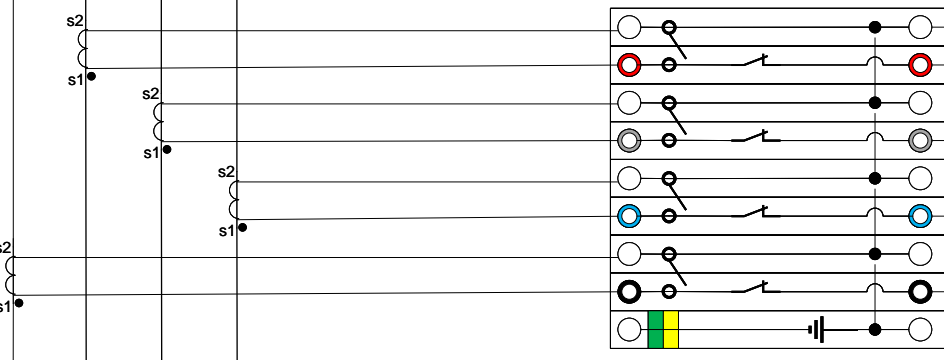


**LOAD**

Vn V1 V2 V3  
N R W B



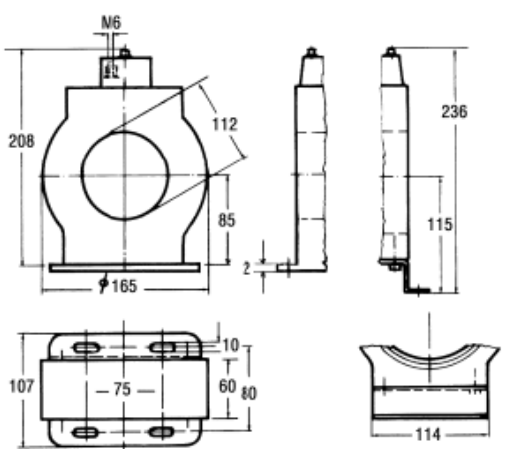
SUITABLE PROTECTION ACCORDING TO AUSTRALIAN STANDARDS

POTENTIAL FUSES 2A

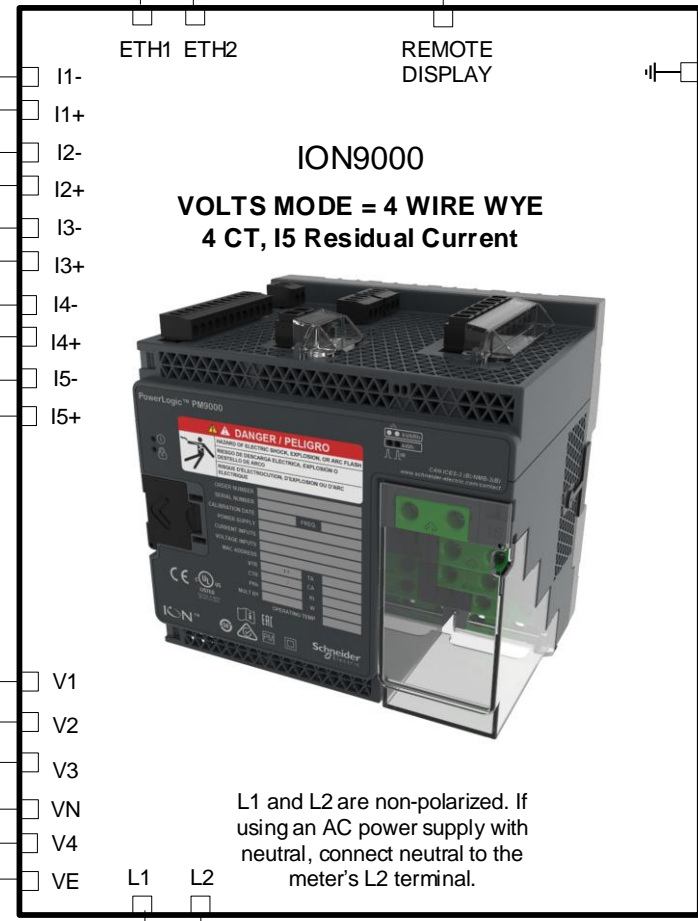
↑ FLOW OF POWER

**LINE**

**1500/5A**



Ethernet TCP/IP Network Remote Display



**ION9000**  
VOLTS MODE = 4 WIRE WYE  
4 CT, 15 Residual Current



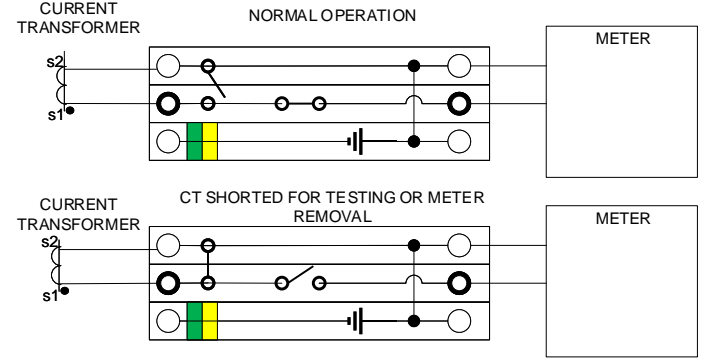
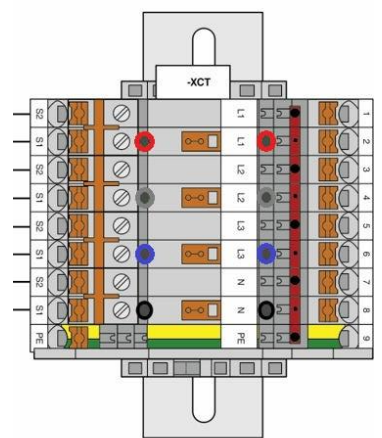
L1 and L2 are non-polarized. If using an AC power supply with neutral, connect neutral to the meter's L2 terminal.

2 A IEC TYPE T SLOW BLOW FUSE  
UPS  
A N

50/60 Hz ± 10% : 90 to 415 V ± 10%  
VOLTAGE INPUT PROTECTION MUST BE RATED FOR THE AVAILABLE SHORT-CIRCUIT CURRENT AT THE CONNECTION POINT

Use the supplied ferrite when terminating the functional ground terminal to earth ground. Make sure the ground wire is looped through, around and back through the ferrite

**CT SHORTING BLOCK DETAIL**



NOTE: S1 AND S2 TERMINALS TO BE SHORTED BEFORE S1-I1- AND S2-I1+ TERMINALS ARE OPEN CIRCUIED. FAILURE TO DO THIS CAN CAUSE HIGH VOLTAGES ACROSS CT TERMINALS AND DAMAGE THE CT OR OTHER EQUIPMENT WHEN LOAD IS PRESENT ON THE CT PRIMARY

**NOTES**

1. To be read in conjunction with the included Schneider Electric installation guide in regards to safety and other installation considerations.
2. We recommend that meters are not shipped mounted in switchboards, as vibration during transit could cause irreparable damage.
3. Refer to manufacturers manuals for comprehensive safety and installation notes.

ION9000 Class Meter CT Burden Table

VA	CT Circuit Cable cross section (mm <sup>2</sup> )													
	1		1.5		2.5		4		6		10		16	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max
15	3.0	12.0	4.4	17.5	7.3	29.2	11.8	47.2	17.7	71.0	30.7	123.0	48.4	193.4

Table shows minimum and maximum length of cable (m) between the energy meter and the CT for various cable cross sections. The length displayed is the one way cable length not the total length.

JOB	ALL
CUSTOMER	ALL
TITLE	ION9000 4 WIRE WYE 4CT DIRECT CONNECTION DIAGRAM
NUMBER	HEX-S0000-ELE000-EN-02-DTP-20
REFERENCE DOCUMENTS	



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			INITIALS	
0	26/03/2019	Version 1.0	CVR	





## 1 Introduction and overview

This specification is to ensure that Queensland University of Technology (QUT) Energy Meterin System (EMS) is maintained, expanded and modified in accordance with manufacturer and professional systems engineering practices including the System V model of strategy, constraints and requirements.

This is to ensure that the system continues to provide the benefits of timely, accurate and accessible information. This information is used to empower the facilities management department to perform their duties around energy efficiency and infrastructure planning and maintenance.

This specification details the minimal requirements of all components based on overall system level requirements for data accuracy, availability, data validity, maintenance and service.

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This publication is not intended to be a comprehensive review of all developments, or to cover all aspects of those referred to. Readers should take professional advice before applying the information contained in this publication to specific issues

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## **2 References**

### ***2.1 Electricity meter standards***

AS 1284:1-2004: Electricity metering - General purpose induction watt-hour 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)

### ***2.2 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)

### ***2.3 Current transformers standards***

AS 60044.1-2007: Instrument transformers - Current transformers and

AS 60044.3-2004: Instrument transformers - Combined transformers.

### ***2.4 Acts and Regulations***

National Measurement Act 1960

National Measurement Regulations 1999

National Measurement Guidelines 1999

National Trade Measurement Regulations 2009

National Electricity Rules Version 79

Queensland Electricity Act 1994

Electricity Regulation 2006

National Energy Retail Law (Queensland) Act 2014



Habits of Excellence

Energy Management Solutions

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Electricity—National Scheme (Queensland) Act 1997



### **3 Private electricity metering**

An approved and factory accredited, specialist and experienced metering subcontractor must be engaged for the design, supply, programming, configuration, integration and testing all private electricity metering points.

#### **3.1 Electricity metering installations**

A metering installation shall:

- a. either contain a device that has a visible or an equivalently accessible display of the cumulative total energy measured by that metering installation.
- b. be accurate in accordance with this specification.
- c. support data transfer from the metering installation to the Energy Management Software in accordance with this specification.
- d. have a measurement element for active energy and a measurement element for reactive energy.

A metering installation may consist of combinations of:

- a. a current transformer.
- b. a voltage transformer.
- c. wiring from the current transformer and the voltage transformer to the meter.
- d. an appropriately constructed panel on which the meter and the data logger are mounted.
- e. an electricity meter and power quality analyser.
- f. communication interface equipment such as a modem, isolation equipment, telephone service, protocol gateway, and media converter equipment.
- g. auxiliary electricity supply to the meter.
- h. test links and fusing.
- i. summation equipment.

#### **3.2 Current transformers**

Current transformers shall meet the relevant requirements of AS 60044.1-2007.

Current transformer secondary winding must be connected to a current transformer terminal block as specified.

The current transformer shall be selected and installed to meet the meter type specification with due consideration for burden and other technical topics as detailed by the AS 60044.1-2007, current transformer and meter manufacturer.

The current transformer accuracy and range shall be as specified by each meter point type.

### ***3.3 Voltage transformers***

The voltage supply and measurement inputs to each metering installation shall be separately fused and located in an accessible position as near as practical to the voltage transformer secondary winding.

If required, voltage transformers shall meet the relevant requirements of AS 60044.2-2007, AS 60044.3-2004, AS 60044.5-2004 and AS 1243-1982. The accuracy of the voltage transformer is to be in accordance with class 0.5.

### ***3.4 Current transformer terminal blocks***

The current transformer terminal block shall allow the secondary winding to be safely shorted and isolated from the meter. The shorting links must be permanently fixed to the terminal block.

The current transformer terminal block shall have colour coded test banana plug compatible terminals to allow the safe testing of the current transformer or secondary injection testing of the meter.

The current transformer terminal block shall be mounted on DIN rail and located for safe and easy access during metering installation maintenance and testing.

The current transformer block shall bridge each current transformers S2 terminal to Potential Earth.

The current transformer terminal block shall be compliant with QUT's Safe Work Methods for current transformer isolation.

Approved current transformer terminals blocks are built using Push to Connect Phoenix Contact PTME 6.

### ***3.5 Electricity Meter Types***

### ***3.6 All meter types***

Refer to the drawings to determine the quantity and location of meter types.

All meter types shall support the following interface with the EMS:

1. At least one of the high level communication protocols supported by the installed EMS.
2. Reading of live data from meter registers.
3. Writing to registers, meter configuration and programming.
4. If the meter type has internal data recorders, read the time stamped data from the meter.
5. If the meter type has internal event recorders, read the time stamped data from the meter.
6. Clock synchronization commands from the EMS.
7. All meters, gateways and RS485 networks must be validated and verified by Hexeis Pty Ltd as EMS connection ready.

### **3.6.1 Power Quality Meter IEC6100-4-30 Class A (drawing reference PQM.c1A)**

#### **3.6.1.1 Selection guide**

This power quality analyser is typically used to monitor the connection between a Substation and Main Switchboard for buildings that are sensitive to power quality issues. Additionally in applications the power quality data will be used to verify compliance with connection and or other agreements.

#### **3.6.1.2 Current transformers**

Current transformers shall be fitted to each Phase plus Neutral.

Current transformer accuracy as installed and connected shall be Class 0.5S.

Current transformer range shall be extended for 1% to 200% of nominal rating.

#### **3.6.1.3 Current transformer terminal block**

Refer to section 3.4 Current transformer terminal blocks

#### **3.6.1.4 Meter**

Shall comply with section 3.5.1 All meter types plus

Integrated display

Hexeis ION9000 framework installed and licensed

Power quality certificate to IEC61000-4-30 Class A.

Accuracy Class 0.1S IEC 62053-22

Installed as either Integrated Meter with Display or Remote Display

Four quadrant metering

Dual Ethernet 10/100 BASE-T communication port for connection to the EMS

Maximum waveform sample rate of 1024 samples/cycle

2GB data storage

Minimum of four (5) voltage inputs plus 1 reference voltage

Minimum of four (5) current inputs with range of 1mA to 20A

Programmable using the ION framework

Transient, Sag and Swell detection with Voltage disturbance direction analysis

Battery backed up real time clock

Time stamped alarms and events

Hexeis Pty Ltd package number S1028HEX9000

## **3.6.2 Power Quality Meter IEC6100-4-30 Class S (drawing reference PQM.c1S)**

### **3.6.2.1 Selection guide**

This power quality analyser is typically used to monitor the connection between a Substation and Main Switchboard for buildings that are sensitive to power quality issues but not deemed as critical as the requiring the IEC61000-4-30 Class A

### **3.6.2.2 Current transformers**

Current transformers shall be fitted to each Phase plus Neutral.

Current transformer accuracy shall be Class 0.5S

Current transformer range shall be extended for 1% to 200% of nominal rating

### **3.6.2.3 Current transformer terminal block**

Refer to section 3.4 Current transformer terminal blocks

### **3.6.2.4 Meter**

Integrated or remote display

Hexeis ION framework installed and licensed

Power quality certificate to IEC61000-4-30 Class S

Accuracy Class 0.2S IEC 62053-22

Four quadrant metering

Ethernet 10/100 BASE-T communication port for connection to the EMS

Maximum waveform sample rate of 256 samples/cycle

512MB data storage

Minimum of four (4) current inputs with measurement range of 5mA to 10A

Programmable using the ION framework

Sag and Swell detection with Voltage disturbance direction analysis

Battery backed up real time clock

Time stamped alarms and events

Hexeis Pty Ltd package number S1028HEX7400

### **3.6.3 Sub Main Multi-Function Meter (drawing reference MFM)**

#### **3.6.3.1 Selection guide**

This multi-function meter is typically used to monitor an outgoing submain from a main switch board. The meter is used to measure energy and manage capacity, load balance and other topics

#### **3.6.3.2 Current transformers**

Current transformers shall be fitted to each Phase plus Neutral.

Current transformer accuracy shall be Class 0.5S

Current transformer range shall be extended for 1% to 200% of nominal rating

#### **3.6.3.3 Current transformer terminal block**

Refer to section 3.4 Current transformer terminal blocks

#### **3.6.3.4 Meter**

Integrated or remote display

Accuracy Class 0.5S IEC 62053-22

Four quadrant metering

Rs485 Modbus port for connection to the EMS Gateway

Battery backed up real time clock synchronised by the EMS Server

Time stamped alarms and events

Hexeis Pty Ltd package number S1028HEX5110

### **3.6.4 Private DB Energy Meter (drawing reference kWh.CT)**

#### **3.6.4.1 Selection guide**

This basic energy meter is typically used to monitor the Light and/or Power energy consumption of a DB circuits.

#### **3.6.4.2 Current transformers**

Current transformers shall be used for loads that exceed 125A. QUT may nominate circuits rated below 125A to be CT.

Current transformers shall be fitted to each Phase.

Current transformer accuracy shall be Class 0.5

Current transformer range shall be for 5% to 120% of nominal rating

#### **3.6.4.3 Current transformer terminal block**

Refer to section 3.4 Current transformer terminal blocks

#### **3.6.4.4 Meter**

Integrated display

DIN rail mount

Accuracy Class 0.5S IEC 62053-22

Four quadrant metering

RS485 communication port for connection to the EMS meter gateway

Minimum of three (3) current inputs with measurement range of 5mA to 6A or Whole Current up to 125A

Hexeis Pty Ltd package number S1028HEX3255 (CT)

Hexeis Pty Ltd package number S1028HEX3355 (Whole Current)



### **3.6.5 Private Energy Meter for Trade (drawing reference kWh-NMI)**

#### **3.6.5.1 Current transformers**

Current transformers shall be fitted to each Phase.

Current transformer accuracy shall be Class 0.5

Current transformer range shall be for 5% to 120% of nominal rating

#### **3.6.5.2 Current transformer terminal block**

Refer to section 3.4 Current transformer terminal blocks

#### **3.6.5.3 Meter**

Optional RS485 Interface for connection to MOXA Ethernet to Serial device server

Compatible with Hexeis Data Hub for EDM I

EDMI Mk6 Genius

### **3.6.6 Solar(PV) Energy Meter (drawing reference kWh.PV)**

#### **3.6.6.1 Current transformers**

Current transformers shall be fitted to each Phase.

Current transformer accuracy shall be Class 0.5

Current transformer range shall be for 5% to 120% of nominal rating

#### **3.6.6.2 Current transformer terminal block**

Refer to section 3.4 Current transformer terminal blocks

#### **3.6.6.3 Meter**

Integrated display

DIN96 Panel mount

Accuracy Class 0.5S IEC 62053-22

Four quadrant metering

256kB data storage

Battery backed up real time clock

Time stamped alarms and events

Hexeis Pty Ltd package number S1028HEX5320

## **3.6.7 EMS Gateway (drawing reference EMS.GWY)**

### **3.6.7.1 EMS Gateway**

Battery backed up real time clock time synchronised by the EMS Server

Log and time stamped alarms and events from connected serial meters for upload to EMS Server

Ethernet gateway to connected meters for live data

Hexeis Pty Ltd package number S1028HEXRTU

## **3.6.8 Hexeis Data Hubs for EDM (drawing reference EMS.EDMIGWY)**

### **3.6.8.1 EDM Gateway**

Shall provide live data for the EMS Server

Shal upload load profile and convert the EDM meters' load profile for uploading into the EMS Server

Hexeis Pty Ltd package number S1028HEXEDMIDH

### **3.6.9 Meter installation testing**

All meter types that use CTs must be primary injection tested using test equipment specifically designed for meter testing such as the Zera MT786.

The meter test system is to use a reference meter with a minimum accuracy class of 0.05%

The testing shall be done using primary injection of voltage and current. Injected phase voltages and currents are to be unbalanced and at a power factor of 0.9.

Testing is to be witnessed by a client representative and is recommended to be conducted at the board manufacturer's factory

All meter installations must be validated and verified by Hexeis Pty Ltd prior ensure the meter data is verified and validated as EMS ready.

### ***3.7 Serial RS485 networks***

Serial RS485 network shall be used to connect metering installations with RS485 communication ports to advanced gateways.

Serial RS485 network shall be a daisy chain network using special RS485 cable with at least 2 pairs between each of the metering points and the gateway. RS485 networks must be designed and installed in strict compliance with the Modbus foundation's "Modbus Serial Line Protocol and Implementation Guide V1.02".

Serial RS485 networks will be limited to a maximum total length of 900m

Serial RS485 networks shall be interface to QUT's Ethernet TCP/IP network using configured EMS gateways.

A metering subcontractor as specified shall be used to RPEQ engineer design, verify and validate the RS485 network.

All RS485 networks must be validated and verified by Hexeis Pty Ltd prior ensure the gateway and data is verified and validated as EMS ready.

### ***3.8 Advanced gateway interface (optional)***

All meters are to be interfaced with an advanced gateway that provides Ethernet access to live data, on board web server for diagnostics and a data recorder to log and time stamp meter data readings. The data recorder is to be fully compatible with XX's EMS so the logs can be uploaded to the server for EMS reports and dashboards.

The data recorder shall support a temporary USB WiFi transmitter to be plugged in to function as a WiFi access point giving access to web browser software on laptops and tablets.

All gateways must be validated and verified by Hexeis Pty Ltd prior ensure the gateway and data is verified and validated as EMS ready.

### ***3.9 Metering Subcontractor***

The metering subcontractor must be authorised and registered by the manufacturer of the electricity metering equipment as offering a high level of competency in providing energy metering systems.

The metering subcontractor must comply with the Queensland's Professional Engineering Act 2002 and shall at least have all engineering design work completed with RPEQ in the areas of Electrical and Computer System.

The metering subcontractor must have experience in the successful design, commissioning and maintenance of at least three (3) metering systems with at least 100 meters using the meter equipment and software. In these reference systems the metering subcontractor must show that 100% of CT meters have been tested using primary injection testing.

The metering subcontractor must be trained using the manufacturer's factory training courses for the metering equipment and software.

The metering subcontractor must ensure that the electricity metering equipment is fit for purpose in the expected operating environment e.g. temperature, impulse levels.

The metering subcontractor must ensure the metering system is installed and maintained in accordance with this metering point specification.

The metering subcontractor is to verify and validate each metering installation, communication networks, interface and connection to the AMR Enabled communications gateway.

The metering subcontractor must be able to exhibit the following capabilities:



### **3.9.1 Detailed design and specification of metering points, including:**

- a. Knowledge and understanding of this electricity metering specification.
- b. Knowledge of equipment including: meters, current transformers, voltage transformers, Ethernet switches and serial RS485 components.
- c. Design experience including knowledge of high and low level interfaces including: hardwired discrete and analogue control loops, serial RS485 networks, TCP/IP Ethernet networks.
- d. Design experience including knowledge of communications protocols OPC, Modbus RTU, Modbus TCP, BACnet, DNP3, and IEC61850.
- e. Design experience including knowledge of current transformers, voltage transformers and the effect of burdens on performance.
- f. Ability to produce documentation, such as single line diagrams, panel layouts and wiring diagrams

### **3.9.2 Programming and certification requirements for metering points to the required accuracy, including:**

- a. Authorised by the manufacturer of the metering equipment and software as and Energy Solutions Partner offering a high level competency.
- b. Licensed access to metering software applicable to all equipment being installed by the Metering Provider
- c. Ability to program requirements by setting variables in meters, communication equipment etc.
- d. Management of the testing of all equipment to the accuracy requirements specified
- e. Certifications that all calibration and other meter parameters have been set, verified and recorded prior to meter, data loggers, communications equipment being released for installation
- f. All equipment for the purpose of meeting test and inspection obligations.

### **3.9.3 Installation and commissioning of Metering Points including remote accessing of data, including:**

- a. The use of special test equipment to perform field accuracy tests
- b. The availability of trained and competent staff to test metering points to determine that the installation is correct
- c. The use of test procedures to confirm that the metering installation is correct and that metering constants are recorded and programmed correctly.

### **3.9.4 Inspection and maintenance of Metering Points and equipment, including:**

- a. Approved test and inspection procedures to perform appropriate tests as detailed in this specification;
- b. For metering points with connected current or voltage transformers, calibrated field test equipment for primary injection and meter testing to the required levels of uncertainty; and

### **3.9.5 Verification of metering data and check metering data, as follows:**

- a. On commissioning metering data, verification of all readings, constraints (adjustments) and multipliers to be used for converting raw data to consumption data; and
- b. On inspection, testing and/or maintenance, verification that readings, constants and multipliers are correct by direct conversion of meter readings and check against the metering database.

Contact Hexeis Pty Ltd (ph: 1300 Hexeis / 1300 439 347)

## ***3.10 Metering register***

The metering subcontractor must supply the metering register for the electricity metering system.

The metering register details information associated with the metering points that determine the validity and accuracy of metering data.

The purpose of the metering register is to facilitate: the verification of compliance with this specification; and the auditable control of changes to the metering points.

Information to be contained in the metering register must at least include following:

### **3.10.1 Connection and metering point reference details, including:**

- a. locations and reference details e.g. drawing numbers;
- b. loss compensation calculation details;
- c. site identification names;
- d. summary details of connected electrical loads associated with the metering point;

### **3.10.2 The identity and characteristics of metering equipment, including:**

- a. serial numbers;
- b. hardware revision;
- c. firmware revision;
- d. metering installation identification name;
- e. metering installation types and models;
- f. instrument transformer ratios (available and connected);
- g. current test and calibration programme details, test results and references to test certificates;
- h. asset management plan and testing schedule;
- i. calibration tables, where applied to achieve metering installation accuracy;
- j. metering subcontractor details;
- k. summation scheme values and multipliers; and
- l. data register coding details.



### **3.10.3 Data communication details, including:**

- a. communication network and routing information for access to data;
- b. communication equipment type and serial numbers;
- c. communication protocol details or references;
- d. data conversion details;
- e. user identifications and access rights; and
- f. passwords.

### **3.10.4 Data validation, substitution and estimation processes, including:**

- a. algorithms;
- b. data comparison techniques;
- c. processing and alarms (eg voltage source limits; phase-angle limits);
- d. metering compensation details; and
- e. alternate data sources.

## 4 Interface to the QUT Energy Metering System

***For sites that are noted to be future interfaced with the QUT's EMS, the following applies.***

The EMS server is connected to meter types with Ethernet ports and EMS gateways using the QUT IT network.

The electricity meters are to be interfaced in the future with the existing EMS. The meter system on site is to be "connection ready" requiring only the Ethernet TCP/IP ports to be configured for connection to the QUT IT network. This means that all electricity meters and gateways to be interfaced must be validated and verified by Hexeis prior to interface with the EMS server to ensure the data is verified and validated.

All communication interfaces and other works with and on the EMS are to be completed and fully verified and validated by Hexeis.

Contact Hexeis Pty Ltd (ph: 1300 Hexeis / 1300 439 347)

***For sites that are noted to be interfaced with the EMS, the following applies.***

The EMS server is connected to meter types with Ethernet ports and advanced gateways using the QUT IT network.

The electricity meters are to be interfaced with the existing EMS. Coordinate with QUT IT department to configure and allocate data outlet and TCP/IP addresses. All electricity meters and gateways to be interfaced must be validated and verified by Hexeis prior to interface with the EMS server to ensure the data is verified and validated.

Once interfaced the existing EMS is to be modified to add the new building to the diagram navigation, update overview diagrams. All communication interfaces and other works with and on the EMS are to be completed and fully verified and validated by Hexeis.

Contact Hexeis Pty Ltd (ph: 1300 Hexeis / 1300 439 347)