APPENDIX 7 - ENERGY MANAGEMENT – ELECTRICITY, GAS AND WATER METERING

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APPENDIX 7

ENERGY 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 several hundred electricity, gas and water meters which measure and log energy and water use parameters. Data from these meters is used to analyse historical trends, determine flow rates and peak demand, discover and trace energy performance issues and leaks, monitor power factors, and generate utilities billing for UNSW tenants.

As a general rule, metering for electricity, gas and water (both potable and bore water) is required for new buildings and/or major plant items, specific services, user groups and tenants.

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

- Documentation, Approvals and Checklists for new installations and changes to existing meters or the metering network architecture.
- Meter Data Communications Network
- Electricity Meters
- 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.

Tenderers and Contractors installing or maintaining approved meters and associated equipment shall connect or incorporate them into the existing EMACS to provide full functionality and remote monitoring capability.

Only competent and approved contractors shall be permitted to install metering at UNSW.

The final step in the integration of a new meter into the system involves software tasks within the EMACS program itself. This work is normally undertaken either by UNSW in-house or by a Contractor specifically assigned to this task by UNSW. Unless otherwise specified, this final step does not fall within the scope of work for installations covered by these requirements.

A7.2 INTERPRETATION AND COMPLIANCE WITH NCC PART J8.3 FACILITIES FOR ENERGY MONITORING

For new and refurbished buildings UNSW requires that appropriate utilities metering, compliant with this guide, be installed to measure the total building use of electricity, gas and water. In addition, sub-metering is to be installed to measure total energy use of the building's mechanical services installation, split into essential and non-essential elements. In certain cases additional metering may be requested to measure specific equipment or plant of special interest to Facilities Management such as the supplies to retail tenancies or to record the import/export of energy from PV systems or trigeneration installations.

UNSW is fully aware of the deemed-to-satisfy Provisions of the Australian National Construction Code (NCC) 2013, J8.3 which states that a building *"….must have the facility to record individually the energy consumption of……"* which some consultants and contractors have interpreted as a requirement to install sub-meters on every distribution board separately for power and lighting plus the installation of sub-meters for additional energy systems as listed in the code.

However, UNSW does not interpret the phrase *"… must have the facility to record…."* as a de-facto requirement that a sub-meter must be installed to comply. If this were the case, then the regulation would have mandated this in plain terms. The UNSW interpretation is that a *"…facility to record…"* implies that a provision is made which facilitates the attachment of a meter, data logger or some other recording device in order to measure energy use in the sub-systems as specified should it be required at some time. This could include fitting of CT's only, or providing suitable space within switchboards and distribution boards where portable recording devices can be readily installed.

Therefore, UNSW does not require or approve design proposals in which a plethora of energy sub-meters are proposed, in excess of those stated above, as a response to the requirements of J8.3. Our requirement is for designers to incorporate only a *"…facility to record…"* those energy systems and elements as specified in the NCC.

A7.3 DOCUMENTATION AND APPROVALS

Documentation

The following are the minimum documentation requirements for the installation and connection of meters and associated equipment to EMACS.

Data Forms

a) Meter Data Forms are required to be completed whenever:
- A new meter is added – full details are required, e.g. location of meter, description of the load, description and meter model, serial numbers, etc.;
- An existing meter is replaced – meter details are required to be updated, e.g. serial number, existing meter reading, etc.;
- A meter is relocated – updated location and meter reading before being moved;
- A meter is disconnected and removed – a final meter reading should be taken; and

- The load on a meter changes substantially – e.g. additional pipework, cabling, DB loads, etc. are added to the metered system.

A meter data form shall be completed and submitted to the Energy Manager for approval before any work is carried out. One form is required for every meter and specific meter data forms are to be used for electricity, gas or water meters.

When approved, a unique meter identification number is allocated to each meter by UNSW Energy Management. This enables accurate tracking of each meter as well as identifying the meter on the EMACS.

b) Programmable Logic Controllers (PLC's) and Ethernet Gateways (ETG's) forms, are required to be completed whenever:

- A new PLC or ETG is added – full details are required, e.g. location, description PLC/ETG, communication details, serial numbers, meters connected to PLC/ETG, etc.;
- A meter is added, relocated or removed – generally electricity meters are connected to ETG's and water/gas meters are connected to PLC's so if the meter changes then so does the communications chain for ETG's or the PLC inputs;
- An existing PLC or ETG is replaced – details are required to be updated, e.g. serial number, etc.;
- A PLC or ETG is relocated – updated location; and
- A PLC or ETG is disconnected and removed.

Completed examples of the Meter Data Forms and the PLC/ETG Data Forms can be seen in sections A7.14 and A7.15 respectively.

Schematics

The Energy Management unit maintains campus wide metering installation schematic drawings for electricity, gas and water services. The schematics depict where in the supply network a meter is installed, what loads are being metered and the relationships between adjacent meters.

There are separate drawings for the:

- Electricity Meter Schematics – based upon the Campus wide Single Line Diagrams (SLD) incorporating the High Voltage feeds onto the Campus down to Low Voltage Distribution Boards.
- Gas Meter Schematics – based on the gas pipework throughout the Campus including a pictorial representation of the equipment or loads that each gas meter measures.
- Water Meter Schematics – based on the potable water pipework throughout the Campus including a pictorial representation of the equipment or loads that each water meter measures. Bore Water meters are shown, however the bore water reticulation system is currently being prepared.
- 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 EMACS. This ranges from the EMACS's servers connected to the EMACS's own private Virtual LAN (VLAN11) which is connected to the PLCs/ETGs down to each device (meters, ETG's and

PLC's). NB it is important that the correct order of devices on each serial RS485 network is shown as this will be reflected on EMACS screens.

Whenever changes are made to the metering installation or communications network, installers or maintenance contractors are required to update or create the schematic drawings accordingly.

Samples of each of the schematics can be seen in sections A7.16 through to A7.19.

Checklists and Check Sheets

To assist contractors with the important steps in either the installation or the commissioning of the meters and associated communications, a checklist (of actions to be undertaken) and a check sheet (to validate the installation) have been prepared and completed for each meter type.

The commissioning process is vital in ensuring that the meter is measuring the load accurately and EMACS is displaying the data correctly.

Examples of the checklists and check sheets can be found in sections A7.9 through to A7.13.

After commissioning the Contractor shall supply an individual calibration certificate for each meter showing details of the meter, the results of the calibration test and the date the calibration was carried out.

Approvals

Approval from the Energy Manager is required before the installation of any new meter, or changes to the EMACS system, is proposed. The approval and documentation process is as follows:

1. The contractor completes the relevant sections of the Meter Data form and forwards it to the UNSW Energy Manager;
2. The Energy Manager will approve/decline the proposal, assign a meter identification number and return the form to the installer;
3. The meter is installed in accordance with this UNSW Metering Design Guide and any special conditions that may be noted by the Energy Manager on the Meter Data Form;
4. When the installation is complete the installer advises the Energy Management Unit by email -energy@unsw.edu.au - and provides further information, such as, the initial meter reading and the meter serial number;
5. The relevant meter schematic shall be updated and submitted for approval;
6. The checklist and commissioning check sheets shall be submitted as proof of the correct install process, including any supporting equipment documents such as meter calibration sheets.
7. For gas meters, the contractor shall also provide documented proof of the hazardous area classification of the gas installation to support the method of installation of the gas meter to EMACS.

For projects with more than 3 meters to be installed, it is also advisable that the design be approved by the Energy Manager from the beginning of the project to ensure that the correct type of meter is installed in the correct location.

A7.4 COMMUNICATIONS NETWORK

The best way to connect a new electricity, water or gas meter to EMACS depends upon a number of factors. These include the quantity of meters; the location of the meters; the proximity to an existing Modbus network that is not already over-populated; proximity to a LAN port; available space to mount panels; etc. The notes below provide further information.

The EMACS currently uses the Schneider StruxureWare Power Monitoring Expert (PME) platform which communicates over the UNSW's Ethernet Network infrastructure (via a Virtual LAN) with the field devices (PLCs, ETGs, Electricity, Gas and Water Meters) distributed throughout UNSW Campuses.

The communication protocol between the EMACS and the meters is Modbus/TCP via a device called a Modbus to Ethernet Gateway (ETG). The preferred ETG is the Com'X 200 (with AC power supply) or the Com'X 510 by Schneider Electrics which shall be configured to operate at 9600 baud.

For temporary/semi-permanent installation & replacement purposes, UNSW will allow use of Link 150 (Part number EGX 150) ETG device by Schneider Electrics but will be subject to case by case review and will need to be approved prior to installation.

When a PLC is used, meters are connected by a localised Modbus (RS485) network in a daisy chain configuration. The last device connected to the daisy chain shall have a 120ohm terminating resistor connected across its communication terminals. The preferred cable to use for the RS485 communications is a 2 twisted pair shielded grey cable from Belden (part number 9842).

The maximum number of Modbus capable meters and PLCs connected to the same RS485 network shall be limited to 20 with an overall cable distance of no more than 1200m. In theory, the number of meters and the maximum distance that a Modbus network can handle is more, but due to the environment in which the meters are located (switch rooms and sub-stations) the design shall be conservative. Where the requirement for Modbus connections is greater than 20, then additional ETGs shall be used. An installer may propose an alternative connection method to the Energy Manager for approval before installation commences.

Several Modbus networks have been setup at various points around the Campuses, mainly at locations where there are clusters of electricity meters and PLCs. Each electricity meter or PLC must have a unique Modbus address to allow the EMACS to identify the device.

Unless otherwise specified or approved by UNSW, all new PLC’s shall be Schneider Modicon M221 PLC’s having 14 digital inputs and 10 outputs as standard. The part number for the PLC is TM221CE24R (240V supply) which includes an Ethernet port. The PLC will also require a 24VDC power supply. If analogue signals are required to be connected, then an additional analogue input module, part number TM3AI2HG, shall be installed. This module has two analogue inputs. If more inputs are required then Schneider can supply alternative modules with up to 8 inputs.

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 Energy Management.

Each EMACS PLC has a standard software structure that is normally copied from one to the next and amended to suit the particular circumstances. Generally the code consists of 2 cascading counters for each PLC digital input and in turn each counter is copied to a memory word that corresponds to the Modbus register that EMACS reads. There are some variations on this:

- If there is an analogue input module installed, e.g. for water pressure then the hardware and software needs to reflect this.
- For serially connected PLC's there will be a Modbus address that has to be entered/changed
- For Ethernet connected PLC's there will be a unique IP address to be entered/changed
- Internal documentation normally has the ID number each input is attached to.

A backup of the PLC's software coding shall be made and passed to the Energy Manager in case the PLC needs to be replaced or becomes corrupted.

Each localised Modbus Network is connected to an ETG which is connected to an UNSW LAN port that has been configured for the EMACS VLAN. The LAN port configuration must be carried out by UNSW IT Services department. Each ETG is configured with a unique IP address allocated by UNSW Energy Management.

Each new communication network shall have a Block Diagram drawing showing the communication paths as shown in section 7.21 below.

The installer or contractor shall issue a communications connection plan to the UNSW Energy Manager during the design process and gain approval before construction proceeds.

Where protection relays (Sepam) are used for the High Voltage Protection System within a substation, then a connection to EMACS shall be designed using the RS485 interface unit (ACE949-2). In this way, not only is metering information at each high voltage switch available for Energy Management, but also the status of the protection can be interrogated for planning and maintenance purposes. The preference is to incorporate any of the metering (Sepams, ION7650s, PM5350s, etc.) within this substation via the RS485 Modbus RTU network and then wired to a Gateway. By doing this, only one EPR isolation device is required (via a length of fibre optic cable) to connect to the UNSW LAN.

A7.5 ELECTRICITY 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 situation, e.g. at Substations, Buildings, Switch Boards, and individual loads when required. Additionally, HV protection relays (Sepams) in Substations are connected to EMACS in order to monitor their status and get important information in case of trip events.

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 Monitoring	Type of Monitoring	Manufacturer – Model	Part No.
Type 1a – e.g. HV feeds, substations	Power quality, transients, and energy	• Schneider – ION9000 • Schneider – PM5560	• METSEION9240 • METSEPM5560
Type 1b – e.g. HV protections	Protection Systems	• SEPAM 1000 series 40	• S10MD XXX JXXX XNT
Type 2 – e.g. building totals	Energy with detailed harmonics	• Schneider – PM5310	• METSEPM5310
Type 3 - building sub-levels or Mech. Services.	Energy with harmonics	• Schneider – PM5110 • Schneider – iEM3200	• METSEPM5110 • iEM3250/3255
Type 4 – tenants	Revenue	• Schneider – PM3250 • Schneider – PM750 • Schneider – EM1350	• PM3250/3255 • PM750MG • EM1350

Type 1a metering requires a dedicated power quality meter with logging and alarm capabilities for the purposes of monitoring and reporting power disturbances along with the standard meter functions of phase currents, voltages, power, etc. PM5560 meters shall be used as main meters in substations along with Sepam protection relays (see section E3.4.6 Protection System), when measurement of the current on neutral is required, and when detailed power quality monitoring is required. ION9000 meters shall be used on the HV feeders at a campus level. NB the parameters and CT class need to match the Meter class and be taken into account for the power quality analysis.

Type 2 shall be preferably the PM5310, while for Type 3 meters the PM5110 should be used. The iEM3250 is also acceptable as a Type 3 when only energy information is required (i.e. not in Mechanical Boards). The advantage of the PM5310 is that it is supplied with four pulse inputs for connecting a limited number of adjacent water or gas meters.

Type 4 meters shall be the PM3250 (or PM3255 when pulse inputs are required, both grandfathered), the PM750MG (grandfathered), or the EM1350 (pattern approved), as they can be used for tenant billing purposes.

Loads that may be required to be metered for energy monitoring purposes are as follows:

i. The low voltage feed from each HV Transformer;
ii. Total building supply;
iii. Building total light and power load;
iv. Building total mechanical services load, both essential and non-essential;
v. Large services such as risers;
vi. Individual Chillers above 500kWr capacity, shall be metered separately for the purposes of calculating their efficiency;
vii. Sections of building that are used for tenant billing;
viii. Areas of a building that have been identified by UNSW as having high energy use; and
ix. Metering as may be required by other legislative codes of practice.

Installation and Configuration of Meters

All meter types shall be installed in accordance with AS 62053.22-2005 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 the Modbus TRU network protocol.

In new projects all DPMs should be installed in a dedicated metering section of the corresponding board. This facilitates troubleshooting and the manual reading of the DPMs.

Meters shall monitor either single or three phase loads as appropriate and shall display and communicate (for each phase and in total) the following parameters:

Phase and Line Voltage (V_{L-N}, V_{L-L})	Accuracy 0.5% of reading
Current (A)	Accuracy 0.5% of reading
Current on Neutral (A)	Accuracy 0.5% of reading PM5560, PM7650
Frequency (HZ)	Accuracy 0.1% of reading
Power (W, VA and VAr)	Accuracy 1.0% of reading
Power Factor (lead/lag)	Accuracy 1.0% of reading
Energy (kWhr)	Accuracy 1.0% of reading
Demand (max/min kVA)	Accuracy 1.0% of reading
THD current and voltage (L-L and L-N)	PM5110, PM5310, PM5560, PM7650
THD and Individual Harmonics, current and voltage (L-L and L-N)	For PM5110, PM5310, PM5560, PM7650

In the case of the Type 1 and 2 meters, the following Demand Calculation parameters are also required to be configured in the meter:

1. Demand Calculation Type: Not-configurable. Both Sliding Window and Thermal Exponential Calculations are available. The EMACS uses the Sliding Window Calculation.
2. Demand Sub-Period: Configurable. Set to 3 minutes.
3. No of Demand Sub-Periods: Configurable. Set to 5.

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 located in a viewable location so that 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.

Preferably, all DPM's shall be mounted in a separate metering panel within a reasonable distance from any Main Switchboard (MSB) to satisfy acceptable burdens. If this is not possible and meters are mounted in the MSB, they shall be located in their own separate compartment that is shrouded from any exposed live equipment, and protected to IP2x rating. 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 MSB) shall be 300mm and 1800mm above floor level with a minimum of clearance of 500mm in front of the meter to any other equipment, wall or other obstruction.

Each DPM shall be powered from an auxiliary 240VAC 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. Where a number of DPM's are fed from the same section of busbar, (therefore they probably have the same potential levels) 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 NSX breaker range for the metering rather than the individual circuit breaker, meter, CT's & potentials.

A checklist 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 A7.11 below.

A7.6 OTHER ELCTRICAL DEVICES

In addition to electricity meters the university also installs protection devices on main switchboards. It is required that these devices are also connected to the EMACS network so that their settings, measurements and alarms may be remotely accessed.

The method for connecting the device to the EMACS system will depend upon the model installed and reference shall be made to the manufacturer's installation manual for details of how the device is to be connected.

A7.7 POTABLE AND BORE WATER METERS

The University uses “pulse” water meters of several types to monitor the potable and bore water consumption throughout the University’s campuses at Campus, Building, Tenants, and Individual loads when required.

Total potable and bore water consumption shall be metered in all buildings. Sub-meters shall be installed on significant plant and equipment. Sub-metering to major plant is also important where noting changes in water consumption assists performance appraisal, leak detection and malfunctions (e.g. in toilet blocks). Examples of where metering may be required are: cooling towers, laboratory non-potable water, reverse osmosis systems, irrigation, toilet flushing supplies and pure water treatment plants.

The preferred meters are as supplied by the Elster Metering Pty. Ltd. with a pulse attachment suitable for connection to the UNSW EMACS. As a guide, a pulse quantity of 10L/pulse shall be used for Sub-metering, and 100L/pulse ($0.1m^3$/pulse) for building gate meters and campus mains.

There are two methods used to connect a pulse meter signal to EMACS:
1. PLC Digital Input – there are currently over 30 PLC’s installed around the campus, which can accommodate up to 14 inputs each.
2. Electricity Meter with Pulse Inputs – there are a number of electricity meters (Schneider PM5350) around campus that have pulse input capabilities.

A 2 pair twisted cable shall be run from the PLC 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 meters are 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 or electricity meter is more than 30m away then a new PLC shall be installed. This PLC can be connected to EMACS either through an existing RS485 network or via a PLC Ethernet Adapter Module cabled to a nearby VLAN11 port.

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 week. The difference in the meter reading should correlate to the amount shown on EMACS. This will be used to determine the actual quantity per pulse to be used on EMACS. A checklist 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 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, where special circumstances arise that make it difficult to install a diaphragm meter then an alternative meter type can be proposed to the Energy Manager for approval.

Each building shall be provided with a pulse type gas meter suitable for connection to UNSW EMACS system. Sub-meters 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 possible 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 usage. Typical values are 0.01 m^3/ pulse, 0.1 m^3/ pulse, and 1 m^3/ pulse.

The preferred gas meters to be used are the Ampy Email meters. The gas flow model relationship is as follows:

Model 750 – up to 7.5m^3 / hour

AL 425 – up to 12m^3 / hour

AL 800 – 0.1 to 22m^3 / hour

AL 1000 – 0.1 to 28m^3 / hour

AL 1400 – 0.1 to 40m^3 / hour

Where a medium pressure supply (100kPa) 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 EMACS, 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 for the water meters, there are two methods used to connect a pulse attachment to EMACS:

1. PLC Digital Input – there are currently over 30 PLC's installed around the campus, which can accommodate up to 14 inputs each.
2. Electricity Meter with Pulse Inputs – there are a number of electricity meters (Schneider PM5350) around campus that have pulse input capabilities.

Due to capacitance build up on long cable runs that affect the pulse attachment, if the nearest PLC or electricity meter is more than 30m away then a new PLC shall be installed. This PLC can be connected to EMACS either through an existing RS485 network or via a PLC Ethernet Adapter Module cabled to a nearby VLAN11 port.

Gas meters shall be fitted with automatic temperature and pressure correction equipment. Where this is considered to be uneconomic for the particular installation, then approval shall be sought from the Energy 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 representatives or consultants. This would involve 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

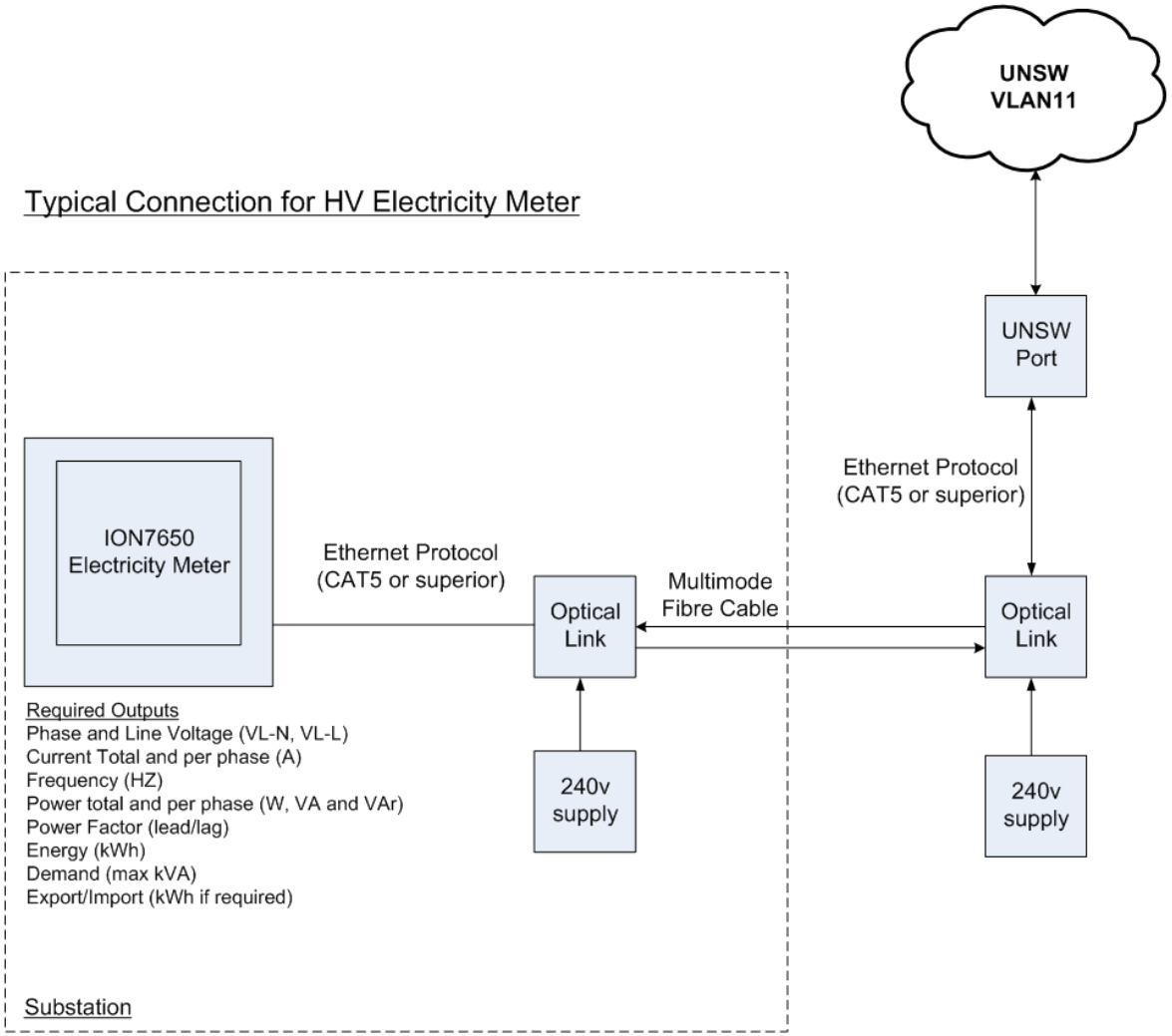
The pulse quantity signals shall be verified by taking a manual reading of the gas meter and then re-checking it after sufficient gas has passed through the meter, e.g. after one week. The difference in the meter reading should correlate to the amount shown on EMACS. This should inform the actual quantity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

A checklist 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

(Next Page)

Typical Connection for HV Electricity Meter



General Notes

- Optical Link and fibre cable to be installed according to UNSW IT Network specifications.

- ION7650 can be specified to be supplied fitted with an optical link to which the Multimode Fibre Cable can be connected

- UNSW ports to be patched to VLAN 11, FM Energy Management to assign IP address.

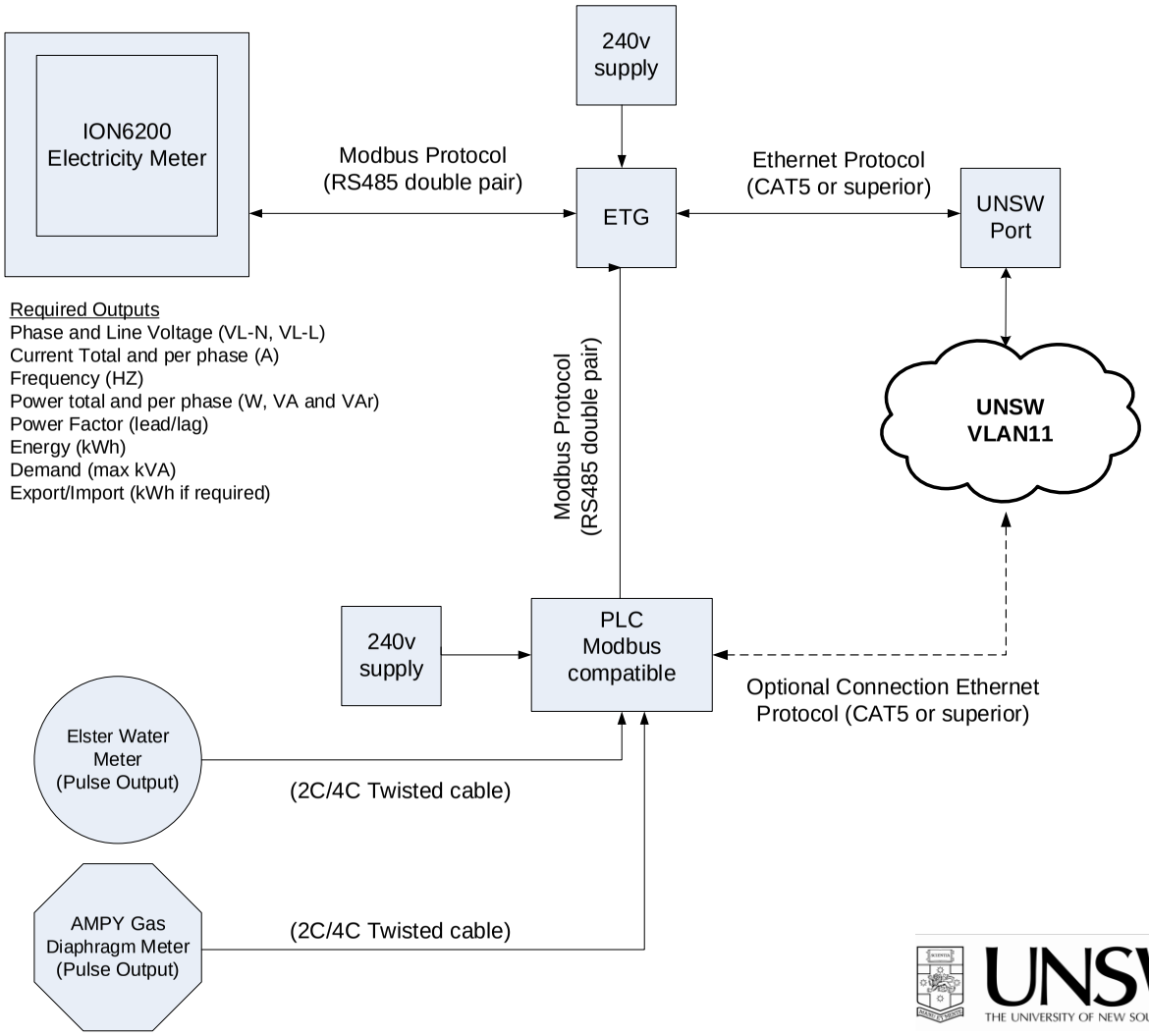
- In case that electricity meters are connected to generation plants (Cogen, Trigen, PV, etc.) and building loads, the export and import registers should be correctly configured.

- 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: October 2012	Title: Typical HV Meter Connection Schematic	
Drawn: JB/LG	Approved: NJ		
Discipline: Energy	Scale:		Sheet No: 2 OF 2
Section: ENERGY MANAGEMENT UNIT	CAD Reference: Typical Meter Connections v2.vsd	Drawing No: EU-MG-001	Revision: 2

Typical Connection for Gate Meters and Sub-Meters



General Notes

- ETG stands for Ethernet Getaway. ETG model TSXETG100 preferred.

- PLC stands for Programmable Logic Controller. TWIDO Compact PLC preferred.

- Electricity Meter ION6200 to have Part Number "ION6200-A0A0B0A0B0R"

- UNSW ports to be patched to VLAN 11, FM Energy Management to assign IP address.

- Meter Types, PLC, ETG and connection arrangements to be approved by FM Energy Management before installation.

- In case that electricity meters are connected to generation plants (Cogen, Trigen, PV, etc.) and building loads, the export and import registers should be correctly configured.

- Some electricity meters and PLCs, can be connected directly to UNSW LAN using ethernet cable. In this case the ETG is not required.

- 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.

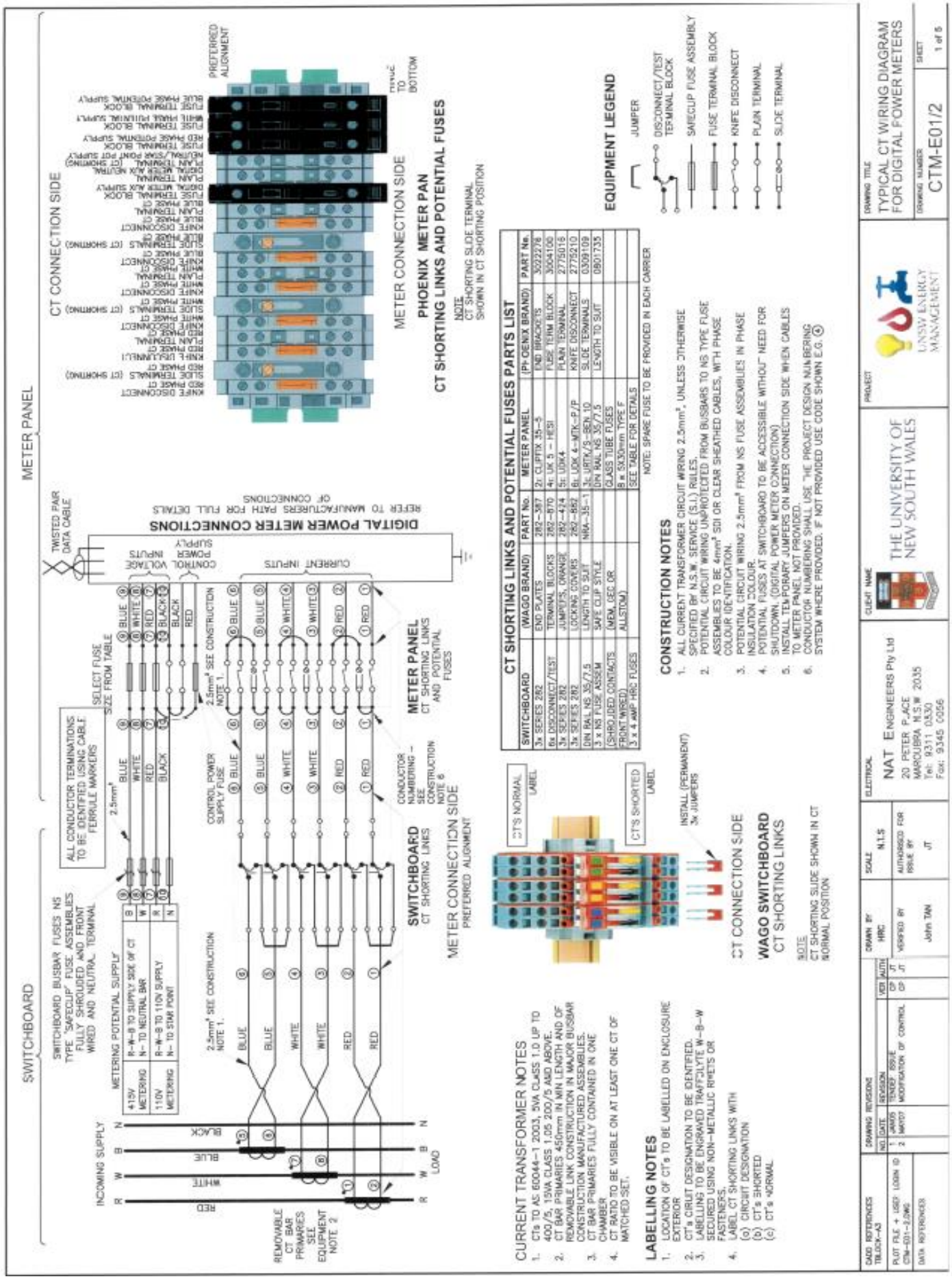
- For more details refer to UNSW metering D&C guidelines "DESIGN AND CONSTRUCTION REQUIREMENTS INSTALLATION OF GAS, ELECTRICITY AND WATER METERS".

UNSW THE UNIVERSITY OF NEW SOUTH WALES

Created: Sep 2012	Modified: October 2012	Title: Typical Gate Meter or Sub-Meter Connection Schematic	
Drawn: JB/LG	Approved: NJ		
Discipline: Energy	Scale:		Sheet No: 1 OF 2
Section: ENERGY MANAGEMENT UNIT	CAD Reference: Typical Meter Connections v2.vsd	Drawing No: EU-MG-001	Revision: 2

A7.10 TYPICAL ELECTRICITY METER WIRING DIAGRAM

(Next Page)


METER PANEL
SWITCHBOARD
SWITCHBOARD BUSBAR FUSES NS TYPE 'SAFECLIP' FUSE ASSEMBLIES FULLY SHROUDED AND FRONT WIRED AND NEUTRAL TERMINAL
ALL CONDUCTOR TERMINATIONS TO BE IDENTIFIED USING CABLE FERRULE MARKERS
SELECT FUSE SIZE FROM TABLE
METERING POTENTIAL SUPPLY
415V METERING
110V METERING
R–W–B TO SUPPLY SIDE OF CT
N– TO NEUTRAL BAR
R–W–B TO 110V SUPPLY
N– TO STAR POINT
INCOMING SUPPLY
LOAD
REMOVABLE CT BAR PRIMARIES SEE EQUIPMENT NOTE 2
2.5mm² SEE CONSTRUCTION NOTE 1.
CONTROL POWER SUPPLY FUSE
CONDUCTOR NUMBERING – SEE CONSTRUCTION NOTE 6
METER PANEL
CT SHORTING LINKS AND POTENTIAL FUSES
METER CONNECTION SIDE
PREFERRED ALIGNMENT
SWITCHBOARD
CT SHORTING LINKS
CONTROL VOLTAGE INPUTS
POWER SUPPLY
CURRENT INPUTS
TWISTED PAIR DATA CABLE
DIGITAL POWER METER CONNECTIONS
REFER TO MANUFACTURERS PATH FOR FULL DETAILS OF CONNECTIONS
CT CONNECTION SIDE
METER CONNECTION SIDE
PHOENIX METER PAN
CT SHORTING LINKS AND POTENTIAL FUSES
NOTE
CT SHORTING SLIDE TERMINAL SHOWN IN CT SHORTING POSITION
CT'S NORMAL LABEL
CT'S SHORTED LABEL
INSTALL (PERMANENT) 3x JUMPERS
CT CONNECTION SIDE
WAGO SWITCHBOARD
CT SHORTING LINKS
NOTE
CT SHORTING SLIDE SHOWN IN CT NORMAL POSITION
CT SHORTING LINKS AND POTENTIAL FUSES PARTS LIST
SWITCHBOARD | (WAGO BRAND) | PART No. | METER PANEL | (PHOENIX BRAND) | PART No.
3x SERIES 282 | END PLATES | 282–307 | 2x CLIPFIX 35–5 | END BRACKETS | 3022276
6x DISCONNECT/TEST | TERMINAL BLOCKS | 282–870 | 4x UK 5 – HESI | FUSE TERM BLOCK | 3004100
3x SERIES 282 | JUMPERS, ORANGE | 282–434 | 5x UDK4 | PLAIN TERMINAL | 2775015
3x SERIES 282 | LOCKING COVERS | 282–862 | 8x UDK 4–MTK–P/P | KNIFE DISCONNECT | 2775210
DIN RAIL NS 35/7.5 | LENGTH TO SUIT | NHA–35–1 | 3x URTK/S–BEN 10 | SLIDE TERMINALS | 0309109
3 x NS FUSE ASSEM | SAFE CLIP STYLE | | DIN RAIL NS 35/7.5 | LENGTH TO SUIT | 0801735
(SHROUDED CONTACTS FRONT WIRED) | (NEW, OEC OR AUSTOM) | | GLASS TUBE FUSES | | |
3 x 4 AMP HRC FUSES | | | 8 x 5X30mm TYPE F | | |
NOTE: SPARE FUSE TO BE PROVIDED IN EACH CARRIER
CONSTRUCTION NOTES
1. ALL CURRENT TRANSFORMER CIRCUIT WIRING 2.5mm², UNLESS OTHERWISE SPECIFIED BY N.S.W. SERVICE (S.I.) RULES.
2. POTENTIAL CIRCUIT WIRING UNPROTECTED FROM BUSBARS TO NS TYPE FUSE ASSEMBLIES TO BE 4mm² SDI OR CLEAR SHEATHED CABLES, WITH PHASE COLOUR IDENTIFICATION.
3. POTENTIAL CIRCUIT WIRING 2.5mm² FROM NS FUSE ASSEMBLIES IN PHASE INSULATION COLOUR.
4. POTENTIAL FUSES AT SWITCHBOARD TO BE ACCESSIBLE WITHOUT NEED FOR SHUTDOWN. (DIGITAL POWER METER CONNECTION)
5. INSTALL TEMPORARY JUMPERS ON METER CONNECTION SIDE WHEN CABLES TO METER PANEL NOT PROVIDED.
6. CONDUCTOR NUMBERING SHALL USE THE PROJECT DESIGN NUMBERING SYSTEM WHERE PROVIDED. IF NOT PROVIDED USE CODE SHOWN E.G. ⑥
EQUIPMENT LEGEND
JUMPER
DISCONNECT/TEST TERMINAL BLOCK
SAFECLIP FUSE ASSEMBLY
FUSE TERMINAL BLOCK
KNIFE DISCONNECT
PLAIN TERMINAL
SLIDE TERMINAL
CURRENT TRANSFORMER NOTES
1. CTs TO AS 60044–1 2003, 5VA CLASS 1.0 UP TO 400/5, 15VA CLASS 1.05 200/5 AND ABOVE.
2. CT BAR PRIMARIES 450mm IN MIN LENGTH AND OF REMOVABLE LINK CONSTRUCTION IN MAJOR BUSBAR CONSTRUCTION MANUFACTURED ASSEMBLIES.
3. CT BAR PRIMARIES FULLY CONTAINED IN ONE CHAMBER
4. CT RATIO TO BE VISIBLE ON AT LEAST ONE CT OF MATCHED SET.
LABELLING NOTES
1. LOCATION OF CT's TO BE LABELLED ON ENCLOSURE EXTERIOR
2. CT's CIRUIT DESIGNATION TO BE IDENTIFIED.
3. LABELLING TO BE ENGRAVED TRAFFOLYTE W–B–W SECURED USING NON–METALLIC RIVETS OR FASTENERS.
4. LABEL CT SHORTING LINKS WITH
(a) CIRCUIT DESIGNATION
(b) CT's SHORTED
(c) CT's NORMAL
CADD REFERENCES TBLOCK–A3
PLOT FILE + USER LOGIN ID CTM–E01–3.DWG
DATA REFERENCES
DRAWING REVISIONS
NO | DATE | REVISION | VER | AUTH
1 | 28/05/09 | ISSUED FOR CONSTRUCTION | DP | JT
2 | 16/07/07 | MODIFICATION OF CONTROL | DP | JT
DRAWN BY HRC
VERIFIED BY John TAN
SCALE N.T.S
AUTHORISED FOR ISSUE BY JT
ELECTRICAL
NAT ENGINEERS Pty Ltd
20 PETER PACE MARQUBRA N.S.W 2035
Tel: 9311 0830
Fax: 9345 0056
CLIENT NAME
THE UNIVERSITY OF NEW SOUTH WALES
UNSW ENERGY MANAGEMENT
PROJECT
DRAWING TITLE
TYPICAL CT WIRING DIAGRAM FOR DIGITAL POWER METERS
DRAWING NUMBER
CTM-E01/2
SHEET
1 of 5

A7.11 ELECTRICITY METER INSTALLATION CHECKLIST

UNSW ENERGY MANAGEMENT

E L E C T R I C I T Y
Meter Checklist

Meter ID

Please return completed sheet to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

Electricity Meter:		**Location:**	
Installing Company:			**Date:**

The following is a checklist to cover the majority of what needs to be considered or taken into account when installing a Digital Power Meter (DPM) and connecting it to the Energy Management System (EMACS). It is not intended to be all encompassing as every scenario will be different.

Put an X in the check box when the checklist item has been addressed and add a comment where required.

Checklist Item	Pass	N/A	Comment
Have the hazards and potential risks of the installation been identified (SWMS)?	❑	❑	
Does this meter satisfy one of the criteria of being either a major supply to the Campus, a building total or a significant building load?	❑	❑	
Has the Meter Data Form been filled in and approval given to proceed by the UNSW Energy Manager? **NB** This is the most important step as without this approval the meter will not be connected to EMACS. It will also give direction on what type of meter to be used.	❑	❑	
Does a shutdown or outage need to be organised to install the meter?	❑	❑	
Have the CT's been sized according to the load and required burden?	❑	❑	
Has the best location for the CT's, potential fuses, links and terminals been determined?	❑	❑	
Can the meter be installed on the MSB/DB/MSSB or does it require a new panel or can it be mounted in an existing meter panel?	❑	❑	
Where is the best location for CT shorting links? **NB** Shorting links maybe required in both the MSB and metering panel to ensure the CTs are never left open circuited under load, especially if cabling or a meter cannot be installed straight away.	❑	❑	

Has the method of connection to the network been determined? Can it be connected to any existing RS485 chain or is a new ETG required?	❑	❑	
If a new ETG is required contact the Energy Management Team to determine the best location. Does a new data port need to be installed?	❑	❑	
Is the installation phase complete, i.e. meter, CTs, potentials, terminals, CT shorting links, comms, wire numbers, etc?	❑	❑	
Has the meter been configured, i.e. with CT ratios, Modbus address and the energy value reset?	❑	❑	
Commissioning – has the commissioning Validation Check Sheet been completed and EMACS can read the meter?	❑	❑	
Has an ID number been returned by the Energy Management Representative to enable labels to be made?	❑	❑	
Have all of the required labels been installed?	❑	❑	
Documentation - has the Meter Data Form been completed and handed over to the Energy Manager/ Energy Management Representative?	❑	❑	
Documentation - have the Metering Schematics been updated to reflect the new meter as per the procedure?	❑	❑	
Documentation - have photos of the completed installation been taken and forwarded onto the Energy Management Representative?	❑	❑	
Documentation – has this checklist and attached procedures been completed, signed off and forwarded onto Energy Manager/ Energy Management Representative?	❑	❑	

Signed	Company
Observer	Date

A7.12 WATER METER INSTALLATION CHECKLIST

UNSW ENERGY MANAGEMENT

W A T E R
Meter Checklist

Meter ID

Please return completed sheet to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

Water Meter:		**Location:**	
Installing Company:			**Date:**

The following is a checklist to cover the majority of what needs to be considered or taken into account when installing a water meter and connecting it to the Energy Management System (EMACS). It is not intended to be all encompassing as every scenario will be different.

Put an X in the check box when the checklist item has been addressed and add a comment where required.

Checklist Item	Pass	N/A	Comment
Have the hazards and potential risks of the installation been identified (SWMS)?	❑	❑	
Has the Meter Data Form been filled in and approval given to proceed by the UNSW Energy Manager? **NB** This is the most important step as without this approval the meter will not be connected to EMACS. It will also give direction on what type of meter to be used.	❑	❑	
Does a shutdown or outage need to be organised to install the meter?	❑	❑	
Have the CT's been sized according to the load and required burden?	❑	❑	
Has the best location for the CT's, potential fuses, links and terminals been determined?	❑	❑	
Can the meter be installed on the MSB/DB/MSSB or does it require a new panel or can it be mounted in an existing meter panel?	❑	❑	
Where is the best location for CT shorting links? **NB** Shorting links maybe required in both the MSB and metering panel to ensure the CTs are never left open circuited under load, especially if cabling or a meter cannot be installed straight away.	❑	❑	
Has the method of connection to the network been determined? Can it be connected to any existing RS485 chain or is a new ETG required?	❑	❑	

If a new ETG is required contact the Energy Management Team to determine the best location. Does a new data port need to be installed?	❑	❑	
Is the installation phase complete, i.e. meter, CTs, potentials, terminals, CT shorting links, comms, wire numbers, etc?	❑	❑	
Has the meter been configured, i.e. with CT ratios, Modbus address and the energy value reset?	❑	❑	
Commissioning – has the commissioning Validation Check Sheet been completed and EMACS can read the meter?	❑	❑	
Has an ID number been returned by Energy Management Representative to enable labels to be made?	❑	❑	
Have all of the required labels been installed?	❑	❑	
Documentation - has the Meter Data Form been completed and handed over to the Energy Manager/ Energy Management Representative?	❑	❑	
Documentation - have the Metering Schematics been updated to reflect the new meter as per the procedure below?	❑	❑	
Documentation - have photos of the completed installation been taken and forwarded onto Energy Management Representative?	❑	❑	
Documentation – has this checklist and attached procedures been completed, signed off and forwarded onto Energy Manager/ Energy Management Representative?	❑	❑	

Signed	Company
Observer	Date

A7.13 GAS METER INSTALLATION CHECKLIST

UNSW ENERGY MANAGEMENT

G A S
Meter Checklist

Meter ID

Please return completed sheet to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

Gas Meter:		**Location:**	
Installing Company:			**Date:**

The following is a checklist to cover the majority of what needs to be considered or taken into account when installing a gas meter and connecting it to the Energy Management System (EMACS). It is not intended to be all encompassing as every scenario will be different.

Put an X in the check box when the checklist item has been addressed and add a comment where required.

Checklist Item	Pass	N/A	Comment
Have the hazards and potential risks of the installation been identified (SWMS)?	❑	❑	
Has the Meter Data Form been filled in and approval given to proceed by the UNSW Energy Manager? **NB** This is the most important step as without this approval the meter will not be connected to EMACS. It will also give direction on what type of meter to be used.	❑	❑	
Does a shutdown or outage need to be organised to install the meter?	❑	❑	
Have the CT's been sized according to the load and required burden?	❑	❑	
Has the best location for the CT's, potential fuses, links and terminals been determined?	❑	❑	
Can the meter be installed on the MSB/DB/MSSB or does it require a new panel or can it be mounted in an existing meter panel?	❑	❑	
Where is the best location for CT shorting links? **NB** Shorting links maybe required in both the MSB and metering panel to ensure the CTs are never left open circuited under load, especially if cabling or a meter cannot be installed straight away.	❑	❑	
Has the method of connection to the network been determined? Can it be connected to any existing RS485 chain or is a new ETG required?	❑	❑	

If a new ETG is required contact the Energy Management Team to determine the best location. Does a new data port need to be installed?	❑	❑	
Is the installation phase complete, i.e. meter, CTs, potentials, terminals, CT shorting links, comms, wire numbers, etc?	❑	❑	
Has the meter been configured, i.e. with CT ratios, Modbus address and the energy value reset?	❑	❑	
Commissioning – has the commissioning Validation Check Sheet been completed and EMACS can read the meter?	❑	❑	
Has an ID number been returned by Energy Management Representative to enable labels to be made?	❑	❑	
Have all of the required labels been installed?	❑	❑	
Documentation - has the Meter Data Form been completed and handed over to the Energy Manager/ Energy Management Representative?	❑	❑	
Documentation - have the Metering Schematics been updated to reflect the new meter as per the procedure below?	❑	❑	
Documentation - have photos of the completed installation been taken and forwarded onto Energy Management Representative?	❑	❑	
Documentation – has this checklist and attached procedures been completed, signed off and forwarded onto Energy Manager/ Energy Management Representative?	❑	❑	

Signed	Company
Observer	Date

A7.14 ELECTRICITY METER VALIDATION SHEET

UNSW ENERGY MANAGEMENT

E L E C T R I C I T Y
Meter Validation Sheet

Meter ID

Please return completed sheet to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

THIS SHEET IS TO BE USED AS A VALIDATION CHECK FOR EACH ELECTRICITY METER THAT IT'S METERING DATA VERIFIES WITH THAT AS SHOWN ON EMACS SOFTWARE

METER INFORMATION

LOCATION OF METER	
LOAD DESCRIPTION ON METER	
LABELLING AT BOARD	

METER BRAND		TYPE	
SERIAL No		ADDRESS	
GATEWAY IP			

OBSERVATION OF METER INSTALLATION

CT RATIO	
CT MANUFACTURER (IF KNOWN)	
IF A SUMMATED LOAD, WHAT ARE RATIOS OF LOADS?	
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
IS GENERAL INSTALLATION ACCEPTABLE? (e.g. LUGS, DUCTING, INSULATION, ETC.)	YES / NO

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

Comments……
……

VALIDATION OF METER SUPPLY

Where possible and safe to do so, a portable digital analyser shall be used to validate the configuration of the meter by comparing it's readings with the meter display values.

VALIDATION OF METER POTENTIAL SUPPLY		415 V/240V/110V
METER AUXILIARY SUPPLY FUSE (2Amp)	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

Comments…….

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				
2				
Consumption (difference)				

WORK REQUIRED TO COMPLETE VALIDATION

..……..……

……

FAULTS / REPAIRS ON METERING / SWITCHBOARD

..…….……

……...

Signed	Company
Observer	Date

A7.15 GAS / WATER METER VALIDATION SHEET

UNSW ENERGY MANAGEMENT

GAS / WATER
Meter Validation Sheet

Meter ID

Please return completed sheet to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

THIS SHEET IS TO BE USED AS A VALIDATION CHECK FOR EACH GAS OR WATER METER THAT IT'S METERING DATA VERIFIES WITH THAT AS SHOWN ON EMACS SOFTWARE

METER INFORMATION

GAS OR WATER METER	
LOCATION OF METER	
LOAD DESCRIPTION ON METER	
LABELLING AT METER	

METER BRAND		TYPE	
SERIAL No		INPUT ADDRESS	
ETG IP		PULSE QTY	
GAS PRESSURE MEASURED AT METER (GAS ONLY)			

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
IS GENERAL INSTALLATION ACCEPTABLE? (e.g. LUGS, DUCTING, INSULATION, ETC.)	YES / NO

Comments……
……

VALIDATION OF METER TO INPUT DEVICE

Where pulses are generated by the gas/water meter then the validation that the pulses are being received at the input counting device is straight forward. If not then a magnet can sometimes be used to check at least the cabling.

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

Comments……...

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

Two meter readings are required to validate readings onto EMACS. The time required between readings will depend upon the pulse quantity and flow through the meter.

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

Comments……....

ALL TESTS COMPLETE…. YES / NO

Comments……...…
…….....
…….....

WORK REQUIRED TO COMPLETE VALIDATION

..……..……
……
……

Signed	Company
Observer	Date

A7.16 METER DATA FORMS

This includes:

- Electricity Meter Data Form
- Water Meter Data Form
- Gas Meter Data Form

(Following Pages)

UNSW ENERGY MANAGEMENT

ELECTRICITY
Meter Data Form

Office Use Only
Meter ID

Please return completed form to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

SECTION A. Pre-Installation Meter Details

New Meter (Y/N) | **Load Change (Y/N)** | **Replacement (Y/N)** | **Disconnect (Y/N)**

Manufacturer | **Model**

Building — **Name** | **Grid Ref.** | **Room** | **Floor Location** | **Is meter external to building? Y/N**

Meter Location Description (Please be specific)

Load Description What's connected to the meter? (details)

SECTION B. Communications Details

Meter — **Serial/Ethernet?** | **Modbus Address**

Gateway/Meter — **ID No.** | **Port No.** | **IP Address**

Comments

SECTION C. Post Installation Meter Details

CT Ratio | **Serial No.** | **Meter Reading**

Comments

SECTION D. Installer Details

Name of Installer | **Contact No.** | **Date** / /

Name of Reporter | **Contact No.** | **Date** / /

Office Use — **Approved? Y/N** | **Date** / /

Special Condition(s)

Signature | **TITLE: UNSW ENERGY MANAGER**

EMS Recorder | **Contact No.** | **Date** / /

SECTION E. Completion

Energy Management: Has A Copy Of This Form Been Returned To Installer (Y/N)

Installer: When Meter Has Been Installed - Email energy@unsw.edu.au (Y/N)

UNSW ENERGY MANAGEMENT

WATER
Meter Data Form

Office Use Only
Meter ID

Please return completed form to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

SECTION A. Pre-Installation of Meter Details

New Meter (Y/N) | **Load Change (Y/N)** | **Replacement (Y/N)** | **Disconnect (Y/N)**

Manufacturer | **Water Quality** (potable or bore)

Model | **Meter Bore Size** mm | **Quantity per Pulse** Litres

Building | **Name** | **Grid Ref.** | **Room**

Floor Location | **Is meter external to building? Y/N**

Meter Location Description (Please be specific)

Load Description What's connected to the meter? (details)

SECTION B. Communications Details

PLC/PQM | **ID No.** | **Input No.** | **Location**

Comments

SECTION C. Post Installation Meter Details

Serial No. | **Present Reading**

Comments

SECTION D. Installer Details

Name of Installer | **Contact No.** | **Date** / /

Name of Reporter | **Contact No.** | **Date** / /

Office Use | **Approved? Y/N** | **Date** / /

Special Condition(s)

Signature | **TITLE: UNSW ENERGY MANAGER**

EMS Recorder | **Contact No.** | **Date** / /

SECTION E. Completion

Energy Management: Has A Copy Of This Form Been Returned To Installer (Y/N)

Installer: When Meter Has Been Installed Email *energy@unsw.edu.au* (Y/N)

UNSW ENERGY MANAGEMENT

GAS
Meter Data Form

Office Use Only
Meter ID

Please return completed form to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

SECTION A. Pre-Installation of Meter Details

New Meter (Y/N) | **Load Change (Y/N)** | **Replacement (Y/N)** | **Disconnect (Y/N)**

Manufacturer | **Model**

System Pressure kpa **Quantity per Pulse** m^3 **Meter Bore Size** mm

Building
Name | **Grid Ref.** | **Room**
Floor Location | **Is meter external to building? Y/N**

Meter Location Description (Please be specific)

Load Description What's connected to the meter? (details)

SECTION B. Communications Details

PLC/PQM **ID No.** | **Input No.** | **Location**

Comments

SECTION C. Post Installation Meter Details

Serial No. | **Present Reading**

Comments

SECTION D. Installer Details

Name of Installer | **Contact No.** | **Date** / /

Name of Reporter | **Contact No.** | **Date** / /

Office Use **Approved? Y/N** | **Date** / /

Special Condition(s)

Signature | **TITLE: UNSW ENERGY MANAGER**

EMS Recorder | **Contact No.** | **Date** / /

SECTION E. Completion

Energy Management : Has A Copy Of This Form Been Returned To Installer (Y/N)

Installer: When Meter Has Been Installed - Email *energy@unsw.edu.au* (Y/N)

A7.17 PLC / ETG DATA FORM

(Following Page)

UNSW ENERGY MANAGEMENT

PLC/GATEWAY
Data Form

Office Use Only
Meter ID

Please return completed form to UNSW Energy Manager – Mathews Building Lv3 (Ph: 9385-3401)

SECTION A. Pre-Installation Details

New (Y/N) | **Replacement (Y/N)** | **Disconnect (Y/N)**

Manufacturer | **Model**

Building — **Name** | **Grid Ref.** | **Room**
Floor Location | **Is it external to building? Y/N**

Location Description (Please be specific)

SECTION B. Communications Details

PLC — **Serial/Ethernet?** | **Modbus Address**

Gateway/PLC — **ID No.** | **Port No.** | **IP Address**

Comments

SECTION C. Post Installation Details

Serial No.

Inputs/Comms Chain

0	ID No.:	7	ID No.:
1	ID No.:	8	ID No.:
2	ID No.:	9	ID No.:
3	ID No.:	10	ID No.:
4	ID No.:	11	ID No.:
5	ID No.:	12	ID No.:
6	ID No.:	13	ID No.:

SECTION D. Installer Details

Name of Installer | **Contact No.** | **Date** / /

Name of Reporter | **Contact No.** | **Date** / /

Office Use — **Approved? Y/N** | **Date** / /

Special Condition(s)

Signature | **TITLE: UNSW ENERGY MANAGER**

EMS Recorder | **Contact No.** | **Date** / /

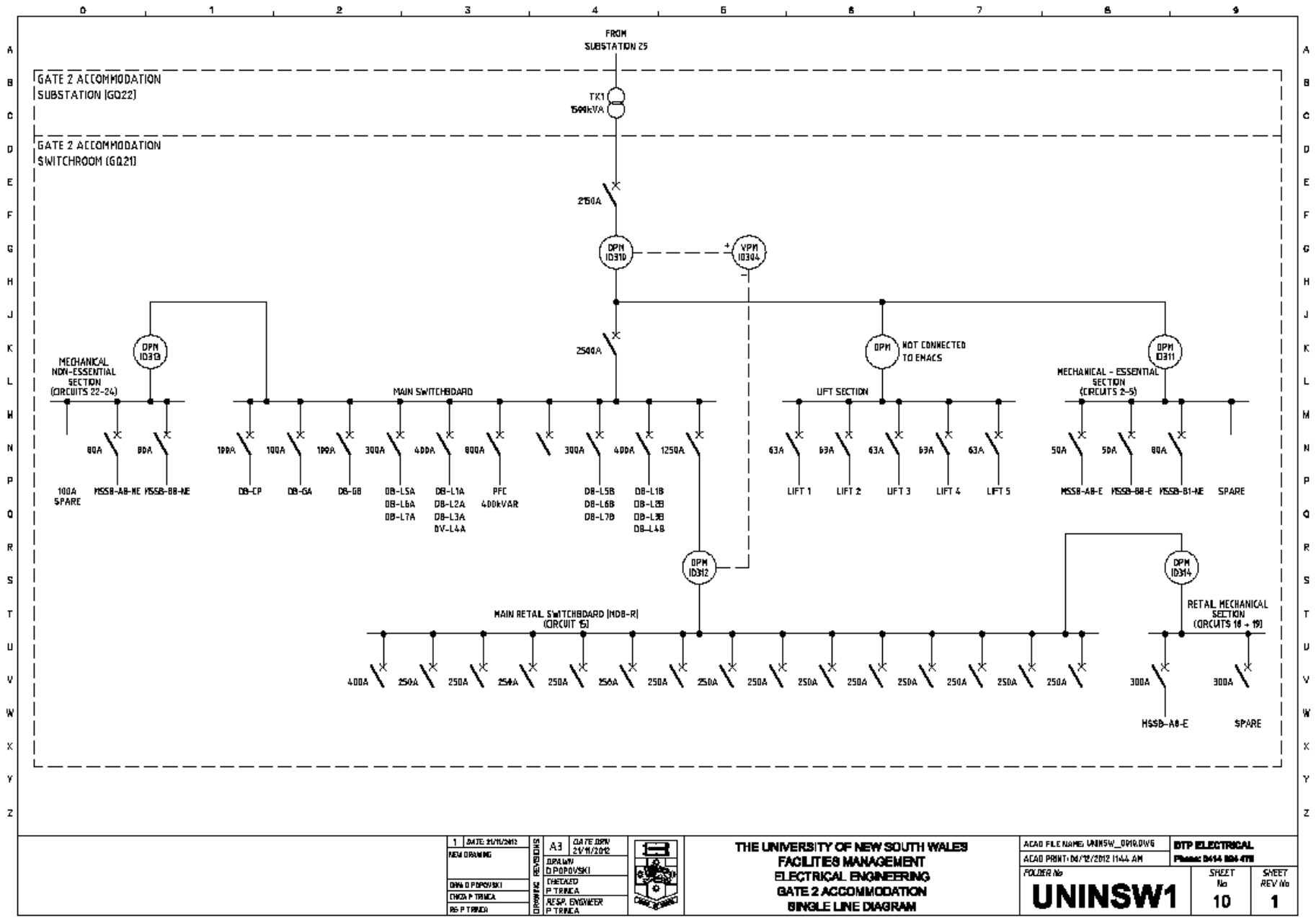
SECTION E. Completion

Energy Management : Has A Copy Of This Form Been Returned To Installer (Y/N)

Installer: When Meter Has Been Installed Email *energy@unsw.edu.au* (Y/N)

A7.18 EXAMPLE OF ELECTRICITY METERING SCHEMATIC

(Following Page)

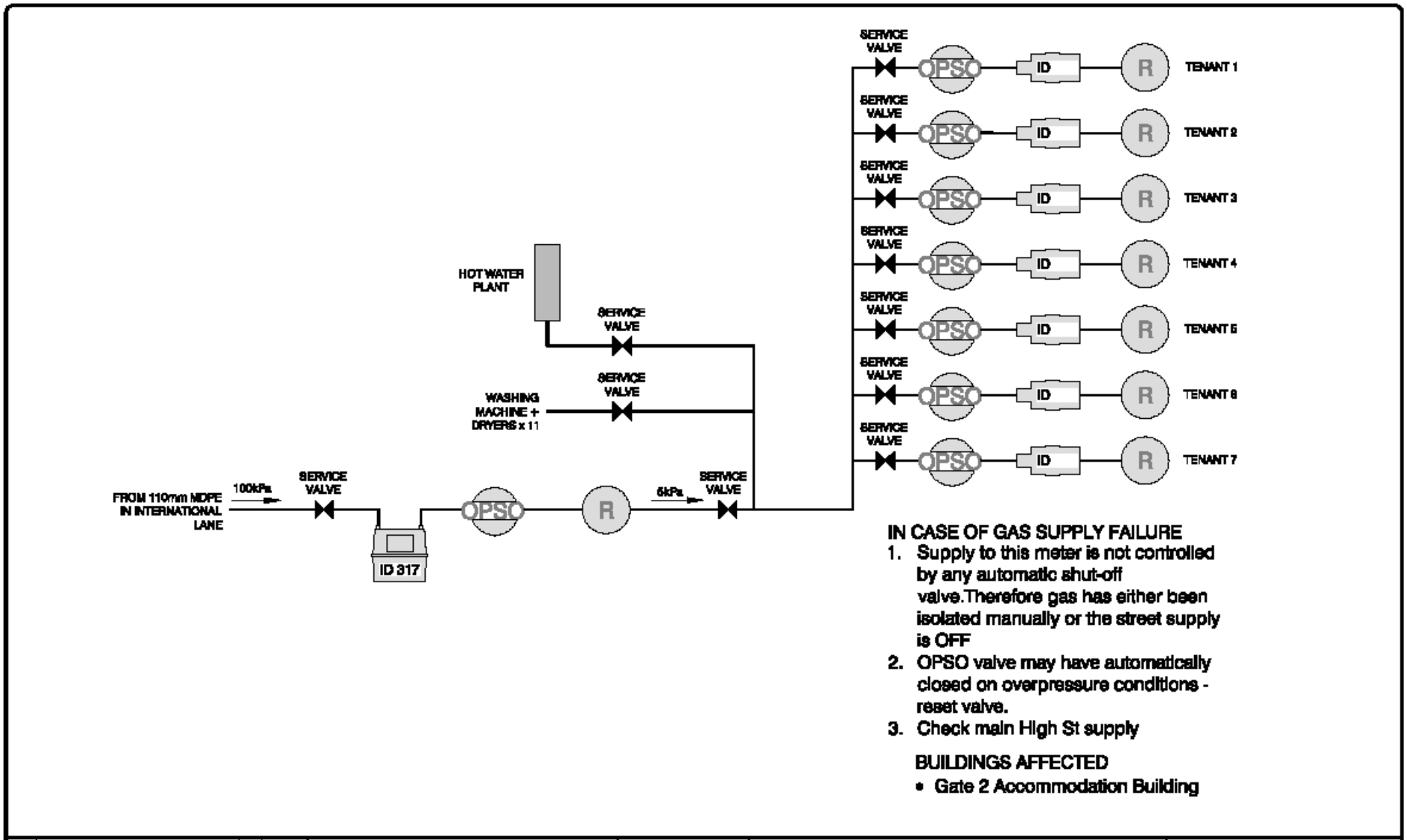


1 DATE: 21/11/2012 NEW DRAWING	A3 DATE: DRN 21/11/2012	ACAD FILE NAME: UNINSW_0010.DWG	DTP ELECTRICAL
DRN D POPOVSKI	DRAWN D POPOVSKI	ACAD PRINT: 04/12/2012 11:44 AM	Phone: 0414 804 478
CHCK P TRINCA	CHECKED P TRINCA	FOLDER No UNINSW1	SHEET No 10
RS P TRINCA	RESP. ENGINEER P TRINCA		SHEET REV No 1

THE UNIVERSITY OF NEW SOUTH WALES
FACILITIES MANAGEMENT
ELECTRICAL ENGINEERING
GATE 2 ACCOMMODATION
SINGLE LINE DIAGRAM

A7.19 EXAMPLE OF GAS METERING SCHEMATIC

(Following Page)



IN CASE OF GAS SUPPLY FAILURE

1. Supply to this meter is not controlled by any automatic shut-off valve.Therefore gas has either been isolated manually or the street supply is OFF
2. OPSO valve may have automatically closed on overpressure conditions - reset valve.
3. Check main High St supply

BUILDINGS AFFECTED

- Gate 2 Accommodation Building

REVISIONS			
No.	Description	By	Date
A	New Drawing	DTP	20.11.12

THE UNIVERSITY OF NEW SOUTH WALES
FACILITIES MANAGEMENT
ENGINEERING

Approved:
Information by:
Drawn: DTP
Date: 20/11/12
Scale: Not to Scale

GAS METER PIPEWORK & EQUIPMENT DIAGRAM

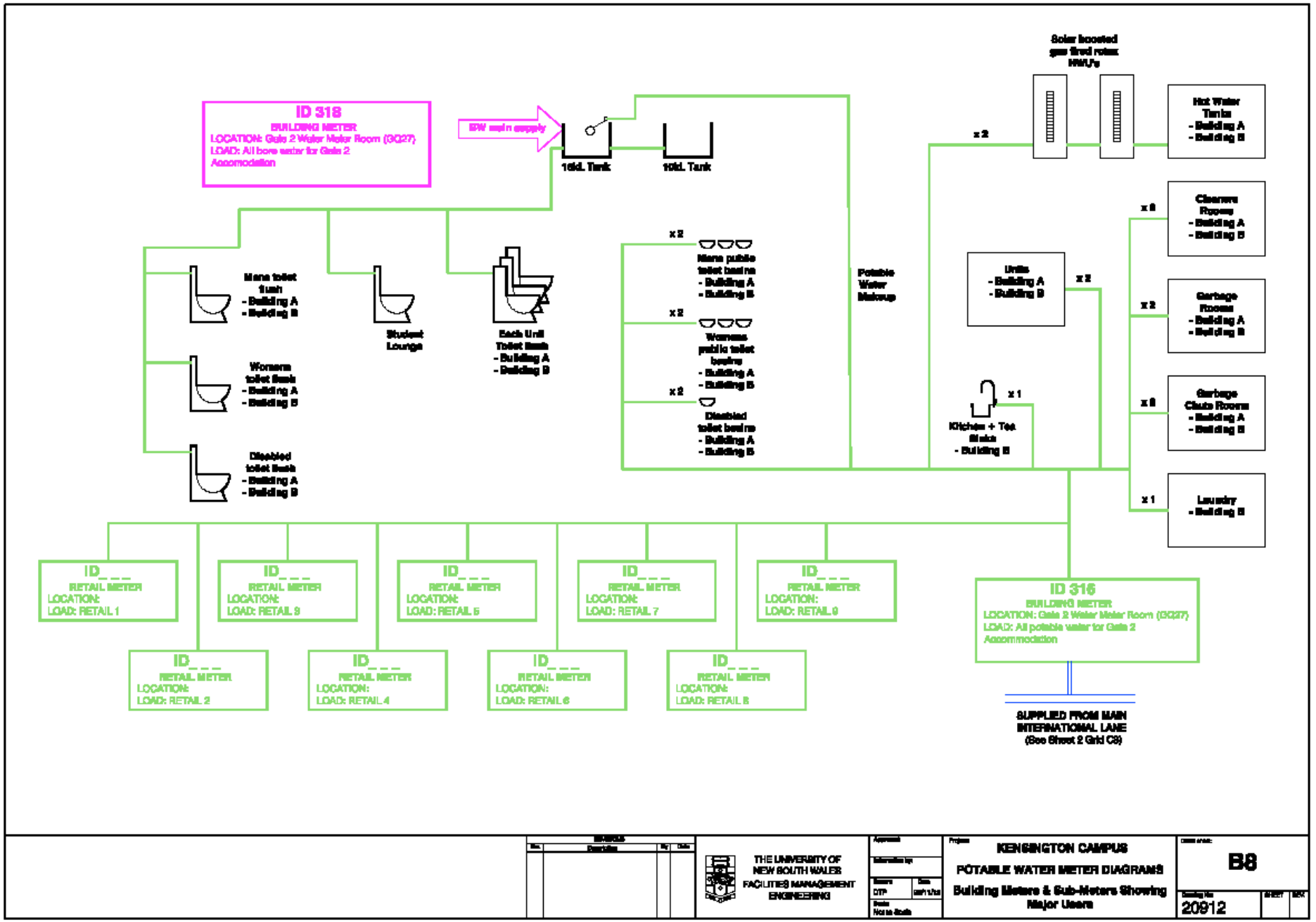
GATE 2 ACCOMMODATION
GAS METER ROOM (GQ6)

METER NUMBER: ID317

DRAWING No | SHEET: 40 | REV.: A

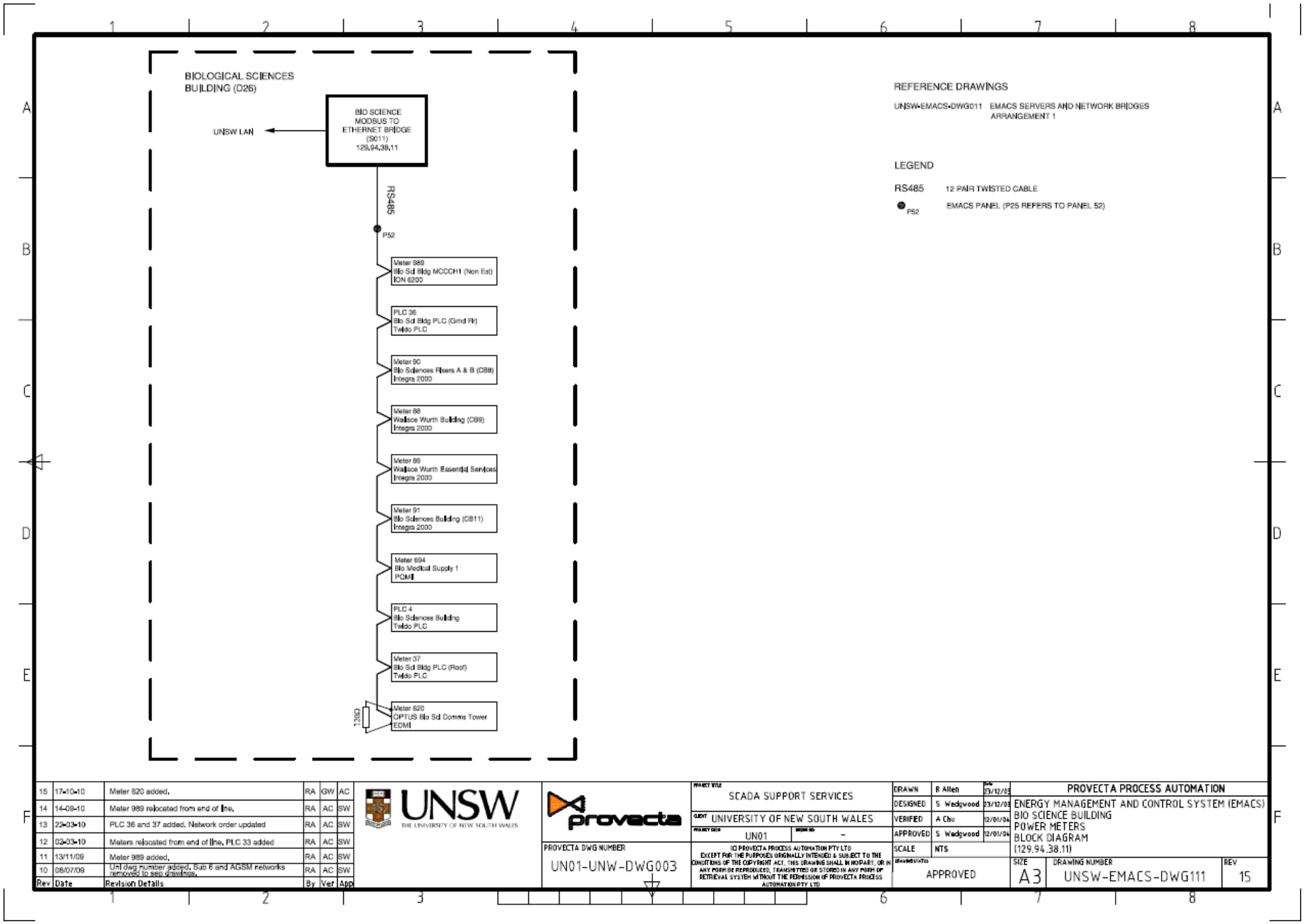
A7.20 EXAMPLE OF WATER METERING SCHEMATIC

(Following Page)


ID 318
BUILDING METER
LOCATION: Gate 2 Water Meter Room (0027)
LOAD: All bore water for Gate 2
Accomodation
BW main supply
16kl. Tank
10kl. Tank
Solar boosted gas fired rotex HWU's
x 2
Hot Water Tanks
- Building A
- Building B
Mens toilet flush
- Building A
- Building B
Womens toilet flush
- Building A
- Building B
Disabled toilet flush
- Building A
- Building B
Student Lounge
Each Unit Toilet flush
- Building A
- Building B
x 2
Mens public toilet basins
- Building A
- Building B
x 2
Womens public toilet basins
- Building A
- Building B
x 2
Disabled toilet basins
- Building A
- Building B
Potable Water Makeup
Units
- Building A
- Building B
x 2
x 1
Kitchen + Tea Sinks
- Building B
x 8
Cleaners Rooms
- Building A
- Building B
x 2
Garbage Rooms
- Building A
- Building B
x 8
Garbage Chute Room
- Building A
- Building B
x 1
Laundry
- Building B
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 1
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 3
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 5
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 7
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 9
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 2
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 4
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 6
ID_ _ _
RETAIL METER
LOCATION:
LOAD: RETAIL 8
ID 316
BUILDING METER
LOCATION: Gate 2 Water Meter Room (0027)
LOAD: All potable water for Gate 2
Accommodation
SUPPLIED FROM MAIN INTERNATIONAL LANE
(See Sheet 2 Grid C8)
THE UNIVERSITY OF NEW SOUTH WALES
FACILITIES MANAGEMENT
ENGINEERING
KENSINGTON CAMPUS
POTABLE WATER METER DIAGRAMS
Building Meters & Sub-Meters Showing Major Users
B8
20912

A7.21 EXAMPLE OF COMMUNICATIONS NETWORK SCHEMATIC

(Following Page)



Rev	Date	Revision Details	By	Ver	App
15	17-10-10	Meter 820 added.	RA	GW	AC
14	14-09-10	Meter 989 relocated from end of line.	RA	AC	SW
13	22-03-10	PLC 36 and 37 added. Network order updated	RA	AC	SW
12	02-03-10	Meters relocated from end of line, PLC 33 added	RA	AC	SW
11	13/11/09	Meter 989 added.	RA	AC	SW
10	08/07/09	Uni dwg number added. Sub 6 and AGSM networks removed to seo drawings.	RA	AC	SW

UNSW THE UNIVERSITY OF NEW SOUTH WALES

provecta

PROVECTA DWG NUMBER: UN01-UNW-DWG003

PROJECT TITLE: SCADA SUPPORT SERVICES
CLIENT: UNIVERSITY OF NEW SOUTH WALES
PROJECT CODE: UN01 WORK NO: -

DRAWN	R Allen	23/12/09
DESIGNED	S Wedgwood	23/12/09
VERIFIED	A Chu	12/01/04
APPROVED	S Wedgwood	12/01/04
SCALE	NTS	
STATUS	APPROVED	

PROVECTA PROCESS AUTOMATION
ENERGY MANAGEMENT AND CONTROL SYSTEM (EMACS)
BIO SCIENCE BUILDING
POWER METERS
BLOCK DIAGRAM
(129.94.38.11)

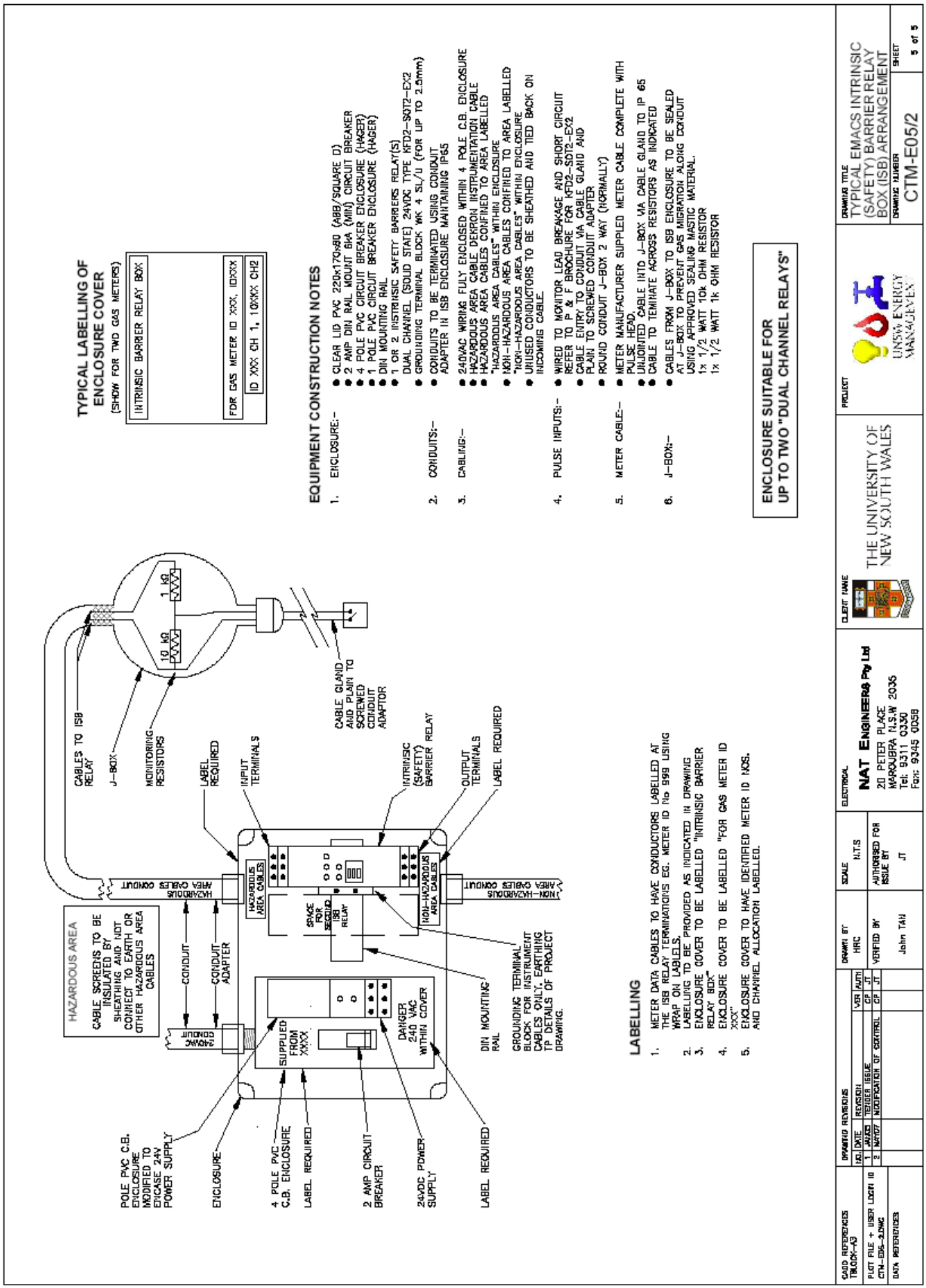
SIZE: A3 | DRAWING NUMBER: UNSW-EMACS-DWG111 | REV: 15

A7.22 PREFERRED EQUIPMENT LIST

SECTION	DESCRIPTION	MANUFACTURER	MODEL
Electricity	Electricity meter - ION7650	Schneider	M7650A0C0B5E0A0E
	Electricity meter – PM5560	Schneider	METSEPM5560
	Electricity meter – PM5310	Schneider	METSEPM5310
	Electricity meter – PM5110	Schneider	METSEPM5110
	Electricity meter – PM750	Schneider	PM750MG
	Electricity meter – PM3250	Schneider	PM3250
	Electricity meter – EM1350	Schneider	EM1350
Water	Water Meter with pulse head	Elster	V100 (PMS-T)
	Water Meter with pulse head	Elster	H4000
Gas	Gas Meter with pulse attachment	Ampy Email	AL 425
	Gas Meter with pulse attachment	Ampy Email	AL 800
	Gas Meter with pulse attachment	Ampy Email	AL 1000
	Gas Meter with pulse attachment	Ampy Email	AL1400
Comms	Ethernet to Serial ETG	Schneider	Com’X 200 or Com'X 510
PLC	Twido PLC for pulse collecting	Schneider - Twido	TWDLCAA24DRF
	Twido RS485 Comms Adapter	Schneider - Twido	TWDNAC485T
	Twido Ethernet Adapter Module	Schneider - Twido	499TWD01100
	Twido Analogue Input Module	Schneider - Twido	TWDAMI8HT
RS485	2 tw pr shielded grey cable	Belden	9842

A7.23 TYPICAL INTRINSIC SAFE BARRIER RELAY BOX ARRANGEMENT

(Next Page)


TYPICAL LABELLING OF ENCLOSURE COVER
(SHOW FOR TWO GAS METERS)
INTRINSIC BARRIER RELAY BOX
FOR GAS METER ID XXX, IOXXX
ID XXX CH 1, 10XXX CH2
EQUIPMENT CONSTRUCTION NOTES
1. ENCLOSURE:-
CLEAR LID PVC 220x170x80 (ABB/SQUARE D)
2 AMP DIN RAIL MOUNT 6kA (MIN) CIRCUIT BREAKER
4 POLE PVC CIRCUIT BREAKER ENCLOSURE (HAGER)
1 POLE PVC CIRCUIT BREAKER ENCLOSURE (HAGER)
DIN MOUNTING RAIL
1 OR 2 INSTRINSIC SAFETY BARRIERS RELAY(S)
DUAL CHANNEL (SOLID STATE) 24VDC TYPE KFD2-SOT2-EX2
GROUNDING TERMINAL BLOCK WK 4 SL/U (FOR UP TO 2.5mm)
2. CONDUITS:-
CONDUITS TO BE TERMINATED USING CONDUIT ADAPTER IN ISB ENCLOSURE MAINTAINING IP65
3. CABLING:-
240VAC WIRING FULLY ENCLOSED WITHIN 4 POLE C.B. ENCLOSURE
HAZARDOUS AREA CABLE DEKRON INSTRUMENTATION CABLE
HAZARDOUS AREA CABLES CONFINED TO AREA LABELLED "HAZARDOUS AREA CABLES" WITHIN ENCLOSURE
NON-HAZARDOUS AREA CABLES CONFINED TO AREA LABELLED "NON-HAZARDOUS AREA CABLES" WITHIN ENCLOSURE
UNUSED CONDUCTORS TO BE SHEATHED AND TIED BACK ON INCOMING CABLE
4. PULSE INPUTS:-
WIRED TO MONITOR LEAD BREAKAGE AND SHORT CIRCUIT
REFER TO P & F BROCHURE FOR KFD2-SOT2-EX2
CABLE ENTRY TO CONDUIT VIA CABLE GLAND AND PLAIN TO SCREWED CONDUIT ADAPTER
ROUND CONDUIT J-BOX 2 WAY (NORMALLY)
5. METER CABLE:-
METER MANUFACTURER SUPPLIED METER CABLE COMPLETE WITH PULSE HEAD.
UNJOINTED CABLE INTO J-BOX VIA CABLE GLAND TO IP 65
CABLE TO TERMINATE ACROSS RESISTORS AS INDICATED
6. J-BOX:-
CABLES FROM J-BOX TO ISB ENCLOSURE TO BE SEALED AT J-BOX TO PREVENT GAS MIGRATION ALONG CONDUIT USING APPROVED SEALING MASTIC MATERIAL.
1x 1/2 WATT 10k OHM RESISTOR
1x 1/2 WATT 1k OHM RESISTOR
ENCLOSURE SUITABLE FOR UP TO TWO "DUAL CHANNEL RELAYS"
LABELLING
1. METER DATA CABLES TO HAVE CONDUCTORS LABELLED AT THE ISB RELAY TERMINATIONS EG. METER ID No 999 USING WRAP ON LABELS.
2. LABELLING TO BE PROVIDED AS INDICATED IN DRAWING
3. ENCLOSURE COVER TO BE LABELLED "INTRINSIC BARRIER RELAY BOX"
4. ENCLOSURE COVER TO BE LABELLED "FOR GAS METER ID XXX"
5. ENCLOSURE COVER TO HAVE IDENTIFIED METER ID NOS. AND CHANNEL ALLOCATION LABELLED.
HAZARDOUS AREA
CABLE SCREENS TO BE INSULATED BY SHEATHING AND NOT CONNECT TO EARTH OR OTHER HAZARDOUS AREA CABLES
CABLES TO ISB RELAY
J-BOX
MONITORING RESISTORS
10 kΩ
1 kΩ
LABEL REQUIRED
INPUT TERMINALS
CABLE GLAND AND PLAIN TO SCREWED CONDUIT ADAPTOR
INTRINSIC (SAFETY) BARRIER RELAY
OUTPUT TERMINALS
LABEL REQUIRED
HAZARDOUS AREA CABLES
NON-HAZARDOUS AREA CABLES
SPACE FOR SECOND ISB RELAY
CONDUIT
CONDUIT ADAPTER
240VAC CONDUIT
SUPPLIED FROM XXXX
DANGER 240 VAC WITHIN COVER
DIN MOUNTING RAIL
GROUNDING TERMINAL BLOCK FOR INSTRUMENT CABLES ONLY. EARTHING TO DETAILS OF PROJECT DRAWING.
POLE PVC C.B. ENCLOSURE MODIFIED TO ENCASE 24V POWER SUPPLY
ENCLOSURE
4 POLE PVC C.B. ENCLOSURE
LABEL REQUIRED
2 AMP CIRCUIT BREAKER
24VDC POWER SUPPLY
LABEL REQUIRED
CAD REFERENCES
TBLOCK-A3
PLOT FILE + USER LOGIN ID
CTM-E05-2.DWG
DATA REFERENCES
DRAWING REVISIONS
NO. DATE REVISION VER AUTH
1 14/10/97 INITIAL ISSUE GP JT
2 14/10/97 MODIFICATION OF CONTROL GP JT
DRAWN BY HRC
VERIFIED BY
John TAN
SCALE N.T.S
AUTHORISED FOR ISSUE BY JT
ELECTRICAL
NAT ENGINEERS Pty Ltd
20 PETER PLACE
MARQUBRA N.S.W 2035
Tel: 9311 0330
Fax: 9345 0058
CLIENT NAME
THE UNIVERSITY OF NEW SOUTH WALES
PROJECT
UNSW ENERGY MANAGEMENT
DRAWING TITLE
TYPICAL EMACS INTRINSIC (SAFETY) BARRIER RELAY BOX (ISB) ARRANGEMENT
DRAWING NUMBER
CTM-E05/2
SHEET
5 of 5

A7.24 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), and
- 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 and
- AS 1243-1982: Voltage Transformers for Measurement and Protection (for 3 phase only)

Current transformers standards:

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