

APPENDIX 7 – UTILITIES MANAGEMENT – ELECTRICITY, GAS, AND WATER METERING

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APPENDIX 7

UTILITIES MANAGEMENT – ELECTRICITY, GAS, AND WATER METERING

A7.1. OVERVIEW

The university has an extensive, campus-wide Energy Management and Control System (EMACS) remotely connected to more than a thousand electricity, gas, and water meters and submeters, measuring and logging energy and water use. EMACS is managed by the Utilities Management team as part of the Facilities Management Directorate and is a critical function of UNSW Estate Management operations. EMACS is comprised of metering infrastructure (e.g., meters, gateways, and PLCs) and the EcoStruxure Power Monitoring Expert (PME) software and server. EMACS is used to analyse historical trends, determine flow rates, discover and trace energy performance issues and leaks, monitor peak demand and power quality across our campuses, and generate utilities billing for UNSW tenants.

This section of the UNSW Design and Construction Guidelines covers the following topics:

- Metering requirements, approval process, and associated documentation.
- Meter data communications network.
- Digital power meters (DPM), also mentioned in the text as electricity meters.
- Potable and bore water meters.
- Gas meters.

The notes that follow provide the minimum technical requirements that shall be incorporated into any proposal to supply and install or maintain meters and associated metering equipment at UNSW premises.

Generally, the electricity, gas, and water supplies (both potable and bore water) must be metered for all new buildings and/or major plant items, specific services, user groups and tenants. Tenderers and contractors installing or maintaining approved meters and associated equipment shall connect or incorporate them into EMACS to provide full functionality and remote monitoring capability.

Only competent and approved contractors are permitted to install metering at UNSW. The final step in the integration of a new meter into EMACS involve software tasks within PME. This work is normally undertaken either by UNSW in-house or by a Contractor specifically assigned to this task by UNSW.

A7.2. REQUIREMENTS AND COMPLIANCE WITH NCC ENERGY MONITORING

UNSW requires that appropriate utilities metering, compliant with this design standard and with NCC section J, is installed to measure the total building use of electricity, gas, and water. In addition, submetering is required for the total energy use of the building's mechanical services, split into essential and non-essential elements. In certain cases, additional submetering may be required for specific loads, such as the supplies to retail tenancies or large loads (e.g., chillers, heat pumps, cooling towers, etc.), or to record the import/export of energy from PV systems or generators. UNSW does not require submetering beyond NCC 2022 Part J9* requirements unless it is specifically indicated in the project brief.

* NCC 2019 Part J8 for projects and installations before May 2023.

A7.3. METER INSTALLATION APPROVAL PROCESS

Approval from the Utilities Manager is required before the design and installation of any metering solution, or changes to the EMACS system, as per the process below:

1. The contractor provides briefs/proposal regarding the metering installation to the Utilities Manager for consultation and review.
2. The Utilities Manager will then review and discuss the briefs/proposal with the requestor. An approved and finalized metering installation design is produced.
3. Contractor then proceeds with the installation and commissioning as per the approved design and produces required documentation.
4. When the installation is completed, the installer submits the required documentation (including meter schematics) to the Utilities Management Unit as proof of correct and complete installation.
5. The Utilities management Unit reviews the submitted documentation, provides rectification actions when needed, and confirms final acceptance of installation.

A7.4. METERING DOCUMENTATION

The minimum documentation required for the installation, connection, and commissioning of meters and associated equipment to EMACS is presented below.

Asset registration form

Metering assets that have been approved for installation will need to be tagged & registered into UNSW Archibus system, including meters (Electricity, Gas, and Water), gateways, PLCs, media converters, and LoRaWAN devices. The current registration of new assets in Archibus is done via the Online Asset Registration Form, or using a spreadsheet, which can be provided by the Utilities Management team. A sample of the online form is provided in section A7.11.

The asset tag (barcode) can be obtained from UNSW Utilities Management Unit and must be placed on a visible area of the asset by the contractor. Meters, gateway & plc will also have an additional unique identification number, provided by Utilities Management, enabling the accurate tracking and identification of the asset on EMACS.

Asset registrations/updates are required to be completed whenever:

- A new asset is added – full details are required, e.g., location of asset, description of the load, description and meter model, serial numbers, etc.
- An existing asset is replaced – asset details are required to be updated, e.g., serial number, existing meter reading, etc.
- An asset is relocated – updated location and any final reading before being relocated.
- An asset is disconnected and removed – a final reading should also be taken if the asset is a meter.
- The load of an asset changes substantially – e.g., additional pipework, cabling, DB loads, are added to the metered system.

Meter commissioning sheets

Commissioning sheets have been prepared for each meter type. As the commissioning process is vital in ensuring that the meter is measuring the load accurately and EMACS is displaying the data correctly, the contractor must submit a completed commissioning sheet for each meter. UNSW is moving towards online forms. Until these online versions are ready, the current sheets can be used, as per examples in sections A7.12 and A7.13.

Meter schematics

The Utilities Management unit maintains campus wide metering schematics for electricity, gas, and water services. The schematics depict the location of each meter in the supply network, the meter ID, the loads being metered, and the relationships between adjacent meters. There are four separate sets of schematics:

- Electricity Meter Schematics – based on each campus wide single line diagrams (SLD), incorporating HV feeds down to LV distribution boards.
- Gas Meter Schematics – based on the gas pipework throughout each campus including information of the equipment or loads that each gas meter measures.
- Potable and Bore Water Meter Schematics – based on the potable and bore water pipework of each campus, including information of the equipment or loads that each water meter measures.
- Communications Network Schematics – a comprehensive representation of the EMACS communication network with all relevant information related to a device (meter, ETG, or PLC) and how it is connected back to the PME server.

Whenever changes are made to the metering infrastructure, including its communications network, installers or maintenance contractors are required to update or create meter schematics accordingly. Samples of schematics are provided in sections A7.14 to A7.17.

A7.5. COMMUNICATIONS NETWORK

EMACS uses the Schneider Power Monitoring Expert (PME) platform which communicates over UNSW's ethernet network infrastructure (via a Virtual LAN, known as the EMACS VLAN) with the field devices distributed throughout its campuses.

Metering connection to EMACS depends on several factors like the type of meter, the location of the meter, the proximity to existing Modbus or LAN network, the numbers of meters to be connected, and the type of gateway. The installer or contractor must include the meter connection plan as part of the metering proposal to UNSW Utilities Management Unit during the design process and gain approval before construction proceeds. Key principles on remote metering installation at UNSW are presented below:

- Hard wired connection is preferred to maintain the best connection stability (when this is not practical, then wireless connection can be considered using the LoRaWAN metering network).
- Data logging of downstream device(s), particularly of pulse meters, is required on new and any upgraded installation to reduce data loss.
- The use of devices with power over ethernet (POE) capabilities is prioritised, to reduce the use of additional power supply units.
- Daisy chaining IP devices is not recommended and will only be considered when no other alternatives are possible.

Modbus/TCP is the communication protocol between EMACS and the meters, which in most cases requires an Ethernet Gateway, or ETG. The communication channel must be configured to operate at 9600 baud. The maximum number of Modbus capable field devices connected (daisy chained) to the same RS485 network shall be limited to 20, with an overall cable distance of no more than 1200 m. Hence, additional ETGs must be used where the requirement for Modbus connection is greater than 20 devices. The last device connected to the daisy chain shall have a 120 ohm terminating resistor connected across its communication terminals. Installers may propose an alternative connection method to the above, but it must be approved before installation commences.

Several Modbus networks have been setup at various points around UNSW campuses, mainly at locations where there are clusters of electricity meters, ETGs, and PLCs. Within a cluster, each device must have a unique Modbus address to allow EMACS to identify the device. Each localised Modbus Network is connected to an ETG or PLC which is connected to an UNSW LAN port that has been configured for the EMACS VLAN. Each ETG is configured with a unique IP address allocated by UNSW Utilities Management and the LAN port configuration must be carried out by UNSW IT. Note that PowerTag meters must use a compatible ethernet gateway, like the PowerTag Link.

Each communication network installation must have a network schematic showing the communication paths. Refer to section A7.17 below for example.

Using PLC to connect gas or water meters to EMACS should only be used in situations where connecting them to new or existing ETGs or DPMs is not viable. The PLC must have data logging capabilities to minimise data losses. The installer must seek approval to use a PLC for remote metering. Furthermore, a LoRaWAN metering network has been set up in Kensington Campus, which is primarily used to connect outdoor gas and water meters to EMACS.

Where a new PLC is used to connect water or gas meters to EMACS the UNSW standard configuration shall be downloaded into the PLC. The only variation required to the standard configuration is that the PLC must have its Modbus address changed to the one allocated by UNSW Utilities Management. A backup of the PLC's code shall be passed to the Utilities Management Unit in case the PLC needs to be replaced or becomes corrupted.

Protection relays of High Voltage Systems within a substation, must also be connected to EMACS. In this way, not only the metering information at each high voltage switch is available, but also the status of the protection device. In the High Voltage installations, media converters (copper to fibre and fibre to copper) might be required to separate the IT network from the high voltage area, to protect other devices in the network. Please contact the Utilities Management Unit to know if this requirement is necessary in a particular installation.

The table below shows the preferred list of ETG, PLC, Media Converters (MC), and LoRaWAN devices to be used at UNSW.

Device Type	Model	Part No.	Note
ETG	Schneider Panel server advance	PAS800	
ETG	Schneider Panel server universal	PAS600	Only with approval
ETG	Schneider A9 PowerTag Link 20	A9XMWD20	
DPM	Meters like PM5560 and ION7650	Several	Only with approval
PLC	Schneider M221 – 16 IO	TMM221CE16R	Only with approval
MC	Moxa media converter SC fiber	IIMC-21-M-SC	
MC	Moxa 5 port unmanaged switch SC	EDS-205A-M-SC	Only with approval
LoRaWAN	Nube iO pulse counter.	NLT-2	Outdoor connection

A7.6. DIGITAL POWER METERS AND HV PROTECTION RELAYS

The University uses several models of Digital Power Meters (DPM's) to monitor power and energy throughout the campuses dependent upon the application and load, e.g., Substations, Buildings, Switch Boards, and individual loads. Additionally, HV protection relays in Substations are connected to EMACS to monitor their status and get important information in case of trip events. Example of loads that require metering for energy monitoring purposes are as follows:

- The low voltage feed from each HV Transformer.
- Total building supply.
- Building total light and power load.
- Building total mechanical services load, both essential and non-essential.
- Large services such as risers.
- Individual loads above 100 kW power.
- Sections of building that are used for tenant billing.
- Areas of a building that have been identified by UNSW as having high energy use.
- Metering as may be required by other codes of practice.

All new DPM shall be defined as scheduled in the table below. Contractors may propose alternative solutions if are of superior or equal quality than the meters listed. However, the contractor must gain permission from the Energy Manager beforehand.

Level of metering	Type of metering	Manufacturer and model	Part No.
Type 1a – HV campus feeders	Power quality, transients, and energy with logging and wave capture (Class 0.1S)	• Schneider ION9000	• METSEION9240
Type 1b – Substations	Power quality, transients, and energy with logging and wave capture (Class 0.2S)	• Schneider PM 8240 or better	• METSEPM8240
Type 2 – Building gate meter	Energy and Power quality with logging (Class 0.2S)	• Schneider PM5560 or better	• METSEPM5560
Type 3a – Total building section (HVAC, lighting) or individual loads above 100 kW (e.g., chillers)	Energy and harmonics with basic logging (Class 0.5S)	• Schneider PM5310 or better	• METSEPM5310
Type 3b – Building level and sub-boards)	Energy and power factor (Class 0.5 - 1)	• Schneider PM3200 series • Schneider PowerTag series	• METSEPM3250 • A9MEM15 series
Type 4 – tenants	NMI approved revenue meter (Class 0.5 - 1)	• Schneider iEM3150-NMI • Schneider iEM3250-NMI • Schneider iEM3350-NMI	• A9MEM3150-NMI • A9MEM3250-NMI • A9MEM3350-NMI

For DPMs type 1a, 1b, and 2, the measurement of the neutral current is also required, and all power quality capabilities must be enabled in the meter and configured in PME. Note that parameters and CT class must match the Meter class and considered for the power quality analysis. Type 4 meters must be NMI certified as they are used for tenant billing purposes. All installed meters must have a local display attached for onsite viewing and troubleshooting.

Installation and configuration of meters

All meter types shall be installed in accordance with AS 62053.22:2018 Class 0.5S in respect to the accuracy of the meters, the CT's and any voltage transformers.

All meters shall have an RS485 serial communication output or Ethernet output and communicate using Modbus TRU or Modbus TCP protocol.

In new projects all DPMs should be installed in a dedicated metering section of the corresponding board protected to IP2x rating, or in a separate metering board. This facilitates troubleshooting and the manual reading of the DPMs. Under no circumstances shall any meter be mounted on a compartment door such that a switch or circuit breaker is required to be turned off to allow access to the metering terminals. The height of the metering panel (or metering section of any board) shall be at least 300 mm and be located 1500 mm above floor level with a minimum of clearance of 500 mm in front of the meter to any other equipment, wall or other obstruction.

Each DPM shall be configured to monitor either single or three phase loads as required. Demand calculation type to be set for Sliding Window with period of 15 minutes. Power Quality features available on installed meters must configured and enabled by the contractor in consultation with the Utilities Management Unit and EM Electrical Engineers.

All meters shall be installed with approved terminal strips for data cables (where required), CT wiring and shorting links, power supplies, fuses, or circuit breakers. CT's shall be installed in a viewable location, so the sizing can be confirmed. The set of terminal strip fuses shall be located adjacent to the meter to allow the safe testing of the meter and for isolation of the meter should it require to be replaced. The same shall apply for the location of the shorting terminals for the CT's. The standard layout and label wording to be used can be found in section A7.10 below.

Each DPM shall be powered from an auxiliary 240 V_{AC} supply fed from the supply side of any individual circuit switches or circuit breakers. This supply must be isolated by the main switch or circuit breaker to the MSB or DB. Care must be taken for DPMs metering backup generators, as the 240 V supply must come from a board that is fed from the grid and not from the generator. DPMs can be powered using POE if available, when approved by the Utilities Management Unit. Where several DPM's are fed from the same section of busbar (therefore probably having the same potential level), then one set of potentials can be used to supply those meters rather than individual potentials supplies. Consideration can be given to using the Schneider PowerTag range for metering small boards or individual circuit breakers.

A guide has been provided to assist the UNSW Facilities Engineer and the Contractor in ensuring that important installation requirements have been completed and signed off. Please refer to section **Error! Reference source not found.** below.

A7.7. POTABLE AND BORE WATER METERS

The University uses water meters with pulse output to monitor the potable and bore water consumption at campus, building, tenants, and individual loads levels when required.

Total potable and bore water consumption must be metered in all buildings by water meters connected to EMACS. Sub-meters shall be installed on significant plant and equipment. Sub-metering to major plant is also important where monitoring water consumption can assist performance appraisal, leak detection, and malfunctions (e.g., in toilet blocks). Examples of where submetering is required include cooling towers (make up and bleed lines), laboratory non-potable water, reverse osmosis systems, irrigation, toilet flushing supplies, and pure water treatment plants.

Potable and bore water meters must be installed in areas of easy access, this to ensure they can be easily inspected and maintained. There should be adequate space surrounding the meter for validation & maintenance purposes. Meters are not to be installed in ceiling spaces.

In accordance with the National Measurement Institute (NMI) utility meters standards, a pattern approved water meter (NMI R 49) must be installed for cold water meter supply to a tenant.

The preferred water meters are supplied by Elster Metering Pty. Ltd. with a pulse attachment suitable for connection to EMACS. As a guide, a pulse quantity of 10 L/pulse shall be used for submetering, and 100 L/pulse (0.1 m³/pulse) for building gate meters and campus mains.

The table below shows the approved water meters models to be used at UNSW campuses. Note that other models can be used following consultation and approval by the Utilities Management and EM Hydraulics engineering service team.

Level of metering	Type of metering	Manufacturer and model
High use (campus) up to 2,000 kL/h	Water meter with pulse head. Primarily used for high usage area. Meter size from 40 mm to 300 mm.	• Elster H4000 + PR7 pulse head • Or alternative meter approved after discussion with Utilities Team.
Medium use between 0.15 – 30 kL/h	Water meter with pulse head. Meter size of 50mm.	• Elster V300 (PMS-T) • Or alternative meter approved after discussion with Utilities Team.
Low use and tenants up to 20 kL/h	Water Meter with pulse head. Mainly used in area where usages are low to medium. Meter size from 20 mm to 40 mm, NMI R 49 pattern approved meter.	• Elster V100 (PMS-T) • Or alternative meter approved after discussion with Utilities Team.

There are several methods used to connect a pulse meter signal to EMACS:

1. ETGs with digital inputs
2. DPMs with digital inputs
3. PLCs (to connect pulse inputs that can't be accommodated by ETGs and DPMs)
4. LoRaWAN device with pulse counter inputs (mainly for outdoor use)

Logging the pulse signal must be configured in the local device. This configuration depends on the method and device type used to connect the pulse signal. This local logging is required to reduce data losses.

A 2-pair twisted cable shall be run from the PLC/ETG or electricity meter to the water pulse attachment. Care shall be taken that there is enough mechanical protection for this cable along its complete length, especially when the water meter is installed in garden beds. The water pulse attachment normally comes with a small length of 2C or 4C cable. The two cables shall be connected together in a small weatherproof junction box. Due to capacitance build up on long cable runs that affect the pulse attachment, if the nearest PLC/ETG or electricity meter is

more than 30 m away, then a new PLC/ETG shall be installed, or a LoRaWAN solution should be considered.

When a more accurate flow rate measurement is required, then a flow meter shall be connected to EMACS through an analogue input card of a PLC. Likewise, if the water pressure measurement is required then the sensor shall also be connected via the analogue input card of a PLC. The necessary modifications shall be carried out to the PLC programme to allow the monitoring of the analogue inputs by EMACS.

When installing and commissioning a new meter, the pulse quantity signals shall be verified by taking a manual reading of the analogue water meter and then re-checking it after sufficient water has passed through the meter, e.g., after a day or a week. The difference in the meter reading should correlate to the amount shown on PME. This will be used to determine the actual quantity per pulse to be used. A guide has been provided to assist the Contractor to ensure that the important steps have been completed and signed off. Please refer to A7.12 below.

A7.8. GAS METERS

Diaphragm meters with pulse output shall be used for all purposes across UNSW Campuses due to their accuracy, minimal maintenance, and turndown ratios. Turbine meters shall not be used. However, an alternative meter type can be proposed to the Utilities Manager for approval where installing a diaphragm meter is very difficult or uneconomical.

Gas meter must also be installed in areas of easy access, this to ensure they can be easily inspected and maintained. There should be adequate space surrounding the meter for validation & maintenance purposes. Gas meters are not to be installed in ceiling spaces.

Total gas consumption must be metered in all buildings by a gas meter connected to EMACS. Submeters shall also be installed on Tenants loads and all major gas consuming plant and equipment. Meters shall be sized for normal demand rather than maximum demand, to ensure that small losses are identified. The volume per pulse shall be determined depending upon the size of the gas pipe and the proposed gas use. Typical values are 0.01 m³/ pulse, 0.1 m³/ pulse, and 1 m³/ pulse. The preferred gas meters to be used are the Ampy Email meters. The table below shows currently approved gas meters models:

Level of metering	Type of metering	Manufacturer and model
High use (campus) up to 39 m ³ /h flow capacity.	Gas meter with pulse attachment. Primarily used for high usage & pressure supply. Max operating pressure is 100 PSI.	- Ampy Email AL 1000 (up to 28 m³/h) + Pulse head - Ampy Email AL 1400 (up to 39 m³/h) + Pulse head - Or alternative meter approved after discussion with Utilities Team.
Medium use up to 22 m ³ /h flow capacity.	Gas meter with pulse attachment. Max operating pressure is 100 PSI.	- Ampy Email AL 800 + Pulse head - Or alternative meter approved after discussion with Utilities Team.
Low use up to 12 m ³ /h flow capacity	Gas meter with pulse attachment. Max operating pressure is 25 PSI.	- Ampy Email AL 425 + Pulse head - Or alternative meter approved after discussion with Utilities Team.

Other gas meter models can be used following consultation and approval by Utilities Management and EM Hydraulics engineering service team.

Where a medium pressure supply (100 kPa) exists, the meter shall be correctly sized by the meter supplier for the given pressure.

The volume per pulse affects the resolution of the information displayed on PME, which can be critical for billing purposes or for the accuracy of the flow rate calculation. If a more accurate flow rate is required, then a flow meter shall be connected to EMACS through an analogue input card of a PLC.

As mentioned in the previous section, several methods can be used to connect a pulse meter to EMACS:

1. ETGs with digital inputs
2. DPMs with digital inputs
3. PLCs (pulse inputs that can't be accommodated by ETGs and DPMs)
4. LoRaWAN device with pulse counter inputs (mainly for outdoor use)

Logging the pulse signal must be configured in the local device. This configuration depends on the method and device type used to connect the pulse signal. This local logging is required to reduce data losses.

Due to capacitance build up on long cable runs that affect the pulse attachment, if the nearest gateway device is more than 30 m away, then a new ETG/PLC shall be installed, or a LoRaWAN solution considered.

Gas meters at a campus or building level shall be fitted with automatic temperature and pressure correction equipment. Where this is uneconomic, then approval shall be sought from the Utilities Manager to relax this requirement. In these cases, the inlet gas pressure (kPa) shall also be metered. The Contractor shall provide the assembly with an upstream filter and regulator to stabilise inlet pressure and downstream regulator with discharge pressure to suit the equipment connected. A pressure test point shall also be provided after the regulator on both the inlet and outlet sides of the meter.

Hazardous and non-hazardous installation requirements

Due to the dangers of potential gas leak explosions, it is advisable that any installations involving gas metering, be classified as either hazardous or non-hazardous by competent and knowledgeable UNSW representative or consultant. This requires the participation of an accredited Hazardous Area person to act as a facilitator. This classification indicates the level of protection and equipment used in the installation. It is the contractor's responsibility to obtain a written copy of this classification before performing any installation work.

Non-hazardous installations

If the gas meter and the area in the vicinity of the gas meter are deemed non-hazardous by UNSW, then the meter's pulse attachment connection is straight forward. The pulse attachment is normally supplied with a short length of 2C or 4C cable and therefore a small junction box mounted alongside the gas meter is required. The pulse attachment cable shall be connected inside this junction box to the 2 twisted pair cable that is run from the PLC or DPM with digital inputs.

Hazardous installations

If the gas meter and the area in the vicinity of the gas meter are deemed hazardous then spark suppression measures need to be installed. After the meter's connection point to the EMACS Communication Network has been determined, a 2 twisted pair cable shall be run from the

PLC or DPM to the gas meter's Intrinsically Safe (IS) Barrier. The IS Barrier shall be mounted in a standard junction box in a suitable location, see section A7.23 below. The cable is connected to the output relay contact of the IS Barrier Relay.

As before, the gas meter pulse attachment is normally supplied with a short length of 2C or 4C cable. A small junction box shall be mounted locally to the gas meter to provide a connection point for the meter pulse output cable to the IS cable that runs back to the IS Barrier. This cable connection shall be carried out using a resistor configuration that utilises the IS Barrier's fault detection function. The resistors enable short circuit and open circuit detection by the IS Barrier which generates an alarm.

The cabling from the IS Barrier to the gas meter shall be identified as an IS installation, preferably using blue coloured screened cable. This cable is then connected to the input of the IS Relay. Care shall be taken to ensure there is mechanical protection for all cables within the hazardous area along their entire length.

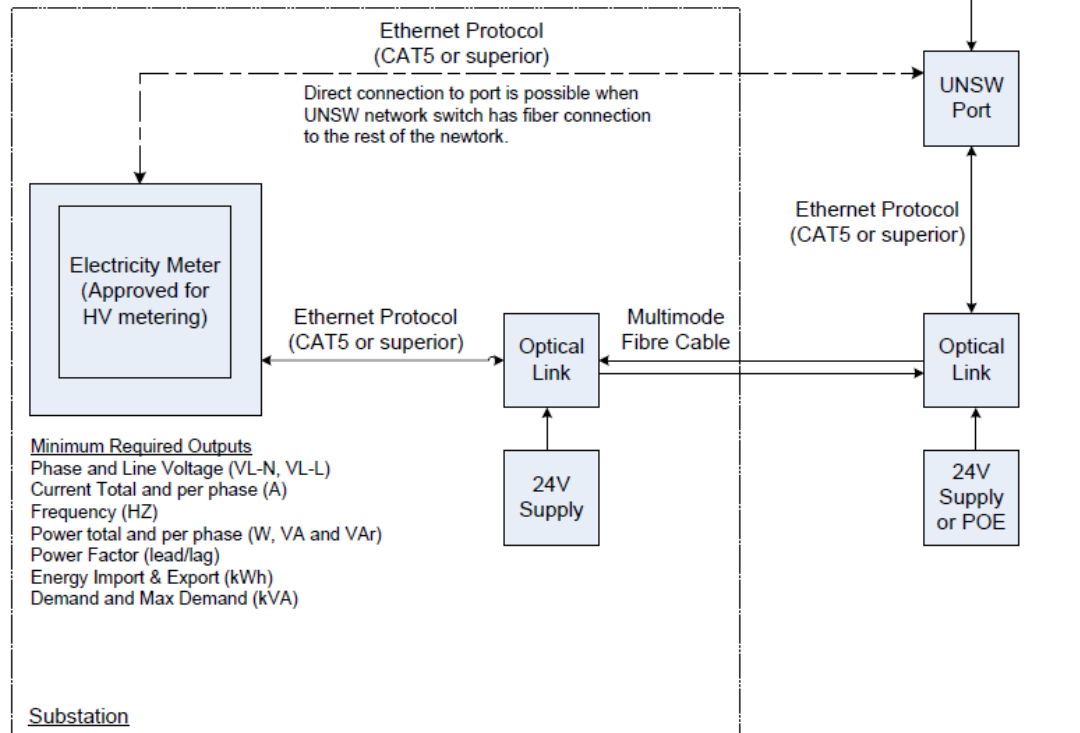
Commissioning

The pulse quantity signals shall be verified by taking a manual reading of the gas meter and then re-checking it after sufficient gas has passed through the meter, e.g., after one week. The difference in the meter reading should correlate to the amount shown on EMACS. This should inform the actual quantity per pulse to be used on EMACS.

A guide has been provided to assist the Contractor to ensure that the important steps have been completed and signed off. Please refer to A7.13 below.

A7.9. METER CONNECTION SCHEMATICS

Typical Connection for HV Electricity Meter

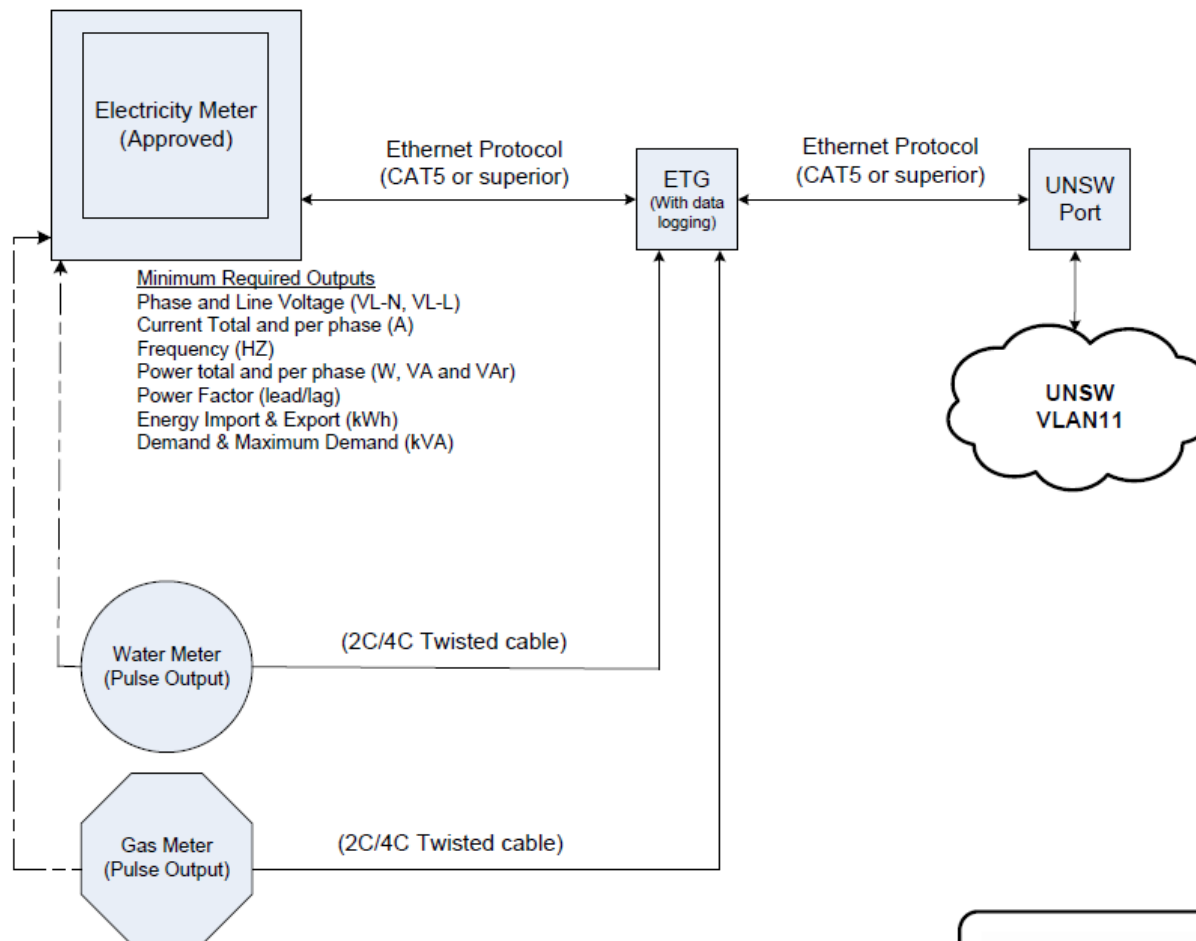


General Notes

- Optical Link and fibre cable to be installed according to UNSW IT Network specifications.
- Power supply for the Optical Link outside the HV area to be determined on a case by case basis. Generally POE (power over ethernet) is preferred where possible.
- Approved HV electricity meter to be installed and configured according to UNSW Metering guidelines.
- UNSW ports to be patched to VLAN 11, Estate Management - Utilities Management Unit will provide/allocate IP address for use.
- For more details refer to UNSW metering D&C guidelines "DESIGN AND CONSTRUCTION REQUIREMENTS INSTALLATION OF GAS, ELECTRICITY AND WATER METERS".

 UNSW THE UNIVERSITY OF NEW SOUTH WALES	Created Sep 2012	Modified Feb 2023	Title Typical HV Meter Connection Schematic
	Drawn JB/LG	Approved JB	
Section UTILITIES MANAGEMENT UNIT	Discipline Energy	Scale	Sheet No: 2 OF 2
	CAD Reference Typical Meter Connections v2.vsd	Drawing No: EU-MG-001	Revision 3

Typical Connection for Gate Meters and Sub-Meters



General Notes

- ETG stands for Ethernet Getaway.
- UNSW ports to be patched to VLAN 11, FM Energy Management to assign IP address.
- Meter Types, PLC, ETG, Pulse output devices and connection arrangements to be reviewed and approved by EM Utilities Management Unit before installation.
- Some electricity meters and PLCs, can be connected directly to UNSW LAN using ethernet cable. In this case the ETG is not required. This will need to be discussed and approved by EM Utilities Management Unit.
- If the gas meter and the area in the vicinity of the gas meter are deemed hazardous, then an Intrinsically Safe (IS) barrier should be used.
- If the ETG or Meter does not have enough inputs to accommodate gas and water pulses, then a PLC device with data logging to be used to connect the pulses.
- UNSW have wireless LoRaWan network to connect gas and water meters in outdoor areas.
- For more details refer to UNSW metering D&C guidelines "DESIGN AND CONSTRUCTION REQUIREMENTS INSTALLATION OF GAS, ELECTRICITY AND WATER METERS".

 UNSW THE UNIVERSITY OF NEW SOUTH WALES	Created Sep 2012	Modified Feb 2023	Title Typical Gate Meter or Sub-Meter Connection Schematic
	Drawn JB/LG	Approved JB	
Section UTILITIES MANAGEMENT UNIT	Discipline Energy	Scale	Sheet No: 1 OF 2
	CAD Reference Typical Meter Connections v2.vsd	Drawing No: EU-MG-001	Revision 3

[illegible]

A7.11. ASSET REGISTRATION FORM

Link to the asset registration form - <https://forms.office.com/r/QF5iVJuuBv>

Asset Registration Form also available in Spreadsheet format for bulk entry. Please contact the Utilities Management Team (energy@unsw.edu.au) to get copy of the spreadsheet.

Below is a screenshot of the online asset registration form,

UNSW Utilities Asset Registration Form

Use this form for registering new asset, remove redundant asset and update asset information.
If you need any assistance with this form, please contact the UNSW Utilities Management Team (energy@unsw.edu.au)

* Required

1. Change Type *

Select your answer

2. In Archibus (Yes/No) ? *

☐ Y

☐ N

3. ARCHIBUS Barcode

Enter your answer

4. ARCHIBUS Previous Barcode (if there is existing barcode on the asset)

Enter your answer

Next

A7.12. DIGITAL POWER METER COMMISSIONING SHEET



Digital Power Meter Commissioning Sheet

Meter ID

OBSERVATION OF METER INSTALLATION

CT RATIO	
CT MANUFACTURER (IF KNOWN)	
CT WIRING	6 Wire / 4 Wire / Earthed
CT SHORTING BLOCKS ARE INSTALLED?	YES / NO
IS BURDEN WITHIN LIMITS?	YES / NO
CT'S ARE NOT SHORTED?	YES / NO
POTENTIAL FUSES ARE INSTALLED?	YES / NO
FUSES ARE SAFE TO REMOVE FOR ISOLATION?	YES / NO
CORRECT METER TERMINATIONS?	YES / NO
TERMINATIONS ARE TIGHT?	YES / NO
CORRECT COLOURED WIRING?	YES / NO
CORRECT WIRE NUMBERING?	YES / NO

If CT Ratio was identified from a different method other than from nameplate, then state method used:

VALIDATION OF METER SUPPLY

A portable digital analyser shall be used to validate the configuration of the meter by comparing its readings with the meter display values.

METER POTENTIAL SUPPLY		415 V / 240 V / 110 V
METER AUXILIARY SUPPLY FUSE (2 Amp)	YES / NO	Amp
CORRECT POTENTIAL SUPPLY VALUES	YES / NO	By Test
CORRECT CURRENT VALUES	YES / NO	By Test
CORRECT POTENTIAL SUPPLY PHASING	YES / NO	Wire Colour / remove fuses
CORRECT CURRENT PHASING	YES / NO	Wire Colour / shorting CTs

COMMUNICATIONS VALIDATION

For multiple meters within the same communications chain, only reading the meter from the ETG is required for every meter within that chain. The other checks refer to the whole communications chain.

VISUAL CHECK OF SERIAL COMMS	YES / NO
ETG CONNECTED TO VLAN 11	YES / NO
ETG CONFIGURED	YES / NO
METER READ FROM ETG	YES / NO

EMACS VALIDATION

There is the need for enough variability between the different meters to ensure that what is displayed at EMACS matches its corresponding Panel Meter.

	PHASE A	PHASE B	PHASE C	AVERAGE/TOTAL
VOLTAGE	YES / NO	YES / NO	YES / NO	YES / NO
CURRENT	YES / NO	YES / NO	YES / NO	YES / NO
POWER	YES / NO	YES / NO	YES / NO	YES / NO

READING	DATE	TIME	METER READING	EMACS READING
1				
Consumption (difference)				

COMMENTS

WORK REQUIRED TO COMPLETE VALIDATION

Signed	Company
Observer	Date

A7.13. GAS AND WATER METER COMMISSIONING SHEET

GAS AND WATER Commissioning Sheet

Meter ID

OBSERVATION OF METER INSTALLATION

PULSE HEAD INSTALLED?	YES / NO
CORRECT PULSE HEAD POSITION?	YES / NO
IS METER WITHIN ACCEPTABLE DISTANCE FROM INPUT?	YES / NO
CORRECT METER & INPUT TERMINATIONS?	YES / NO
TERMINATIONS ARE TIGHT?	YES / NO
CORRECT CABLE USED?	YES / NO

VALIDATION OF METER TO INPUT DEVICE

ARE PULSES RECEIVED AT THE INPUT DEVICE?	YES / NO
DOES THE No. OF PULSES CORRELATE WITH THE METER READING & QUANTITY PER PULSE?	YES / NO

COMMUNICATIONS VALIDATION

For multiple meters connected to the same input measuring device, i.e., PLC or DPM with pulse inputs, these checks are only required to be performed once.

VISUAL CHECK OF SERIAL COMMS	YES / NO
ETG CONNECTED TO VLAN 11	YES / NO
ETG CONFIGURED	YES / NO
PLC/METER READ FROM ETG	YES / NO

EMACS VALIDATION

There is the need for enough variability between the different meters to ensure that what is displayed at EMACS matches its corresponding Gas/Water Meter. Where possible varying the pulse quantities between each meter.

VERIFIED COUNTER VALUE MATCHED EMACS VALUE?	YES / NO
--	----------

At least two meter readings are required to validate Gas/Water meters in EMACS. The time gap between readings depends upon the pulse quantity and flow through the meter.

READING	DATE	TIME	ACTUAL METER READING	EMACS PQM/PLC PULSE COUNTER READING
1				
2				

ALL TESTS COMPLETE: YES / NO

COMMENTS

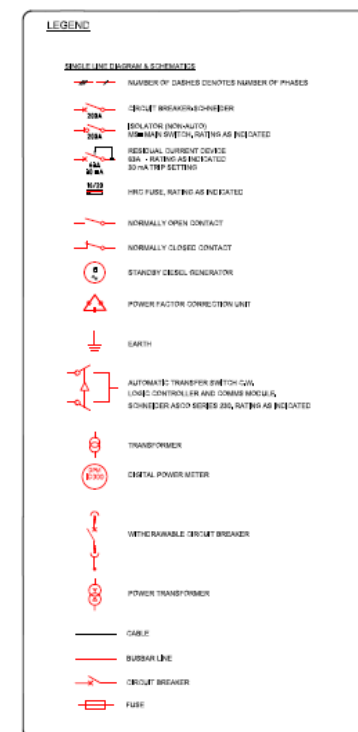
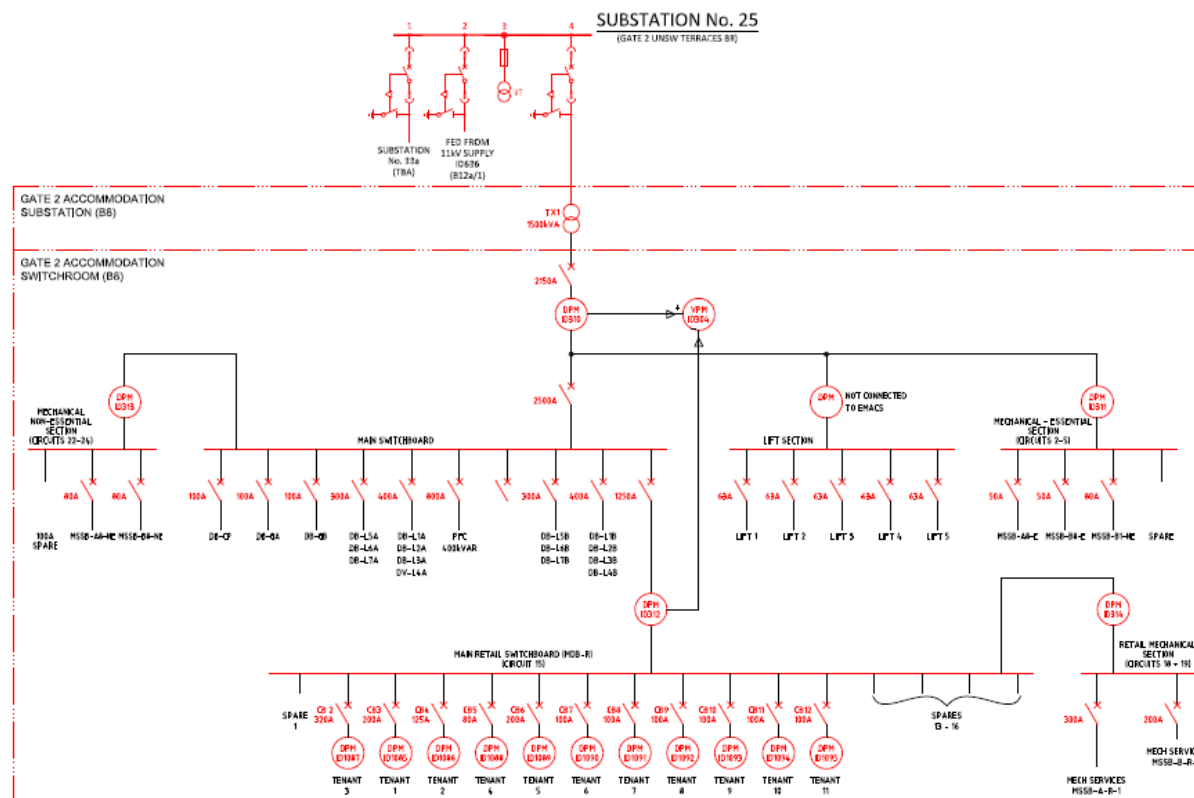
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WORK REQUIRED TO COMPLETE VALIDATION

--

Signed	Company
Observer	Date

A7.14. EXAMPLE OF ELECTRICITY METERING SCHEMATIC



PRELIMINARY
INFORMATION ONLY
CONTINUOUSLY UPDATED

NOTES:
ALL INFORMATION SHOWN IN THIS PLAN IS CONFIDENTIAL AND SHOULD BE KEPT PRIVATE PRIOR TO ANY ACTION.
THESE NOTES ARE THE PROPERTY OF THE UNIVERSITY OF NEW SOUTH WALES AND SHOULD NOT BE REPRODUCED WITHOUT THE APPROVAL OF THE INFORMATION SERVICES DIVISION.

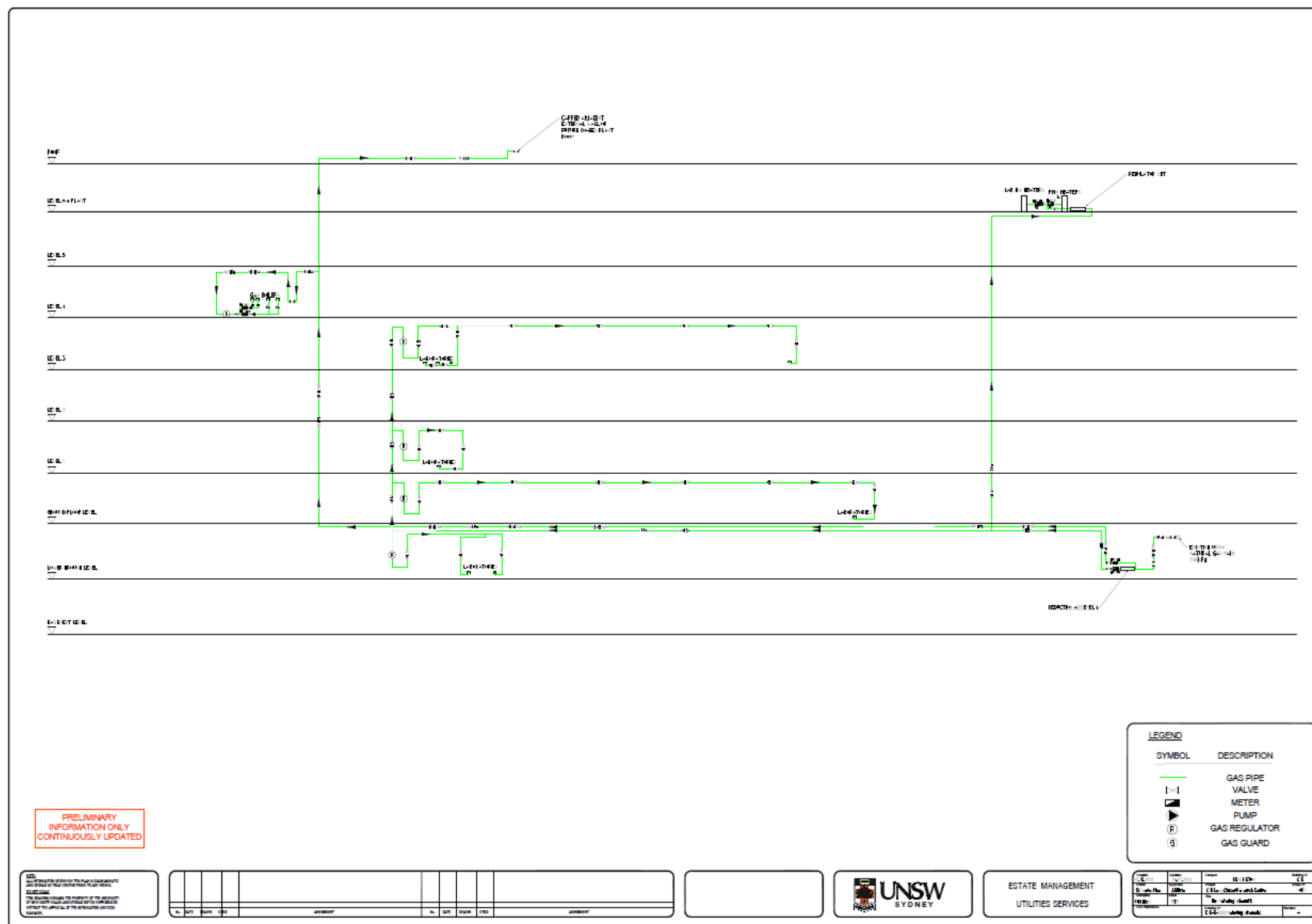
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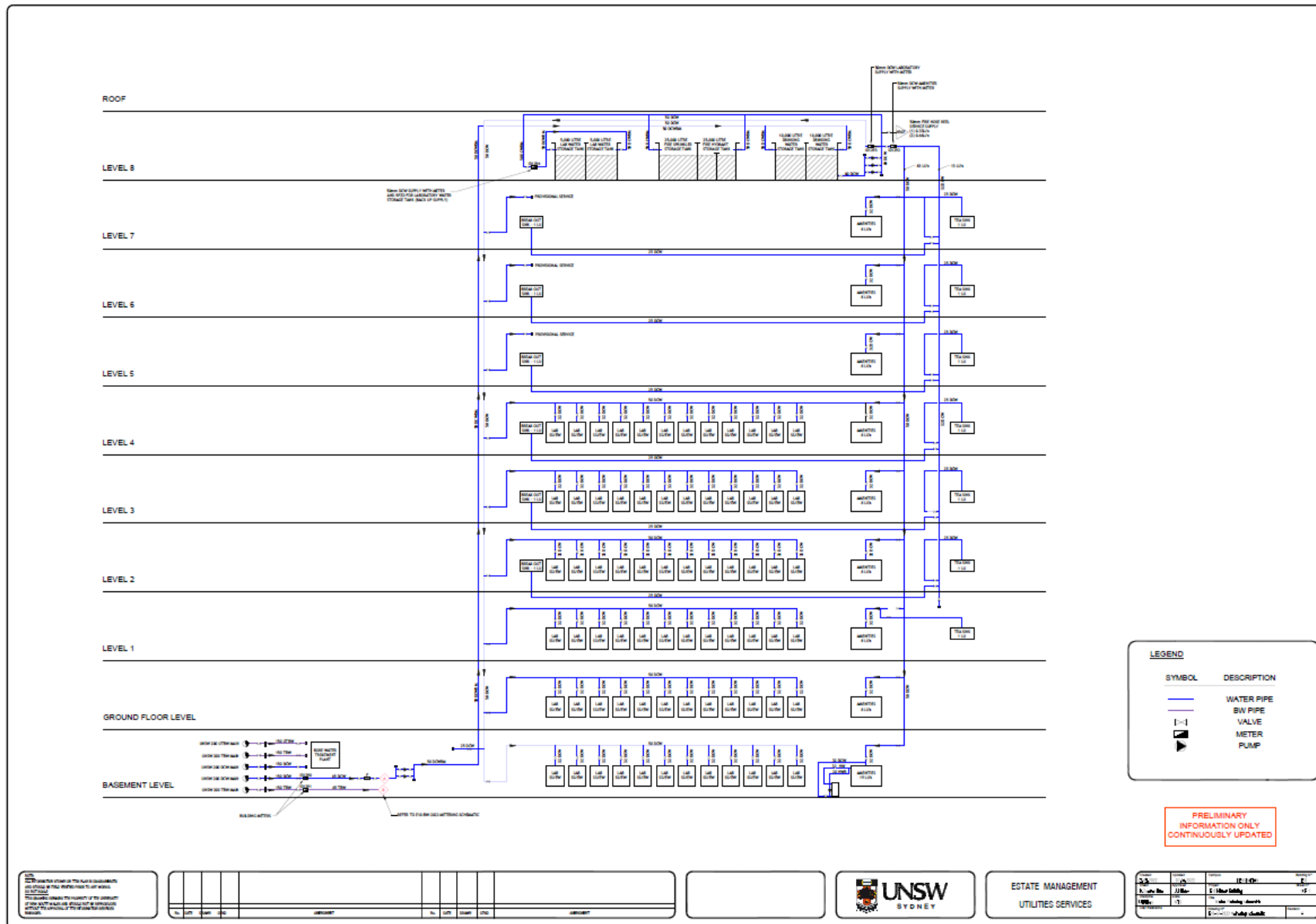
ESTATE MANAGEMENT
UTILITIES SERVICES

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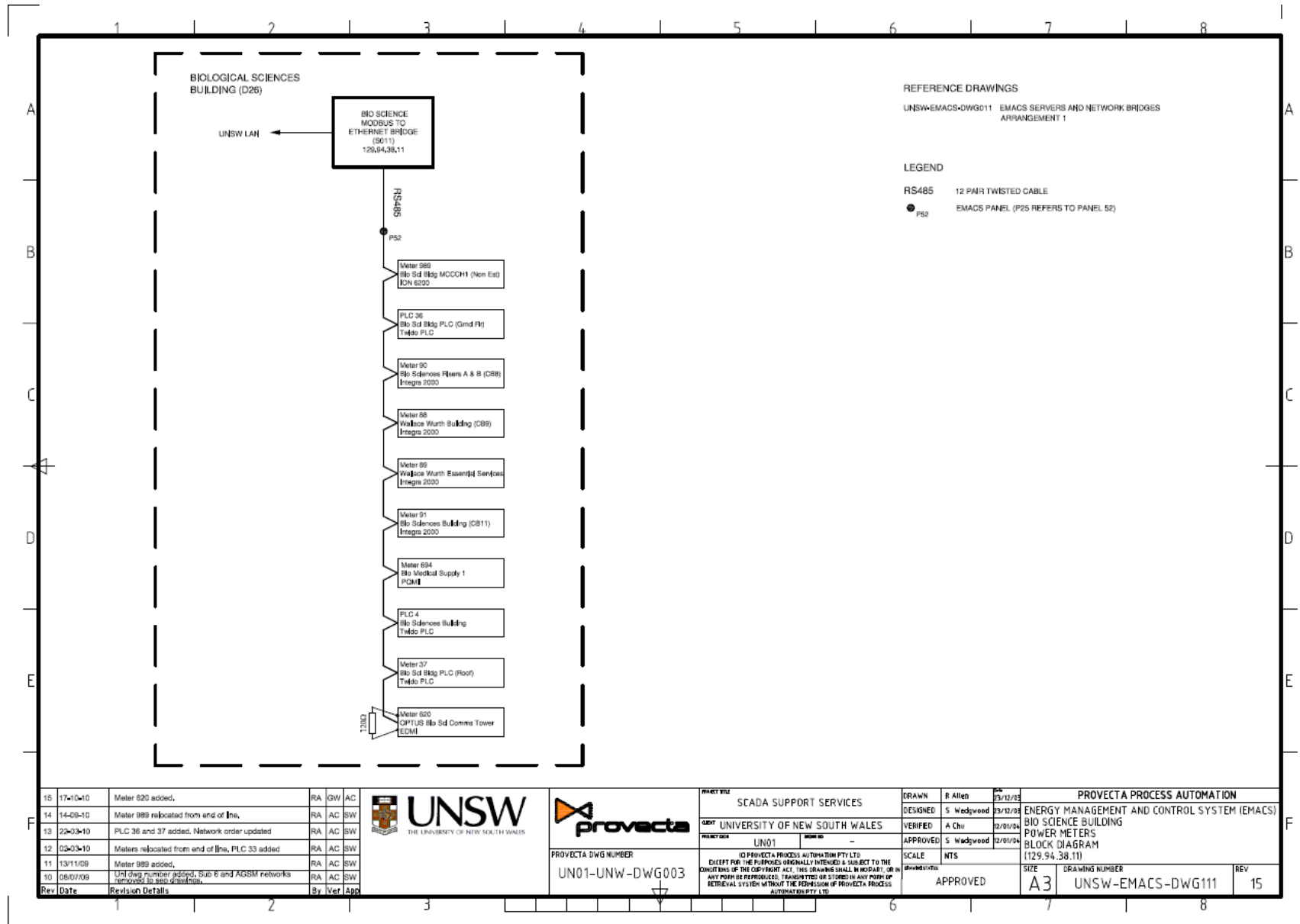
A7.15. EXAMPLE OF GAS METERING SCHEMATIC



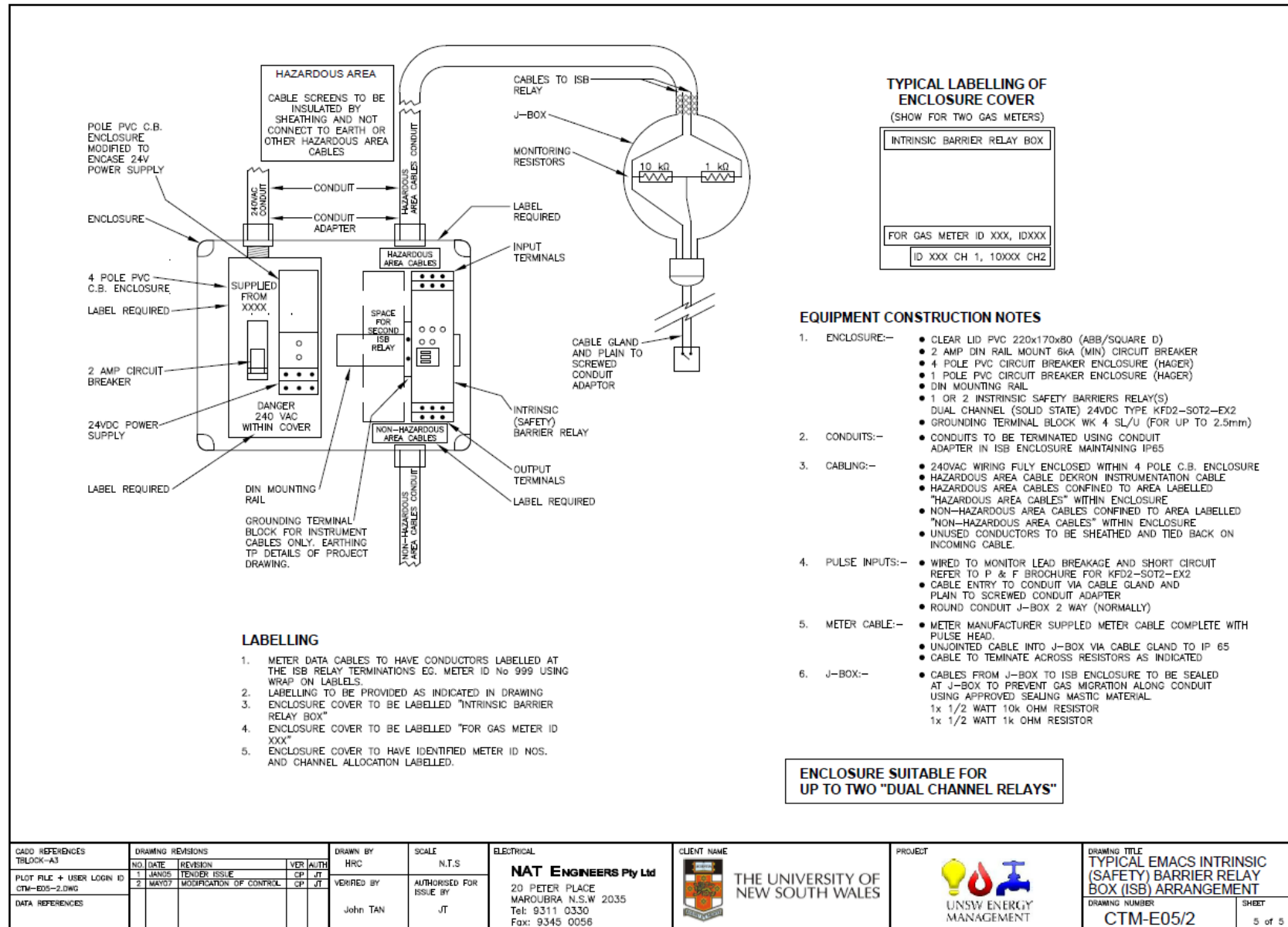
A7.16. EXAMPLE OF WATER METERING SCHEMATIC



A7.17. EXAMPLE OF COMMUNICATIONS NETWORK SCHEMATIC



A7.18. TYPICAL INTRINSIC SAFE BARRIER RELAY BOX ARRANGEMENT



A7.19. APPLICABLE AUSTRALIAN METERING STANDARDS

Electricity meter standards:

- AS 1284.1-2004: Electricity metering - General purpose induction watthour meters.
- AS 62052.11-2005: Electricity metering equipment (AC) – General requirements, tests, test conditions – Metering equipment.
- AS 62053.21-2005: Electricity metering equipment (AC) – Particular requirements – Static meters for active energy (classes 1 and 2).
- AS 62053.22-2005: Electricity metering equipment (AC) – Particular requirements – Static meters for active energy (classes 0.2S and 0.5S).

Voltage transformer standards:

- AS 60044.2-2007: Instrument transformers Inductive voltage transformers.
- AS 60044.3-2004: Instrument transformers - Combined transformers.
- AS 60044.5-2004 (part): Instrument transformers - Capacitor voltage transformers.
- AS 1243-1982: Voltage Transformers for Measurement and Protection (for 3-phase only)

Current transformers standards:

- AS 60044.1-2007: Instrument transformers - Current transformers.
- AS 60044.3-2004: Instrument transformers - Combined transformers.