consistent.
- Recording of trends for all meters.
- Meter alarm conditions can be triggered and cleared.
- Meter graphical user interfaces and dashboards report correctly.

Metering Commissioning Template requirements are not to supersede any tender specifications, manufacturer instructions or relevant standards. Meters shall not be considered commissioned until completed Metering Commissioning Templates are successfully received and verified by a MU representative. Delays arising from incomplete or inaccurate Metering Commissioning Template submissions shall not constitute a MU delay.

8 MAINTENANCE

8.1 GENERAL

Maintain the meters for the documented maintenance period so that the performance, reliability, service life, energy efficiency and safety of the systems are equal to or better than at the beginning of the maintenance period. Maintenance period shall be a minimum of 12 months after practical completion, unless otherwise specified in the project contract.

Maintenance shall be undertaken in accordance with:

- Operation and Maintenance Manual.
- Australian Standards.
- MDCS.
- Manufacturer recommendations and maintenance program.

Maintenance outcomes, including meter calibration and validation records, shall be provided to MU

8.2 MAINTENANCE SCOPE

Provide maintenance work including:

- Periodic and statutory maintenance.
- Attend to reported defects and complaints.
- Check for and repair corrosion or physical damage.
- Check for and rectify any unsafe conditions.
- Replace faulty or damaged parts and consumable components.
- Safety signs maintenance.
- Emergency repairs.
- Submit reports summarising the maintenance performed and the performance of the systems in the preceding period. Set out the report in a form that permits comparison with previous reports.

Select products, as consumables or replacement items, of the same make, model and type as those being replaced. Where the existing product is no longer available, provide products with at least the same performance, energy profile and construction characteristics.

8.3 FAULT RESPONSE AND EMERGENCY REPAIRS

Respond to call outs for breakdowns or other faults requiring emergency repairs. Rectify faults and replace faulty materials and equipment. Carry out any remedial work, including temporary work, necessary to restore each system to safe and satisfactory operation. Verify each system operates correctly before leaving the site: do not leave the equipment in an unsafe condition.

Provide contact details including mobile phone numbers for normal working hours and emergency call outs. Attend site for emergencies within the documented response time. Promptly replace temporary work with permanent rectification. Rectify faults, make adjustments and replace consumable and faulty materials and equipment within 24 hours of notification. Restore removed, damaged, contaminated or soiled services and building elements when the maintenance task is complete.

8.4 END OF MAINTENANCE

At the end of the maintenance period:

- Remove waste and clean all parts of the installation.
- Remove temporary protective coatings, packaging and labels.
- Clean interior of switchboards, switchgear, contactors and other electrical contacts to remove dust and foreign matter.
- Check for hot joints, burnt insulation and burnt contacts.
- Check electrical connections for tightness.
- Check operation of all components and systems.
- Check indicating lights and replace if necessary.
- Check overload settings.
- Check and report any changes to controls and wiring.
- Carry out a thermal scan of joints and cable terminations by use of an infrared temperature detector or cameras and repair any joints showing high temperatures.

9 APPROVED TOPOLOGIES

Monash University Managed Network

DEVICES SHOWN ARE INDICATIVE EXAMPLES ONLY. APPLICABLE PERFORMANCE REQUIREMENTS AND APPROVED PRODUCT SELECTIONS ARE DEFINED IN THE BODY OF THE METERING STANDARD.

TIER 1A METER

Device: Schneider ION9000

TIER 1B METER

Device: Schneider ION7400

TIER 2 METER

Device: Schneider PM8000

TIER 3 METER

Device: Schneider PM5560

MODBUS RTU-TO-ETHERNET GATEWAY (OR SUPPORTED TIER 2/3 METER)

Device: Moxa MB3180

PULSE DATA LOGGER

Device: Moxa ioLogik E1210

THERMAL ENERGY METER

Device: Indicative Thermal Energy Meter

TIER 3 METER

Device: Schneider PM5560

TIER 3 METER

Device: Schneider PM5560

MODBUS RTU METER(S)

Device: Schneider iEM3250

WATER/GAS METER(S)

Device: Generic Pulse Device(s)

TIER 4 METER

Device: Schneider iEM3250

WATER/GAS METER

Device: Generic Pulse Device

MODBUS RTU METER(S)

Device: Generic RTU Device

NOTES:

1. This drawing summarises approved meter communications pathways and shall be read in conjunction with the Metering Standard. Where any inconsistency exists, the written requirements of the Metering Standard take precedence.
2. No device shall be connected to the MU managed network until the New Metering Device Request Form has been submitted and approved, and MU-assigned network details and an authorised Ethernet port have been provided.
3. Where manufacturer-supported Ethernet daisy chaining is used, multiple Tier 2 and/or Tier 3 meters may share a network connection. Where different meter tiers are included, the highest-tier meter shall be connected closest to the MU network connection.
4. Tier 4 or other Modbus RTU meters may connect through an approved Modbus RTU-to-Ethernet gateway, or through a supported serial gateway interface of a Tier 2 or Tier 3 meter.
5. Pulse-output water or gas meters may connect to a dedicated pulse data logger or to a dedicated pulse-counting input of a Tier 2 or Tier 3 meter where supported. Each pulse meter shall use its own cable and dedicated input; pulse circuits shall not be daisy chained.
6. Where a gateway or head-end device provides multiple independent Modbus RS-485 channels, the 20 m maximum applies separately to each channel.
7. Alternative topology arrangements not shown require MU approval before installation.

MONASH University

LEGEND

- Modbus TCP/IP
- Ethernet – ION Protocol
- Modbus RTU
- Pulse

PROJECT	SHEET
APPROVED METER TOPOLOGY PATTERNS	1 / 1
DOCUMENT NUMBER: MU-METERTOP-001	TITLE: APPROVED METER COMMUNICATIONS TOPOLOGIES

REV.	DESCRIPTION	DATE	DRAWN
1.0	INITIAL RELEASE	28/07/26	IM

10 METER NAMING CONVENTION

The equipment naming methodology follows the naming pattern below, described further in Table 13:

- <Meter Type>_<Building Code>_<Distribution Point>_<Branch Designation>

Each field is separated by underscores, and underscores within fields are not permitted (replace with hyphens if necessary).

Field	Description	Format	Example
Meter Type	Service measured by the meter.	PM (power), WM (water), GM (gas), TM (thermal)	PM
Building Code	Monash University building identifier.	Three digits plus letter where applicable	036, 013A
Distribution Point	Electrical switchboard, plant item, or utility network node being measured.	Asset or node identifier (e.g., switchboard, plant tag, header, riser)	MDB-1, MSSB-1, CT-1, CH-1
Branch Designation	Smallest subdivision being metered such as switchboard chassis/circuit, equipment item or branch. Use generic chassis names where applicable (e.g. MAIN, LGT, PWR, MECH, VT), thermal circuit types (e.g. CHW, HHW, CCW), or specific feeder/equipment identifiers (e.g. CH-1, AHU-01, INV-2). For water and gas meters this is typically MAIN unless multiple flow paths exist (e.g. IN, OUT, MU, BD). Where multiple branches of the same designation exist within a distribution point, append a numeric suffix (e.g. LGT-1, LGT-2) to uniquely identify each branch.	Short code representing chassis, circuit, feeder, or equipment	MAIN, LGT, CHW, CH-1, AHU-01, LGT-1

Table 13: Monash University Meter Naming Convention

'Distribution Point' identifies the physical node being measured. 'Branch Designation' identifies the smallest stable subdivision of that node. Use equipment identifiers where a feeder serves a specific plant item. Use numeric suffixes only when the same branch type repeats. Do not use load category terms as branch identifiers.

Example meter names: PM_075_MDB-1_LGT; PM_075_MSSB-1_CH-1; TM_039_CH-1_CHW; WM_075_CT-1_MAIN; and GM_075_BLR-1_MAIN.